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Economic Costs of the U.S. Wheat Export Enhancement Program: Manna from Heaven or from Taxpayers?

by

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Abstract

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Traditional models of export bonus programs focus only on the effects of *disposing* public stocks on the world market. We show that the economic effects of export bonus programs are significantly different when one includes the costs of *acquiring* these stocks. Including stock acquisition costs has the domestic price always rising, rather than an ambiguous effect of the traditional model of an export bonus program. We also show that including stock acquisition costs results in an export bonus scheme to be equivalent to cash export subsidies. When an export bonus program is combined with an existing target price scheme, government cost may either rise or fall in either model, but for different reasons. In an empirical simulation of the U.S. Export Enhancement Program for wheat, we show that the model that includes acquisition costs induces a lower level of tax cost than the traditional model even though taxpayers bear the additional burden of acquisition expenditures.

JEL classification: Q17 Agriculture in International Trade

Keywords: agricultural trade, Export Enhancement Program, export subsidies, in-kind

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1. Introduction

In 1985, the United States established the Export Enhancement Program (EEP) whereby government owned commodities were donated to exporters as a bonus with commercial exports.[1] Several theoretical analyses of this policy that reduces public stocks have shown it to have ambiguous effects on domestic market prices, commercial sales and export earnings (Houck; Paarlberg 1995, 1996; Anania, Bohman and Carter; and Chambers and Paarlberg), while empirical studies have generated conflicting results (Anania, Bohman and Carter; and Brooks, Devadoss and Meyers). All previous studies that analyze the effects of an in-kind export bonus program ignore the costs of *acquiring* the surplus stocks, and simply focus on the market and taxpayer cost impacts of *disposing* public stocks.

Studies that treat stocks as manna from heaven are consistent with the "dubious" accounting practices of the Office and Management and Budget, whereby the cost of stocks given away as bonuses is "contrived" as sunk and the only taxpayer impact of the program is the cost if its administration (Paarlberg, 1990). Such an approach is based on the logic that the cost of already acquired government stocks should not be considered as part of the market effects of their disposal. There are important economic reasons why such an approach may not be appropriate. Export bonuses from government inventory for wheat over the entire time period was on the order of 40 times the change in government inventories over that same period. This means that

[1] Since its inception, EEP has donated over $3 billion of surplus Commodity Credit Corporation (CCC) commodities into export channels, subsidizing approximately 40 percent of U.S. wheat exports from 1985 to 1991 (Anania, Bohman and Carter).

costs of the bonuses were replaced by government stock purchases. Indeed, government inventories even increased in some marketing years when EEP was in effect.[2]

We adopt a partial equilibrium framework to show how the economic effects of export bonus programs are significantly different if one includes the acquisition costs of the public stocks. Toward this end, we organize our paper as follows: section 2 compares the standard theoretical results in the literature of an export bonus program, focussing only on the effects of disposing of public stocks, to a model which also includes the costs of acquiring these stocks. If only disposals are considered, an export bonus program may increase or decrease domestic price, but if acquisition cost is taken into account, the domestic price always rises. In both models, the world price always falls, and total exports always increase. We also prove that if one includes acquisition costs, an export bonus scheme is equivalent to an appropriately defined cash export subsidy.

In section 3, following the analysis of Anania, Bohman and Carter, we incorporate the specifics of the U.S. deficiency payment program with and without export bonus constraints. Given an existing deficiency payment program, the traditional model (that ignores acquisition costs) predicts that an export bonus scheme can either increase or decrease taxpayer costs, depending on whether the domestic market price falls or rises. When acquisition costs are considered, the effect of the export bonus program on government cost is also ambiguous, but for different reasons. Deficiency payments always decline because the domestic price always rises, but taxpayers must bear the additional burden of purchasing the stocks that are given away as bonuses. The net effect on government cost depends on whether the savings in deficiency

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[2] Even if purchases and sales do not occur in the exact same time period, inter-temporally linked markets makes our analysis most relevant.

payments outweigh the cost of stock acquisition. This impact depends on market parameters and is an empirical question. We simulate the effects of the wheat export bonus program to illustrate the significance of including acquisition costs, using data and parameters from a stylized version of Anania, Bohman and Carter's empirical model. Even though acquisition expenditures are an additional component in taxpayer cost in our proposed model, government costs are always lower than in the traditional model.

2. The Theoretical Effects of an Export Bonus Program with and without Acquisition Costs

Consider a competitive industry which has the supply function Q(P) and sells its output to both domestic and foreign buyers. Denote the domestic demand function by $D_D(P)$, and importers' (excess) demand function by $D_F(P)$. Throughout, we assume that $Q'(P) > 0$, $D_D'(P) < 0$ and $D_F'(P) < 0$, and abstract from any transportation costs. In Figure 1, the curve labeled *ES* is the industry's excess supply function $Q(P) - D_D(P)$, and *ED* represents excess demand by importers. Free trade equilibrium occurs where excess supply and excess demand are equal; it is the pair (Q*, P*), such that $Q^* = Q(P^*) - D_D(P^*) = D_F(P^*)$. Below, we explore the departures from this equilibrium which result from three distinct policy experiments: (1) an export bonus program such as the one discussed by Houck, whereby previously accumulated government stocks are awarded as export bonuses: (2) an export bonus program which must be sustained by government purchases of the product in the current period; and (3) a cash export subsidy program. We go on to prove that (2) and (3) are exactly equivalent policies for a given amount of exports, in that their affects on domestic price, world price, and government cost are identical.

