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THE SOCIAL PROFITABILITY OF EXPORT SUBSIDIES FOR AGRICULTURAL EXPORTS FROM LDC: THE CASE OF GHANA*

by

Walter Haessel and Edward Vickery

Many less developed countries (LDC) maintain an exchange rate which results in a tendency to run a deficit on the balance of trade and/or current account. Devaluation is often considered to be a politically unacceptable solution due to the adverse effects on the domestic price of imported capital and consumer goods. Curbing imports through higher tariffs is ruled out for the same reason. Frequently used instruments in these situations are quotas and restrictions on imports and various controls on the use of foreign exchange. In this paper we consider a method of estimating the increase in social welfare that can result from a system of export subsidies in an economy with the foregoing constraints. This method is applied to some traditional agricultural exports in Ghana.

Social welfare is clearly the relevant criterion. Producing additional commodities for export involves a reduction in consumer surplus as well as utilization of resources which could be employed in alternative projects. By contrast, a naive criterion of maximizing the generation of foreign exchange earnings would result in a lower level of social welfare. We shall also demonstrate that a policy of export subsidies can be socially desirable even though in certain cases

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it may result in decreased foreign exchange earnings on some commodities. For the typical crop, however, we expect foreign exchange earnings to increase.

This paper consists of four parts. The first discusses the theoretical framework and the method of empirical approximation. Included is a discussion of a method of estimating consumer surplus when a shift occurs in the demand curve which, to the best of our knowledge, has never appeared in the literature. In the second part Ghanaian data are used to estimate the approximate magnitude of the change in social welfare which could be expected from implementing the recommended export subsidies. The third part discusses the fiscal implications of such a policy. The final part contains a summary and conclusions.

I. THEORETICAL FRAMEWORK

A. The General Case

We begin with the discussion of a subsidy on one crop only and then generalize this to multiple subsidies. Following Harberger [10], the net social benefit (NSB) to the economy of a particular policy can be measured by the change in the total of collective consumers' and producers' surplus. Thus the NSB of an export subsidy of $\Delta P_j$ on commodity $j$ can be expressed as

\[
\Delta W_j = \sum_{i \in J} \int _0 ^{\Delta P_j} [D_i(Z_j) \partial X_i / \partial Z_j] dZ_j,
\]
where $D_i$ represents the excess of marginal social benefit (MSB) over marginal social cost (MSC) per unit of activity $i$, $X_i$ is the number of units of activity $i$, $Z_j$ is the policy variable (export subsidy in this case), and $I_j$ is the set of all activities in the economy with divergences between MSB and MSC and whose levels of activity are affected by the policy change.

In this particular problem there are two types of divergences which are worthy of consideration; a divergence between the social opportunity cost (SOC) of labor and the wage rate and secondly, a divergence between the official exchange rate and the marginal social value of foreign exchange. Regarding the possibility of the former divergence, there is considerable evidence that Ghana is not a labor surplus economy, especially in the rural areas with which we are primarily concerned. (See Rourke [16] and Addo [1].) Hence we assume that the rural wage rate is an accurate reflection of the SOC of rural labor. However, the industrial wage probably exceeds the SOC of industrial labor in view of the widespread urban unemployment in Ghana (see Williams and Ntim [20]). A policy of agricultural export subsidies is unlikely to have any substantial effect on the level of industrial employment and we assume such changes to be negligible. In the event that the subsidies increase the level of industrial employment or if the SOC of rural labor is below the rural wage rate (for example, if additional rural employees came from the urban unemployed), then our measure of the social benefits would be an underestimate of the true social benefits.
Turning now to the divergences resulting from an overvalued exchange rate, equation (1) indicates that to appraise the NSB of a subsidy on commodity $j$ account must be taken of any activity involving the use of foreign exchange (either export or import) whose level will be affected by the subsidy. Two types of activities fall into this class: factors of production which are imported and other 'tradeable' commodities. The import content of factors of production are explicitly taken into account in computing the level of subsidy through shadow pricing of production costs and are discussed below. A tradeable commodity we define as one which is currently being produced in Ghana and either exported, imported, or not traded but would be profitable to export if an optimum export subsidy were provided. The tradeable commodities whose levels of production are likely to be affected are other agricultural commodities which compete with commodity $j$ for resources such as land and labor. Hence we concentrate only on agricultural commodities.