Previous analyses of export bonus programs (Houck; Anania, Bohman, and Carter) model only the disposition of government stocks as bonuses, and ignore the process by which stocks were acquired. In such models, the government donates $R(Q_C, P)$ units from (already acquired) government stocks to exporting firms who arrange to sell Q_C units of product through commercial channels at a price of P, where $R(\cdot)$ is any positive-valued, nondecreasing function[3]. Thus, the post-policy excess supply function becomes $Q(P) - D_D(P) + R(\cdot)$, and lies to the right of the original excess supply, as shown by the curve *ES′* in Figure 1.

We assume perfect competition among exporting firms. The function of these firms is to obtain wheat in the domestic market and then sell it to foreign buyers. Given the assumption of competition, each exporting firm earns a profit of zero. When these intermediaries arrange to export $Q_C + R(Q_C, P)$ units under the bonus program, they purchase buy Q_C units at the domestic price P and receive $R(\cdot)$ units for free from government stocks. Their average cost of obtaining wheat to export is thus αP, where $\alpha \equiv Q_C/(Q_C + R(\cdot))$ is the proportion of commercial product in total exports. The zero profit condition implies that $P_W = \alpha P$, where P_W is the world price. Consequently, the "effective" excess demand function for product exported under the bonus program is $D_F(\alpha P)$, or the original excess demand evaluated at the average price of exported product αP. Geometrically, this post-policy demand schedule is a vertical expansion of the original excess demand, as illustrated by the curve *ED′* in Figure 1.

In equilibrium, total demand equals total supply, and imports equal the sum of commercial exports and bonuses. Formally,

(1) $$D_D(P) + D_F(\alpha P) = Q(P) + R(Q_C, P)$$

(2) $$D_F(\alpha P) = Q_C + R(Q_C, P)$$

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[3] In general, the amount of bonuses may depend on both commercial exports and the export price. In a proportional bonus program, which is the type depicted in Figure 1, bonuses are a fixed percentage of commercial exports; R is thus independent of P and takes the form $R = rQ_C$. If, as in the U.S. EEP, bonuses are awarded in dollar-denominated certificates which can be exchanged for an equivalent value of the commodity, $R = Q_C B/P$, where B is the dollar value of the certificates awarded per unit of Q_C.

A rearrangement of (1) implies that the post-policy equilibrium (Q′, P′) occurs at the intersection of the post-policy excess demand and supply curves, shown in Figure 1 as point *c*. Combining (1) and (2) reveals that commercial exports, Q_C, equals the pre-policy excess demand, Q(P′) – D_D(P′). Thus, commercial exports can represented by the distance *ab*, bonuses are equal to *bc*, and α is the ratio *ab*/*ac*. In general, the new equilibrium price (P′), commercial exports (αQ′), and the value of commercial exports (αP′Q′) may be larger, smaller, or equal to their values under free trade, depending on the elasticity of excess demand. However, the new equilibrium world price is (αP′) is always smaller than P*, and the total quantity traded, including bonuses, (Q′) is always larger than Q* (Houck).

By not accounting for stock acquisition, the model ignores the fact that the initial acquisition of the stocks involves taxpayer costs and affects the market. In order to incorporate these effects, we now explicitly include the acquisition process in the model, requiring that an equal amount of stocks are acquired and released as bonuses each period.[4] That is, stocks given away in the current period must be replaced by an equal amount of new government purchases.

As above, the government gives R(Q_C, P) units as bonuses for each Q_C units sold commercially. From importers' perspective, this bonus schedule is the only information of relevance, and the post-policy demand schedule takes the same form, D_F(αP). Within the domestic market, supply and demand relationships are as before, but the government is now an additional buyer. Let G(P) be government purchases of the product. In Figure 2(a), domestic supply and demand are shown by the curves *D* and *S*, respectively, and the sum of government

[4] Even if the amount going into stocks does not equal EEP disbursements each year, one still has recognize that storable commodities have an intertemporal equilibrium such that the current market price reflects the anticipated effects of the stock change.

and domestic market demand is D'. Thus, at the price P', domestic consumption is the distance *ab*, government purchases are *bc*, and *cd* units are available for commercial export.

Compared to the model above, the market equilibrium conditions are changed to accommodate the additional demand by the government and the fact that bonuses must be balanced by government purchases:

(3) $D_D(P) + D_F(\alpha P) + G(P) = Q(P) + R(Q_C)$

(4) $D_F(\alpha P) = Q_C + R(Q_C)$

(5) $G(P) = R(Q_C)$

Substituting (5) into (3), the equilibrium quantity traded Q' and domestic price P' must satisfy:

(6) $Q' = D_F(\alpha P') = Q(P') - D_D(P')$;

i.e., post-policy excess demand equals excess supply. The new equilibrium is shown in Figure 2(b) at the intersection of ED' and ES, or at point *g*. *ES* does not shift in this model because the government acquires the same quantity as it releases as bonuses. The dashed line above *ES* represents the quantity of commercial exports; it is the horizontal distance between *S* and D' in Figure 2(a). In equilibrium, the quantity of commercial exports is thus *ef* (equal to the distance *cd* in Figure 2(a)), and bonuses are *fg* (which equals government purchases, *bc*). Because the government acquires $R(Q_C, P')$ units at a cost of P' per unit and releases the same quantity as free bonuses, the cost of the program is $R(Q_C, P')P' = (1 - \alpha)Q'P'$, or the area *fgih*. The new world price is $\alpha P'$. In this model, the domestic price always increases if an export bonus program is initiated ($P' > P^*$), and the world price always falls ($\alpha P' < P^*$). This result contrasts the traditional literature, where the change in domestic price is ambiguous.

As a third policy option, we consider a cash export subsidy program. To make an appropriate comparison, we need to consider the subsidy required to achieve the same amount of total exports as the bonus program (namely, Q′ units in Figure 2(b)). Geometrically, this subsidy is the vertical distance between *ES* and *ED* at Q′, represented by the segment *gj* in Figure 2(b). It is the value S (with corresponding price P) such that $D_F(P - S) = Q(P) - D_D(P) = Q'$, where import demand and excess supply are both equal to Q′, given that the price to importers is reduced by S per unit. Because P′ is the unique price where $Q(P) - D_D(P) = Q'$ (Figure 2(b)), this condition reduces to $D_F(P' - S) = Q'$. By equation (6), the unique value of the appropriate subsidy is $S = (1 - \alpha)P'$.

The cost of such an export subsidy program is the subsidy rate times exports, or $(1 - \alpha)P'Q'$, which is exactly equal to the cost of the export bonus program. This means that the areas *fgih* and *egjk* in Figure 2(b) are equal. In general, therefore, any export bonus program can be modeled as an export subsidy, where the subsidy rate is defined as the difference between equilibrium domestic and world prices with the bonus program in place.

An Analytical Example

Consider the case of constant elasticity excess supply and demand curves of the form $Q(P) = AP^a$, and $D(P) = BP^{-b}$, respectively. Free trade equilibrium is given by:

$$P^* = A^{\frac{-1}{a+b}} B^{\frac{1}{a+b}}$$

$$Q^* = A^{\frac{b}{a+b}} B^{\frac{a}{a+b}},$$

while *export earnings* are $P^* Q^* = A^{\frac{b-1}{a+b}} B^{\frac{a+1}{a+b}}$.

Suppose the government then implements an export bonus program where bonuses are proportional to commercial exports: $R(Q_C, P) = rQ_C$. In such a program, the proportion of commercial product in total exports is the constant fraction $\alpha = \frac{1}{1+r}$. In the traditional model of no acquisition costs, the post-policy excess supply and excess demand functions are, respectively:

$$(1+r)Q(P) = (1+r)AP^{a}$$

$$D(\tfrac{1}{1+r}P) = B(\tfrac{1}{1+r}P)^{-b}.$$

The equilibrium domestic price (received for commercial exports) is:

$$P' = A^{\frac{-1}{a+b}} B^{\frac{1}{a+b}} (1+r)^{\frac{b-1}{a+b}} = P^*(1+r)^{\frac{b-1}{a+b}}$$

Thus, an export bonus program may cause the domestic price to remain unchanged, fall, or rise, depending on the elasticity of excess demand:

$P' = P^*$ if $b = 1$

$P' < P^*$ if $b < 1$

$P' > P^*$ if $b > 1$

The equilibrium world price is given by

$$\frac{1}{1+r}P' = P^*(1+r)^{-\frac{a+1}{a+b}} < P^*$$

Total exports (including bonuses) are:

$$Q' = A^{\frac{b}{a+b}} B^{\frac{a}{a+b}} (1+r)^{\frac{b(a+1)}{a+b}} = Q^*(1+r)^{\frac{b(a+1)}{a+b}} > Q^*$$

Commercial exports are:

$$Q_C = \frac{1}{1+r}Q' = Q^*(1+r)^{\frac{a(b-1)}{a+b}}.$$

Again, the level of commercial exports depends on the elasticity of excess demand:

$Q_C = Q^*$ if $b = 1$

$Q_C < Q^*$ if $b < 1$

$Q_C > Q^*$ if $b > 1$

Post-policy export earnings are $Q_C P' = Q^* P^* (1+r)^{\frac{(a+1)(b-1)}{a+b}}$, which is equal to, greater than, or less than Q*P* (free trade export earnings) if b is equal to, greater than, or less than unity, respectively. Because acquisition costs of bonuses are not considered, the additional taxpayer cost of the traditional program is zero.

If acquisition costs are considered in the model, the post-policy excess supply and excess demand functions become:

$$Q(P) = AP^{a}$$

$$D(\tfrac{1}{1+r}P) = B(\tfrac{1}{1+r}P)^{-b}$$

The equilibrium domestic price in this model is:

$$P'' = A^{\frac{-1}{a+b}} B^{\frac{1}{a+b}} (1+r)^{\frac{b}{a+b}} = P^*(1+r)^{\frac{b}{a+b}} > P^*.$$

Note also that $P'' > P'$. Equilibrium world price is:

$$\frac{1}{1+r} P'' = P^*(1+r)^{\frac{-a}{a+b}} < P^*.$$

Total exports are:

$$Q'' = A^{\frac{b}{a+b}} B^{\frac{a}{a+b}} (1+r)^{\frac{ab}{a+b}} = Q^*(1+r)^{\frac{ab}{a+b}} > Q^*.$$

Commercial exports are:

$$Q_C = \frac{1}{1+r} Q' = Q^*(1+r)^{\frac{a(b-1)-b}{a+b}} \gtrless Q^*.$$

Export earnings in this model are $Q_C P'' = Q^* P^* (1+r)^{\frac{a(b-1)}{a+b}}$, which depends on b in the same manner as above. Taxpayers must bear the cost of the bonuses, equal to

$$(Q'' - Q_C)P'' = \left[\frac{r}{1+r} Q^*\right]\left[P^*(1+r)^{\frac{b}{a+b}}\right]$$

which reduces to $rQ^* P^* (1+r)^{\frac{a(b-1)}{a+b}}$. Thus, taxpayer cost is always r times export earnings.