Let $J$ denote the set of all tradeable agricultural commodities. Define $I_j'$ as the subset of $I_j$ not in $J$. Now $I_j'$ is the set of activities whose levels change when commodity $j$ is subsidized and have divergences between social and private costs because of the overvalued exchange rate (i.e., the imported inputs required in the production of commodity $j$). If an export subsidy is placed on all commodities in $J$, the NSB of the set of subsidies would be given by

$$
(2) \quad \Delta W = \sum_{j \in J} \sum_{i \in I_j'} \int [D_i(Z_j) \Delta X_i / \Delta Z_j] dZ_j ,
$$
which can be rewritten as

\[ \Delta W = \sum_{j \in J} \int_0^{\Delta P_j} \left[ D_j(Z_j) \frac{\partial x_j}{\partial Z_j} \right] dZ_j + \sum_{j \in J} \sum_{i \in I, i \neq j} \int_0^{\Delta P_j} \left[ D_i(Z_j) \frac{\partial x_i}{\partial Z_j} \right] dZ_j. \]

The first term on the right hand side of (3) is a measure of the direct NSB of the subsidies arising from the changes in consumption, production and export levels while the second is a measure of the NSB arising from changes in the level of imported resources. The latter set of divergences will be taken into account by shadow pricing imported resources when evaluating the direct benefits. Let \( P^* \) be the appropriate level of subsidy that takes account of imported resources. Then (3) can be rewritten as

\[ \Delta W = \sum_{j \in J} \int_0^{P^*} \left[ D_j(Z_j) \frac{\partial x_j}{\partial Z_j} \right] dZ_j. \]

B. Estimating the NSB of Export Subsidies

In this section we discuss a method for approximating equation (4) empirically when the only significant divergences between social and private costs and returns arise in the foreign exchange market. We define the following notation:
$R$ = official exchange rate (local currency-price of foreign exchange);

$R_s$ = social opportunity cost (in local currency) of foreign exchange;

$r = (R_s - R)/R =$ proportion by which the currency is overvalued by the official exchange rate;

$P_{0j}$ = existing domestic wholesale price of commodity $j$ at the normal port of export (which is assumed to equal marginal private costs of production);

$P_{wj}$ = existing f.o.b. world price of commodity $j$ (in foreign currency) at the normal port of export of commodity $j$;

$\alpha_j$ = proportion of commodity $j$ production costs comprised of imports;

$P_{lj}$ = the appropriate (subsidized) price in local currency;

$P'_{lj} = P_{wj}R_s$

Correction for the foreign exchange price divergence proceeds in two steps. First, $RP_{wj}$ must be adjusted for the difference between the SOC of foreign exchange and the official exchange rate, i.e., $R_sP_{wj}$ since $P_{wj}$ is measured in foreign currency units. Second, the import content of production costs must be raised similarly, i.e., $\alpha_jP_{0j}(R_s/R)$ since $P_{0j}$ is measured in local currency units. Thus, the set of subsidies which will correct for the foreign exchange divergence for commodity $j$ will be

\begin{equation}
P_j^* = P'_{lj} - P_{0j}(\alpha_j r + 1)
\end{equation}

Note that $P_j^*$ must be calculated separately for each commodity since $\alpha_j$ is specific to the commodity. (For simplicity we drop the subscript $j$ at this point.) Calculation of $P^*$ in this manner implies that production occurs in perfectly competitive conditions and the exporting country has no monopoly power in the world market for the commodities in $J$. The former assumption is satisfied in Ghana and the case of monopoly power is discussed below.

We now turn to a diagramatic representation of the individual terms of equation (4). In Figure 1, $D$ represents the short-run domestic demand function while $S_p$ and $S_s$ represent, respectively, the private and social short-run domestic supply functions for a commodity in the set $J$. At the existing domestic price, $P_0$, the quantity $O_S$ is being produced, $Od_o$ is being consumed, and $d_oS_o$ is being exported. If subsidy $P^*$ raises the price to $P_1$, production will increase by $\Delta S = S_oS_1$, consumption will decrease by $\Delta D = d_1d_o$, and exports will increase by the sum of the two changes, $\Delta E = \Delta S + \Delta D$.