If the government had chosen a cash export subsidy program to accomplish its export goal of Q′′ units, it would need to offer a cash subsidy equal to the difference between the equilibrium values of domestic and world prices under the export bonus program. The necessary subsidy is therefore:

$$P'' - \frac{1}{1+r} P'' = \frac{r}{1+r} P''$$

This is an *ad valorem* export subsidy, with subsidy rate r/(1+r); for any domestic price P, importers would receive a discount equal to $\frac{r}{1+r} P$, and their effective price would be $\frac{1}{1+r} P$. Thus, the post-policy excess supply and demand functions are identical to the export bonus program with stock acquisition, and generate the same equilibrium (Q′′, P′′). The taxpayer cost of the cash export subsidy program is the subsidy rate times the value of exports, or $\frac{r}{1+r} P'' Q''$, which equals $rQ^* P^* (1+r)^{\frac{a(b-1)}{a+b}}$, or the costs of the export bonus program with stock acquisition.

Summarizing their effects in Table 1 reveals the differences in these two models. When including acquisition costs, producer (consumer) welfare always increases (decreases) because the domestic market price unambiguously increases (unlike in the model ignoring acquisition costs), taxpayer costs are now positive and the effect on the level of commercial exports is always ambiguous.

3. Implications of Including Acquisition Costs: An Empirical Example

We use a stylized version of Anania, Bohman and Carter's model to illustrate the implications of including acquisition costs in the U.S. Export Enhancement Program (EEP) for wheat. As in their study, the data are based on U.S. wheat sales in calendar year 1988. In the U.S. program, EEP sales to each targeted market could not exceed a specified maximum, and Anania, Bohman and Carter report that these constraints were binding in 1988 for all major importers. As in their analysis, we therefore include a volume constraint on eligible EEP wheat sales, implying that $R(Q_C)$ takes the form:

$$(7) \qquad R(Q_C) = \begin{cases} rQ_C \text{ if } (1+r)Q_C < \overline{Q} \\ \frac{r}{1+r}\overline{Q} \text{ if } (1+r)Q_C \geq \overline{Q} \end{cases}$$

where $\overline{Q}$ is the maximum volume of total exports (including bonuses) which can be sold under the EEP. For "small" amounts of total exports, the bonus constraint does not bind, and bonuses are proportional to total exports. Therefore, the dashed line above *ES* in Figure 3, representing the division of exports between bonus and commercial wheat, is an upward rotation of *ES* for total exports in the range $[0, \overline{Q}]$. Once the volume constraint is reached, bonuses are a fixed amount, and the "division line" lies parallel to *ES*, $\frac{r}{1+r}\overline{Q}$ bushels to its left.

If importers buy some quantity of wheat for which constraint is not binding, the fraction of commercial wheat in total exports is $\alpha = \frac{r}{1+r}$, and the post-policy excess demand function is therefore $D_F(\frac{1}{1+r}P)$. This relationship is shown in Figure 3, where the locus *ED′* is a proportional vertical increase of the original excess demand *ED* for total exports in the appropriate range. If the constraint binds, the proportion α varies with commercial exports Q_C: $\alpha = \frac{Q_C}{\frac{r}{1+r}\overline{Q} + Q_C}$. It can shown that the demand function $D_F(\alpha P)$ in this range is bounded by the functions $D_F(P)$ and $D_F(\frac{1}{1+r}P)$. Further, if $D_F(P)$ is linear (as in Figure 3), then $D_F(\alpha P)$ is strictly convex to the origin. Accordingly, *ED′* in this range is shown as a strictly convex locus lying between the original *ED* and its upward rotation $D_F(\frac{1}{1+r}P)$.

The equilibrium quantity traded and price of commercial exports are determined by the intersection of *ES* and *ED′*. Consistent with the general results above, total exports Q′ and the price of commercial exports P′ are unambiguously larger than their values under free trade, (Q*, P*). The equilibrium corresponds to a binding volume constraint; the distance *eb* in Figure 3 is the bonuses awarded for the maximum eligible sales $\overline{Q}$. The equilibrium value of α is thus the ratio *ae*/*ab*, and the world price is αP'. Invoking the equivalence of an export bonus and an export subsidy, the program is equivalent to a cash subsidy equal to the segment *bc*, and government cost is the area *abcd*.

In the U.S. wheat program, producers do not receive the market price of commercial exports, but rather are guaranteed a target price through deficiency payments. Figure 4 shows the situation when an export bonus program is combined with a deficiency payment program. The left panel depicts domestic supply (*S*), demand (*D*), and target price (T). Because farmers receive a guaranteed minimum target price, the effective supply is perfectly inelastic at Q_T for all prices below T. This policy intervention in the domestic market creates a "kink" in the excess supply curve; *ES* is constructed as the distance between Q_T and $D_D(P)$ if $P < T$, and the distance $Q(P) - D_D(P)$ if $P \geq T$. Because the domestic deficiency payment program does not change foreign demand, the *ED* curve is not affected. The equilibrium without an export bonus or subsidy occurs at the intersection of the kinked *ES* and *ED*, where Q* bushels are traded on the world market and the world price is P*. The cost of the deficiency payment program to the U.S. government is $Q_T(T - P^*)$, or the area $a + b + c + d + e + f + g$.