The marginal social benefit of one unit of export of the commodity is $P_1$ regardless of whether or not a subsidy is being paid. The marginal social cost of production is given by the height of curve $S_s$. Hence in the range $S_oS_1$, the MSB of increased exports exceeds the MSC, and the NSB of expanding output by $S_oS_1$ and exporting that quantity is given by the area $fgh$ (composed of $fgkt$ of privately and socially perceived benefits offset by $fhkt$)

(Insert Figure 1 here.)
Figure 1. NSB of Export Subsidies
of socially perceived costs). The MSC of decreased domestic consumption is given by the height of the demand curve, which is less than the MSB of increased exports in the range \( d_1d_0 \). Social welfare will be increased if a subsidy of \( P^* \) is paid for each unit exported. This will raise the producer price to \( P_1' \). The NSB from decreased domestic consumption and increased production would be equivalent to areas abcd and fgh, respectively.

It would not be socially optimal to pay a subsidy equal to \( P_1' - P_0 \). While this would reduce domestic consumption to the optimum level of \( Od_1' \) (yielding NSB of ebc), it would at the same time expand production such that MSC > MSB. An excess of social costs equivalent to area fnm will be generated by increasing production from \( Os_1 \) to \( Os_1' \). As long as \( \partial \text{NSB}/\partial P^* > 0 \), it is efficient in social welfare terms to increase the producer price beyond \( P_1 \). The optimum subsidy would be attained where \( \text{NSB}/P^* = 0 \), which will be somewhere between \( P_1 \) and \( P_1' \). We limit our analysis to a subsidy set equal to \( P^* \) which promises a definite gain in social welfare.

If the demand and supply curves are almost linear over the range of changes in output and consumption, and if \( S_s \) is parallel to \( S_p \), the gain in social welfare can be approximated as

\[
\Delta W = \frac{1}{2} P^* (\Delta D + \Delta S) + (P_1' - P_1) \Delta D.
\]
We can obtain an empirical estimate of the NSB for each commodity if we know the elasticities of demand and supply and the quantities produced and consumed. If $\varepsilon_s$ is the elasticity of supply, then

\[(7) \quad \Delta S = \varepsilon_s S_o (P^*/P_o)\]

is an estimate of the supply change. Similarly,

\[(8) \quad \Delta D = \varepsilon_d d_o (P^*/P_o)\]

is an estimate of the change in quantity demanded, where $\varepsilon_d$ is the absolute value of the demand elasticity.

C. **Estimating the NSB of Import Taxes**

Turning briefly to the case of imported commodities, we consider a tariff to remove the implicit subsidy to consumers from an over-valued official foreign exchange rate in Figure 2. Before a tariff is imposed, $P_o$ is the market price for the imported good at the official exchange rate. At this price, $O_d O_o$ is demanded, $O S_o$ being supplied by domestic production and $S_o d_o$ by imports. A tariff equal to $T^*$ as given by equation (5) would be optimal with respect to increasing domestic output to $O S_1$, but would only reduce imports by $d_1 d_o$ instead of the optimal $d_0 d_0$. Nevertheless, $T^*$ produces a definite gain in social welfare (equivalent to areas abcd plus fgh). As with producer price subsidies, an estimate of

(Insert Figure 2 here.)
the NSB represented by areas abcd plus fgh can be obtained by using equations (6), (7) and (8).

D. NSB for Subsistence Vs. Cash Crops

The foregoing discussion is strictly correct for cash crops only, a cash crop being one that is grown by the farmer for sale and is not consumed on the farm. A qualification is necessary for subsistence crops, by which we mean a crop that is grown for home consumption as well as for cash sale.

It is well known that for subsistence crops the quantity marketed may decline when the price rises even though the quantity produced increases. (See, for example, Behrman [3] or Krishna [11].) The reason for the possibility of this phenomenon is that as the price increases the producer's money incomes increase which will shift the producer's demand curve to the right (assuming a positive income elasticity of demand). Whether the producers' consumption increases or decreases when the price increases depends on the relative magnitudes of the total price and money income effects, (where the total price effect includes both the substitution and real income effects of the Slutsky-Hicks variety). Whether marketings increase or decrease when the producers' consumption increases depends on whether output increases by more or less than consumption. Even if producers market less when the price increases, it is still possible that exports will increase if consumption by non-producers declines sufficiently at the higher prices.
The empirical approximation of the NSB of an export subsidy defined by equation (6) is relevant for subsistence crops as well as for cash crops. The case of a subsistence crop is depicted in Figure 3. $P_0$ is the producer price prevailing before the subsidy, $S_P$ and $S_s$ represent the private and social short-run supply functions, $D_o$ and $D_1$ are, respectively, the short-run demand functions before and after the subsidy. These demand functions represent the combined demand of both producers and non-producers. The initial equilibrium is characterized by $OS_0$ being produced, $Od_0$ being consumed, and $d_0S_0$ being exported. When the export subsidy of $P^*$ is introduced, the producers' surplus increases by the area $P_1P_0ki$. This increase in their money (and real) income shifts the total domestic demand curve to $D_1$. The new equilibrium with the subsidy is where $OS_1$ is produced, $Od_1$ is consumed, and $d_1S_1$ is exported. This means less exports than the situation described for cash crops (which would be $d_0^*S_1$).

Suppose, however, that the producer price subsidy is combined with a lump-sum tax on the producers so that their money incomes with the subsidy plus tax are equal to their incomes without subsidy or tax (i.e., the tax would be equal to the area $P_1P_0ki$. Then domestic consumption with the subsidy would be $Od_0^{*}$ and quantity $d_0^*S_1$ would be exported. The NSB of a policy of subsidy-cum-lump-sum-tax would be equal to the areas abcd plus fgh and could be approximated using equation (6). The lump-sum tax is simply an

(Insert Figure 3 here.)
income redistribution device which does not affect the NSB to the economy as a whole. The fact that the producers choose to consume more of the subsidized commodity without the lump-sum tax does not diminish the NSB.\textsuperscript{10}

E. The Effect of Monopoly Power in the Export Market

Some LDC produce significant proportions of the total world output of certain commodities and can significantly influence the world price. Our general solution in equation (4) still captures the total $\Delta W$ for imperfect competition. However, the empirical approximation must be modified to take account of marginal social revenue (MSR) instead of simply the world price.

If a country has monopoly power in an export market then the socially optimum level of exports would be determined by $\text{MSR} = \text{MSC}$. The MSR depends on the level of exports and would be given as

\begin{equation}
\text{MRS} = P_w R_s \left(1 + \frac{1}{\eta_g}\right)
\end{equation}

where $\eta_g$ is the (negative) price elasticity of world demand for Ghana's exports of the commodity in question. Blomqvist and Haessel [4] have shown this elasticity is

\begin{equation}
\eta_g = [\eta_w - (1 - 0 \gamma)]/0,
\end{equation}
where $\eta_w$ is the price elasticity of world demand for world output, 
$\gamma$ is the price elasticity of supply of the rest-of-the-world (ROW), 
$\theta = \frac{S_g}{S_g + S_r}$ is Ghana's share of the world market, and $S_r$ and 
$S_g$ are Ghana's and ROW's outputs, respectively. MSC would be given as

\begin{equation}
(11) \quad MSC = P + \alpha P_0 \, ,
\end{equation}

where

\begin{equation}
(12) \quad P = f(S_g)
\end{equation}

is the inverse of the private supply function or the private supply price. This must be adjusted for the underpriced portion $\alpha$ which is imported and $P_0$ is the existing supply price. Similarly, $P_w$ can be denoted as the inverse of the world demand function as

\begin{equation}
(13) \quad P_w = h(S_g + S_r) \, .
\end{equation}

Thus, for any given level of $S_{ro}$, it is possible to determine the optimum level of production for Ghana by equating (9) and (11) and substituting (10), (12) and (13). Denote this optimum level as $S_{gl}$. From (12) and (13) we get corresponding values for $P_1$ and $P_{wl}$. The optimum export subsidy (or tariff) level would be given by $^{12}$
(14) \[ T = P_1 - P_{w1} R. \]

The problem is illustrated in Figure 4 under the assumption that the commodity is not consumed domestically but produced only for export. As before, \( S_p \) and \( S_s \) denote the private and social supply curves for Ghana. Assuming some level of production for ROW \( S_{ro} \), \( D_p \) and \( D_s \) denote the world demand price for Ghana's production converted at the official and social exchange rates respectively.\(^{13}\) The MRS curve is the marginal curve for \( D_s \).