If the government introduces a constrained export subsidy, in addition to the deficiency payment program, the excess demand and supply curves change as described above. The bonus function is once again of the constrained form in (7); the "division line" between commercial and bonus exports is an upward rotation of *ES* until the volume constraint holds, and for all greater quantities lies parallel to *ES*. The new excess demand curve *ED'* is exactly the same as in Figure 3. The equilibrium quantity traded under the combined policies is Q′, the price of U.S. exports rises to P′, and world price falls to $\alpha P'$. By the equivalence proposition, the export bonus program is equivalent to a cash subsidy of $(P' - \alpha P')$ dollars, and the cost of the export bonus is the rectangular area $e + f + g + h + i + j$. Total government costs are made up of this bonus cost, plus deficiency payments of area $a + b + c$. The change in total government cost, as a result of initiating an export bonus program, is therefore the area $(h + i + j)$ minus area d.

Anania, Bohman and Carter argue that a constrained export bonus program always lowers domestic price and therefore increases government expenditures through larger deficiency payments. If the acquisition of stocks is taken into account, this result does not hold. The export bonus program will increase government expenditures if the area $h + i + j$ is larger than area d, or if the impact of export subsidies on the world market price offsets the savings in deficiency payments. Whether expenditures rise or fall depends on market elasticities. In the limiting case of a completely elastic excess demand curve (the "small country" case), the price $\alpha P'$ would equal P*, and the area $h + i + j$ would disappear. Provided the new domestic equilibrium price is smaller than the target price, government expenditures would unequivocally fall in such a case.

Empirical Simulation

To illustrate the consequences of not incorporating acquisition costs, we compare the outcome of the model described in Figure 4 with that of ignoring acquisition costs. Although we use all of the data and parameters of Anania, Bohman and Carter's wheat example, we do not replicate their empirical model. Instead, the model we calibrate in Figure 4 differs from that of Anania, Bohman and Carter by more than just including acquisition costs. In their study, the wedge between domestic and world prices before the volume constraint is binding is depicted as the value of commodities awarded per unit of commercial exports. This wedge is inappropriate for the case when bonuses are in the form of commodities.[5] *After* the export constraint is reached, Anania, Bohman and Carter depict the bonus inclusive excess demand curve to be the original linear excess demand curve *ED* in Figure 4 (not the non-linear segment) and so ignore the wedge between domestic and world prices. The data and parameters used for calibration of our model, as well as the calibrated equations, are reported in the Appendix.

The impact of including acquisition costs (with deficiency payments and a volume constraint) is summarized in Table 2. Domestic market prices always increase with acquisition costs (less likely when ignoring acquisition costs at lower levels of excess demand only) and the more so relative to the traditional model ignoring acquisition costs at lower excess demand elasticities. World prices always fall as in the traditional model but always less so (and the gap decreases with the elasticity of excess demand). Total exports always go up but less so than the traditional model ignoring acquisition cost because acquisition costs have to come out of current

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[5] To see this, suppose that the domestic price is P and that bonuses come in the form of a certificate worth \$B of commodity for each unit of commercial exports sold. In Anania, Bohman and Carter's model, the post-policy excess supply curve lies everywhere below the original excess supply by a distance of B; domestic and world prices always differ by \$B. However, in equilibrium, the world price is must equal the average price paid by an importer buying $Q_C + Q_C B/P$, which is $P^2/(P+B)$. Thus, the difference between world and domestic prices (the "shift" in ES) is $PB/(P+B) \neq B$.

production.   Commercial exports always goes down in our model where it is ambiguous in the traditional model. As for taxpayer costs, deficiency payments always go down in our model because domestic price always increases. Net tax costs can theoretically increase or decrease, however, because acquisition costs are always positive. The net effect depends on the elasticity of excess demand *and* the share of production exported. Even though acquisition costs are included, Table 2 shows how total tax costs decline in our empirical model but can either increase or decrease in the traditional model (and be more or less so than in our model). Note that deficiency payments are the reason for tax costs to decline when including acquisition costs because the results in Table 1 clearly indicate that tax costs increase when including acquisition costs in the basic model of an export bonus program with no other government policy instruments in place.

Concluding remarks

Traditional analyses of EEP have ambiguous effects on domestic market prices, commercial sales and export earnings. But all previous studies ignore the costs of *acquiring* the surplus stocks, and focus only on the market and taxpayer cost impacts of *disposing* public stocks. Studies that treat stocks as manna from heaven assume the cost of existing government stocks should not be considered as part of the market effects of their disposal. However, export bonuses from government inventory for wheat over the entire time period was in the order of 40 times the change in government inventories over that same period. This means that most of the bonuses were replaced by government stock purchases.

Using a partial equilibrium framework, we show that the economic effects of export bonus programs are significantly different if one includes the acquisition costs of the public stocks. If only disposals are considered, an export bonus program may generate an increase or decrease in domestic prices, but if acquisition cost is taken into account, the domestic price always rises. In both models, the world price always falls, and total exports always increase. When including acquisition costs, producer (consumer) welfare always increases (decreases) because the domestic market price increases, taxpayer costs are now positive and the effect on the level of commercial exports is always ambiguous. Following the analysis of Anania, Bohman and Carter, we incorporate the specifics of the U.S. deficiency payment program, with and without export bonus constraints. Given an existing deficiency payment program, the traditional model ignoring acquisition costs predicts that an export bonus scheme can either increase or decrease taxpayer cost, depending on whether the domestic market price falls or rises. When acquisition cost is considered, the effect of the export bonus program on government cost is also ambiguous, but for different reasons. Deficiency payments always decline because the domestic price always rises, but taxpayers must bear the additional burden of purchasing the stocks that are given away as bonuses. The net effect on government cost depends on whether the savings in deficiency payments outweigh the cost of stock acquisition. This impact depends on market parameters and is an empirical question.