If production and marketing in Ghana is atomistic, then equilibrium will occur at \( e \) where every producer receives the world price converted at the official exchange rate \( (P_{wo} R = P_o) \) and an amount \( S_{go} \) will be produced. However, at that level MSC > MSR and welfare will be increased by restricting production to \( S_{g1} \) where MSC = MSR.\(^{14}\)

The NSB would be given by the area \( abd \) which may be approximated as

(15) \[ \Delta W = \frac{\Delta Q^2}{2} \frac{S_{go}}{R} \left( \frac{1}{2 \varepsilon_s} + \frac{R}{R_{g}} \right), \]

where \( \Delta Q = S_{g1} S_{go} \) and \( \varepsilon_s \) is Ghana's elasticity of supply.\(^{15}\) If the commodity is consumed domestically, the supply curve \( S_p \) must be interpreted as an export supply function and \( \varepsilon_s \) must be modified accordingly.

(Insert Figure 4 here.)
Figure 4. NSB with Monopoly Power in the World Market
II. Empirical Results for Ghana

Cocoa earnings (including beans and cocoa products) have typically contributed about two-thirds of Ghana's total export earnings throughout the years 1955-1971.\textsuperscript{16} Ghana's share of world cocoa production has fluctuated between 25 and 40\% since 1960 suggesting she has some monopoly power in the world market. Blomqvist and Haessel [4] estimated that the 1971 producer price was about optimum to equate MSR and MSC. Thus there was little scope for improvement from cocoa and we concentrate on estimating increases in NSB which can be achieved via export subsidies on other tradeable agricultural commodities.

Appendix Table A summarizes our estimates of net social benefits in 1971 for selected crops from setting producer prices equal to $P_1$, the social value of output.\textsuperscript{17} Three categories of crops are distinguished: tree crops, starchy foods, and other cash crops.

Tree crops are characterized by relatively small absolute levels of output (compared to the subsistence crops of yam, for example). Further, tree crops display highly inelastic short-run supply functions. Coffee is further complicated by export quotas imposed by the International Coffee Agreement. Since Ghana filled her entire quota in 1971, the NSB for coffee were evaluated at 1971 non-quota prices. In spite of this, the NSB of expanded coffee exports are quite large.\textsuperscript{18}
Since total Ghanaian output of other cash crops is insignificant relative to total world demand, increased exports will have a negligible effect on world prices. Also, it is possible to expand output for these crops with a lag of less than eighteen months. This combination of favorable characteristics suggest that export subsidies on other cash crops possess great potential for generating NSB. The large NSB estimated in Table A for groundnuts and pineapples are consistent with this hypothesis. 19

Starchy foods generally appear to have low export potential. 20 The message of Table A is that maize and bananas should not be traded, and rice and guinea corn (sorghum) are produced more efficiently in other countries. In fact, increased imports of guinea corn would have generated positive NSB. Imported rice is somewhat underpriced and a tariff increase will yield a positive NSB. Other potential exports of starchy foods are cocoyam, yam, and plantain. However, total world imports of these crops are small and increased exports could probably not be marketed without substantial declines in world prices.

Several additional items in Table A deserve mention:

1) A comparison of $P_R^w$ and $P_o^w$ indicates that of all the commodities only pineapples and coffee show commercial profits for export at the then existing prices, with coffee almost breaking even. Since $P_R^w$ for guinea corn, maize and rice are import prices (C.I.F. Tema), expanded imports of these commodities would be commercially profitable.
(2) Some commodities which exhibit negative or zero commercial profits \((RP_w - P_o)\) for exports show positive social profits \((P_1 - P_o)\). This is the case for cola nuts, oranges, copra, and groundnuts.