Anania, Bohman and Carter argue that a constrained export bonus program always lowers domestic price and therefore increases government expenditures through larger deficiency payments while our model has deficiency payments always going down because the domestic price increases. The export bonus program will increase net government expenditures if the impact of export subsidies on the world market price offsets the savings in deficiency payments in our model (the outcome depends on market elasticities). In theory, net change in tax costs can go up or down, depending on the elasticity of excess demand *and* the share of production exported. Even though acquisition costs are included, total tax costs decline in our empirical model but can either increase or decrease in the traditional model (and be more or less so than in our model).

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Appendix: Model Calibration

Table A1. Base Data and Parameters for Calibration[a]

Item	Value	Source
Domestic Production (mmt)	65.1	Anania, Bohman and Carter, Table 3
Domestic Consumption (mmt)	26.5	Anania, Bohman and Carter, Table 3
Total Exports (mmt)	38.6	Domestic Prod. – Domestic Cons.
EEP Sales (mmt)	25.74	Anania, Bohman and Carter, Table 2 (total EEP sales over all importers)
Bonus Rate ($/mt)	28.95	Anania, Bohman and Carter, Table 2 (weighted average subsidy across importers)
Bonuses (mmt)	5.44	EEP Sales × Bonus Rate / Domestic Price
Commercial Exports (mmt)	33.16	Total Exports – Bonuses
Domestic Price ($/mt)	137.00	Anania, Bohman and Carter, Table 2
World Price ($/mt)	117.70	Domestic Price × Comm. Exp. / Total Exp.
Target Price ($/mt)	155.00	Anania, Bohman and Carter, Table 2
Elasticity of Domestic Demand	0.3	
Elasticity of Excess Supply	0.206	Elasticity of Domestic Dem. × Domestic Cons. / Total Exports

[a] U.S. data for wheat, 1988 crop year

Table A2. Calibrated Excess Demand and Excess Supply Equations

	Excess Demand Elasticity			
	-0.5	-1.0	-3.0	-5.0
Excess Demand Equation				
Intercept	57.90	77.20	154.40	231.60
Slope	-0.16	-0.33	-0.98	-1.64
Excess Supply Equation				
Intercept	30.65	30.65	30.65	30.65
Slope	0.06	0.06	0.06	0.06

Table 1. Effects of a proportional export bonus program[a]

	Without acquisition cost			With acquisition cost		
	Unitary	Inelastic	Elastic	Unitary	Inelastic	Elastic
Domestic price	0	-	+	+	+	+
World price	-	-	-	-	-	-
Total exports	+	+	+	+	+	+
Commercial exports	0	-	+	?	?	?
Export earnings	0	-	+	0	-	+
Stock acquisition cost	0	0	0	+	+	+

[a] A proportional export bonus program means that $R(Q_C, P) = rQ_C$ for some $r > 0$.

Legend:
0 no change compared to free trade
- less than under free trade
+ more than under free trade
? ambiguous

Table 2. Effects of the U.S. Wheat Export Bonus Program in 1988 with a Volume Constraint and Deficiency Payments

	Excess Demand Elasticity							
	-0.5		-1		-3		-5	
	No Acquisition	With Acquisition	No Acquisition	With Acquisition	No Acquisition	With Acquisition	No Acquisition	With Acquisition
Changes in:								
Domestic Price ($/mt)	-14.21	14.26	-1.27	16.40	9.96	18.23	12.54	18.64
World Price ($/mt)	-28.14	-5.05	-16.36	-2.90	-6.12	-1.08	-3.76	-0.66
Total Exports (mmt)	4.61	0.83	5.37	0.95	6.02	1.06	6.17	1.08
Commercial Exports (mmt)	-0.82	-4.61	-0.07	-4.49	0.58	-4.38	0.73	-4.36
Taxpayer Costs (mil. $)								
deficiency payments	925.19	-928.18	82.70	-1067.73	-648.27	-1186.66	-816.09	-1213.70
stock acquisition	0.0	745.11	0.00	745.11	0.00	745.11	0.00	745.11
total	925.19	-183.08	82.70	-322.62	-648.27	-441.55	-816.09	-468.59

Source: calculated

Figure 1. The Traditional Model of an Export Bonus Program

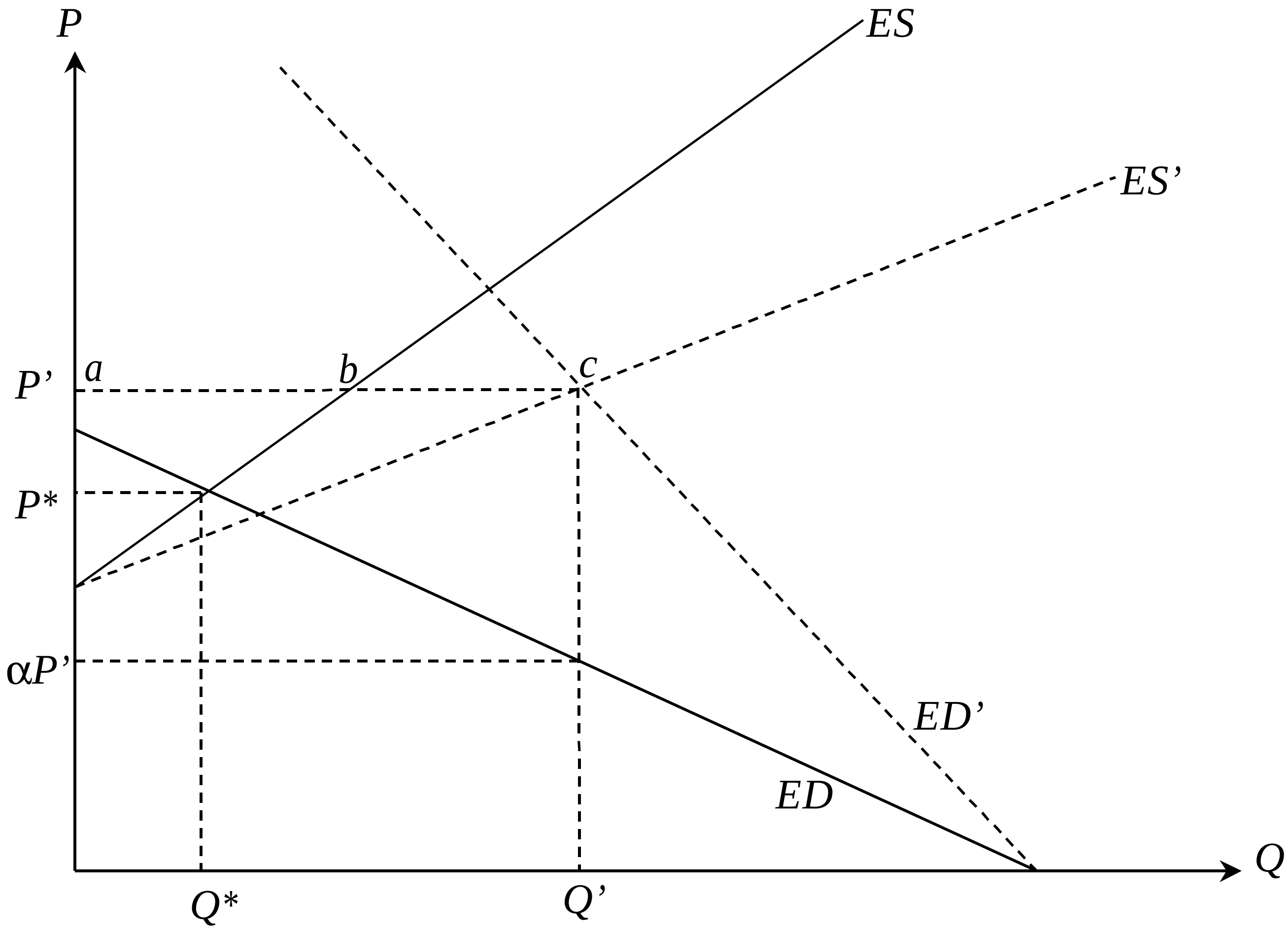

Figure 2. An Export Bonus Program with Stock Acquisition

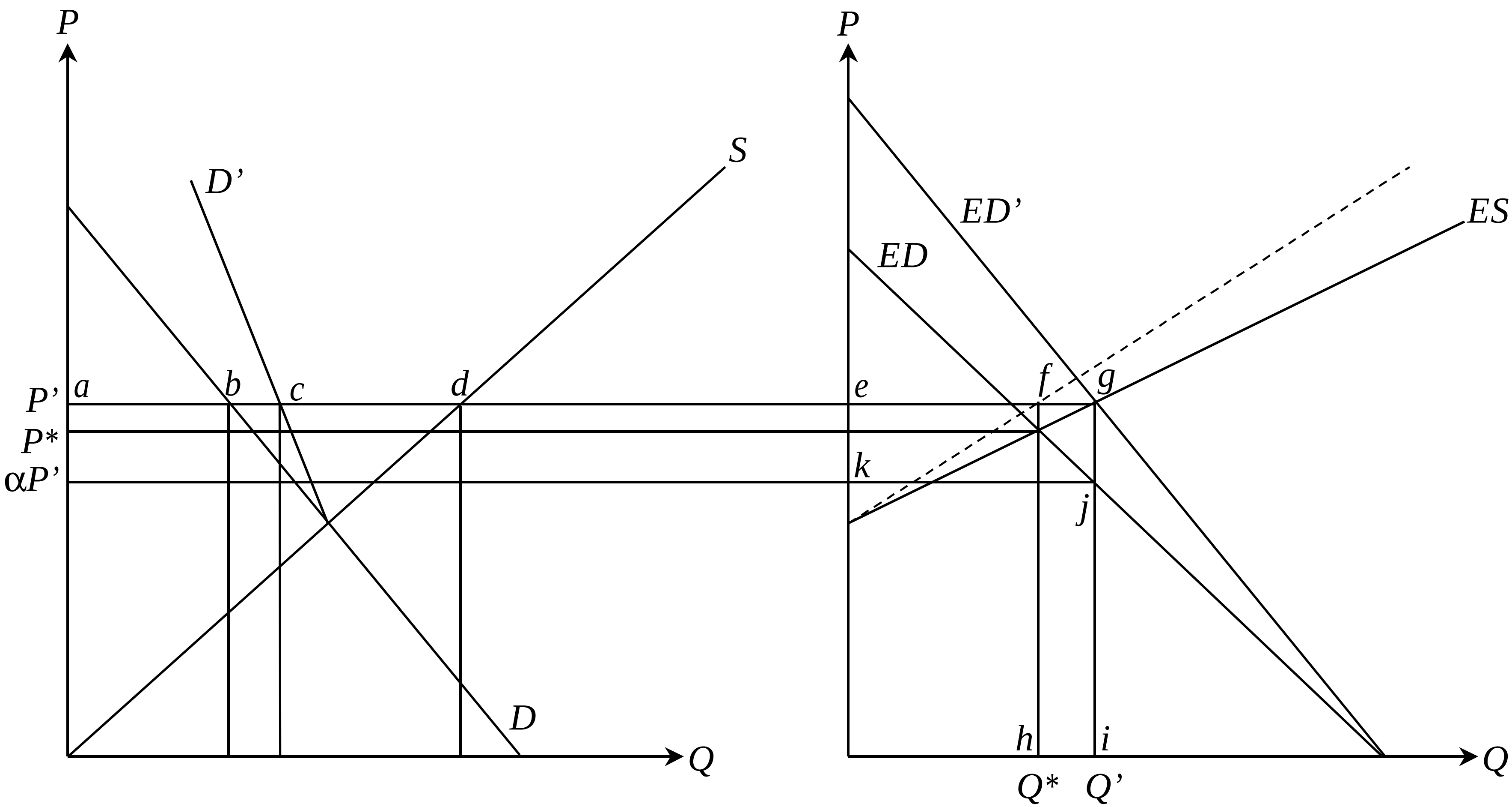