(3) Positive export subsidies \((P^* = P_1 - P_o)\) for coffee, cola nuts, copra, oranges, groundnuts and pineapples indicate the extent that 1971 export prices should have been increased to reflect the difference between the social and official values of foreign exchange in Ghana. For bananas, the very small (negative) subsidy indicates they should not be traded and the positive value for rice (which is imported) indicates that an increase in tariffs would be socially desirable.

(4) Using equation (5) to calculate the optimum subsidy for maize and guinea corn leads to the conclusion that imports should be increased. In the case of increased imports, however, it can be shown the appropriate domestic price will be \(P_{wS}\). In this case the appropriate tariff will not be the same as the optimum change in the domestic price which is used to calculate NSB. As it turns out the domestic price of maize and guinea corn are about correct but small imports of guinea corn would be socially profitable resulting in both savings in production costs and increased consumer surplus through higher consumption.

(5) For rice, an increase in the import price will result in positive NSB. The optimum tariff is larger than the optimum change in domestic price since \(P_o > P_{wR}\).
To summarize, Table A reports estimates of the NSB to be gained by instituting an appropriate system of export subsidies, import tariffs, and increasing imports of guinea corn to supplement domestic production. Of the commodities considered, coffee, cola nuts, ground-nuts, and pineapples show the greatest prospects for additional exports. Of the starchy foods, none show any prospect for exports but rice imports should be reduced. The status quo in maize and guinea corn is about correct and bananas should not be traded. Based on the assumed responsiveness of producers and consumers, total NSB's of the subsidies program are estimated to be between 5.2 and 8.7 million cedis for the commodities considered.

III. FINANCING THE SUBSIDIES

One of the more serious disadvantages of a system of export subsidies is the fiscal burden it places on the government budget. The cost of an optimal export-bonus/import-tariff scheme would be given by

\[(16) \quad \Delta G = \sum_{i} F_i P_i^* - \sum_{j} H_j T_j^*\]

where \(i\) and \(j\) are summed over all the exports and imports involved in the scheme. Using (16) to evaluate the implications for the government budget for the 10 commodities considered we find net expenditures of \(\phi 6.5\) and \(\phi 11.3\) million would be required to finance the scheme for
the low and high estimates respectively. These estimates range from 1.9 to 3.3 percent of the Ghanaian government recurrent expenditures for the fiscal year 1970/71.\textsuperscript{21} Considering that our analysis included only a few of the potential exports, it is clear that an export bonus scheme of this type can place a tremendous burden on the government budget.

If as a result of the increased foreign exchange earnings there is an increase in imports of $\Delta M$, the scheme will be at least partly self financing. Government revenue collected as tariffs on all imports $M$ will be sufficient to finance the export bonus scheme if $T^W M > EP^W$, where $T^W$ and $P^W$ are weighted average tariff and subsidy rates and $M$ and $E$ are total imports and exports. Unfortunately some of the tariff revenue collected prior to the export bonus scheme will be earmarked for other uses and only some portion $\Delta M^W$ would be available for financing the export bonus scheme.

This portion will be insufficient to finance the increased expenditure required. For the ten commodities considered in Table A, the additional net foreign exchange earnings are \$17.6 and \$26.4 million for the low and high estimates respectively. Historically, the weighted average import tariff rate for Ghana $T^W$ has varied between 15 and 30%.\textsuperscript{22} Assuming that all the additional net foreign exchange earnings are spent on imports, we get the results in Table B for three alternative assumptions about $T^W$. Depending on the tariff rate and the responsiveness of the producers and consumers,
the subsidy scheme may be anywhere from 33% to 68% self-financing. When this self-financing aspect is taken into account, the net increase in government expenditure (deficit) implied by the scheme varies from between 0.6% and 2.3% of the 1970-71 recurrent government budget.

IV. **SUMMARY AND CONCLUSIONS**

In this paper we have developed a methodology for evaluating the NSB of instituting a system of optimal export subsidies and import tariffs. A technique is discussed for evaluating consumer surplus when the demand curve shifts due to an income change.

This methodology is applied to selected Ghanaian data to estimate the social profitability of an export subsidies scheme. It is found that such a policy would have yielded substantial social benefits given the private and social prices prevailing in 1971. While such a program requires substantial government expenditures, if increased foreign exchange earnings are matched by increased imports, the program would be anywhere from 33% to 68% self-financing. This reduces the burden on the government budget substantially.

If the system of optimal export subsidies and import tariffs is extended to cover all traded commodities, the economy will in fact have experienced a de facto devaluation as far as incentives to importers and exporters are concerned. There are, however, two major advantages a de jure devaluation has over a de facto devaluation.
First, a de jure devaluation avoids the fiscal burden discussed above. Second, and perhaps even more important, a de jure devaluation is much easier to administer than a system of export subsidies and import tariffs. Given that highly qualified administrative personnel tend to be scarce in LDC this is an important consideration. Unfortunately, all too often devaluation is considered to be a politically unacceptable policy. In the event that it is impossible to solve the problem of an over-valued exchange rate through devaluation, we recommend a policy of export subsidies. That, however, is our second choice.
NOTES

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1. By social welfare we mean the excess of social benefits over social costs attributable to any given policy.

2. See Szerekowski [18] for evidence that the linkages between agriculture and other sectors of the Ghanaian economy are weak.

3. If $X_k$ is the level of non-agricultural employment, we are in essence assuming $\frac{\partial X_k}{\partial Z_j} = 0$. If this is not the case, the bias (actual measure minus true measure) would be given by

$$B = - \int_0^{\Delta P_j} [D_k(Z_j) \frac{\partial X_k}{\partial Z_j}] dZ_j$$

Since we expect $D_k > 0$ (i.e., the non-agricultural wage exceeds the SOC of non-agricultural labor), $B$ would be of the opposite sign of $\frac{\partial X_k}{\partial Z_j}$ which will probably be positive if it is not zero. For example, an increased demand for the processing of
additional commodities for export and increased transport requirements would result in \( B < 0 \). It is difficult to think of cases which lead to biases in the opposite direction.

4. Logically, this category should also include commodities which are not being produced in Ghana but which could be produced for export (if justified by the appropriate export subsidy) or local consumption (if current imports had the appropriate tariff). In addition, commodities which are being produced for domestic consumption behind a tariff wall but would be imported if the tariff were reduced to the appropriate level should be included.

5. In essence, by shadow pricing foreign exchange, the second term is incorporated into the first by adjusting the \( D_j \) for other divergences. See Harberger [10, pp. 789-791], for a convincing discussion.

6. This is derived as

\[
P^* = P_1 - P_o = R_s P_w - [(1 - \alpha) P_o + P_o (R_s / R)]
\]

\[
= P_1' - P_o \ (\alpha + 1)
\]

7. At price \( P_1 \) there is still an implicit subsidy to consumers equal to area \( P_1 P_1' \) in Figure 1, the incremental consumer surplus enjoyed by keeping the price at \( P_1 \) instead of \( P_1' \). The only way to achieve the economically optimum levels of
consumption, production, and exports without a de facto devaluation would be with a consumption tax of \( rP_0 \) and an export subsidy of \( P^* \). The consumption tax would be very difficult if not impossible to administer.

8. This does not remove all of the subsidy to the consumer. The optimum solution would require a tariff of \( rP_0 \) and a production tax of \( aP_0 \). In the event that \( P_0/RP_w \) (due perhaps to existing import duties) the optimal tariff would be given as

\[
T^* = P_w(R_S - R) - aP_0.
\]

9. The result is a demand curve for a constant money income, which is one of the items usually included in the ceteris paribus assumptions. See Friedman [7].

10. Alternatively, one could start from the situation with a subsidy but without a lump-sum tax. Thus, consumption would be \( O_{d_1} \) and exports \( d_1S_1 \). Now if the export subsidy is removed and the producers are given a lump-sum transfer equal to area \( P_1P_0^{ki} \), the demand curve would remain unchanged and \( d_1^* \) would be consumed. Exports would be reduced to \( d_1^*S_0 \), and the cost to the economy would be equal to areas \( t_mw \) plus \( fgh \). The sum of these two areas can be approximated by equation (6).