Figure 3. An Export Bonus Program with a Volume Constraint

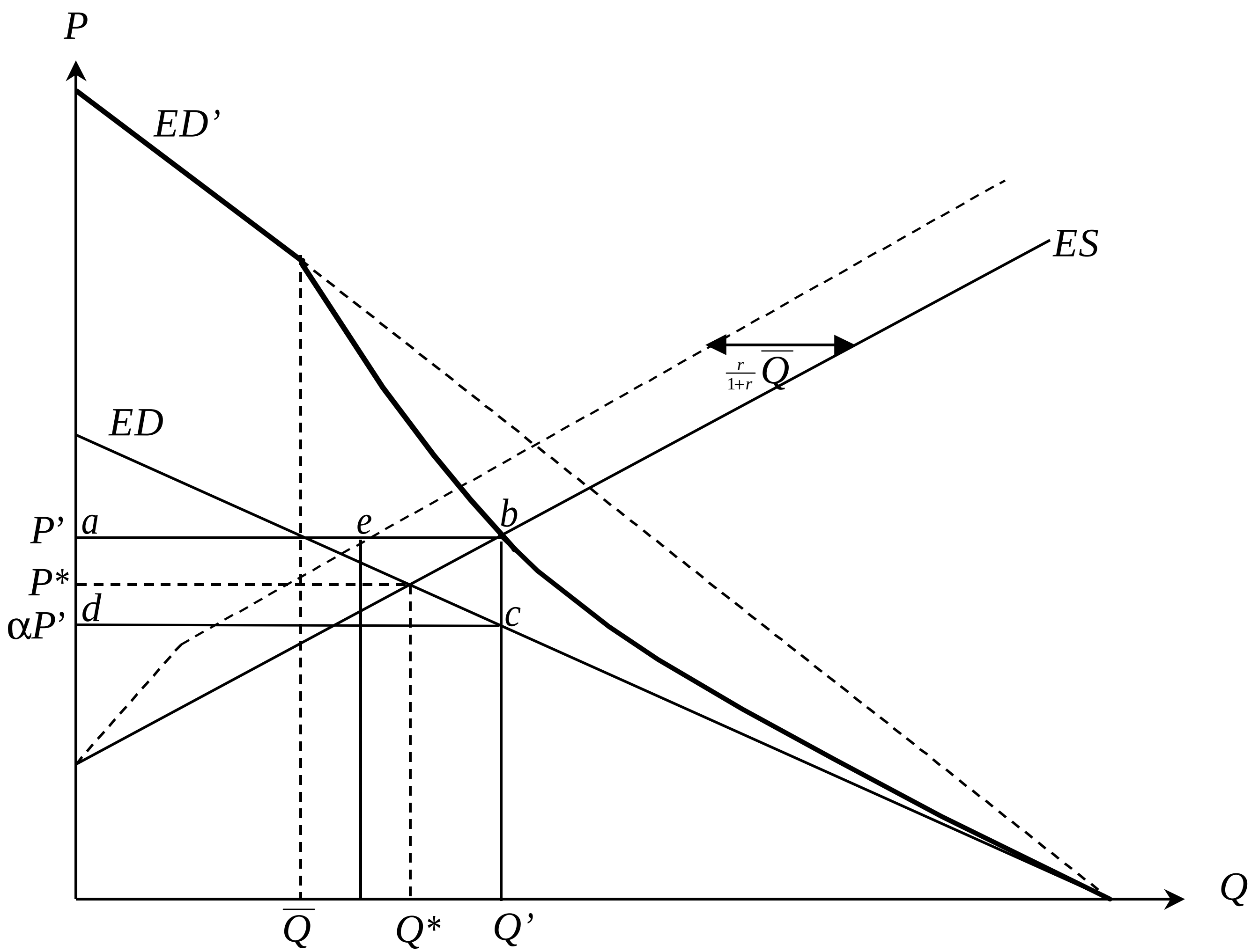

Figure 4: An Export Bonus Program with a Volume Constraint and Deficiency Payments