11. As before, this specification implies that the absolute level of foreign exchange costs per unit of output remains constant over varying levels of output.
12. This is essentially the method used by Blomqvist and Haessel [4] to determine the optimum level of export tariff on cocoa exports from Ghana. However, they did not indicate how to evaluate the net social benefits of instituting such a tariff.

13. The positions of $D_p$ and $D_s$ depend on a fixed $S_{ro}$ but their slopes take into account expected ROW reactions to any change in $P_w$ since ROW's supply elasticity is included in (10).

14. Figure 4 could also be drawn to illustrate the case where at the private equilibrium MSR > MSC and an export subsidy would be justified. The algebra and geometry apply equally well to that case.

15. The area abd may be approximated as $\Delta W = \frac{1}{2} \Delta Q (\Delta P + \Delta MRS)$ where $\Delta P$ and $\Delta MRS$ are the change in producer price and MRS that result from the policy. Using equation (7), $\Delta P = \Delta Q P_o / e Q_o$. If the world demand for Ghana's output is approximately linear in the region of the price change, $\Delta MRS = 2 R_s \Delta P_w$. From equation (8), $\Delta P_w = \Delta Q P / e Q_o$. Substituting and simplifying gives (15).

16. See Stern [17, p. 52].

17. The basis for selecting the commodities which appear in Table A was data availability. Consequently, the estimated NSB reported in this Table are not intended to represent the NSB to all of Ghanaian agriculture. Rather, they should be viewed as illustrative of the order of magnitude.
18. There are other promising tree crops for which insufficient data are available. Ghana now exports significant quantities of lime juice; and avocados, grapefruits, lemons, mangoes, and oil seeds are produced in large quantity for local consumption.

19. Other promising commodities in this class include peppers and onions.

20. An exception may be export of cassava chips for animal feed to Europe.


22. This is based on the cedi value of total imports reported in *External Trade Statistics of Ghana* and the cedi value of import tariffs collected in *Quarterly Digest of Statistics*.

23. Applying our methodology to all tradeable commodities in the economy would amount to evaluating the NSE of a devaluation.

24. Teigeiro and Elson [19] found that even though the various export schemes used in Colombia were very effective in stimulating exports, the fiscal burden was substantial enough that they recommended greater reliance on exchange rate adjustments as an export promotion device.
# Appendix Table A

**NSB's from Establishing Optimum Export Subsidies and Import Tariffs for Selected Agricultural Commodities in Ghana: 1971**

<table>
<thead>
<tr>
<th></th>
<th>Tree Crops</th>
<th>Starchy Foods</th>
<th>Other Cash Crops</th>
<th>Total NSB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coffee</td>
<td>Cola Nuts</td>
<td>Copra</td>
<td>Oranges</td>
</tr>
<tr>
<td><strong>1971 Quantities, '000 long-tons</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Production, ( S )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( 3^a )</td>
<td>33(^b)</td>
<td>23(^b)</td>
<td>25(^c)</td>
<td>.74(^d)</td>
</tr>
<tr>
<td>Exports or (Imports), ( D_o )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( 5^f )</td>
<td>2(^f)</td>
<td>2(^f)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Domestic Consumption, ( d_o )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>21</td>
<td>25</td>
<td>74</td>
<td>16</td>
</tr>
</tbody>
</table>

| Demand Elasticities, \( e \) |            |               |                  |           |          |             |       |      |            |            |
| Low | - .20 | - .18 | - .10 | - .32 | - .32 | - .79 | - .79 | - .52 | - .59 | - .32 |
| High | - .29 | - .27 | - .20 | - .30 | - .50 | - 1.97 | - 1.97 | - 1.36 | - .84 | - .50 |

| Supply Elasticities, \( h \) |            |               |                  |           |          |             |       |      |            |            |
| Low | .16 | .16 | .05 | .05 | .10 | .14 | .14 | .20 | .50 | .10 |
| High | .40 | .50 | .10 | .10 | .20 | .18 | .18 | .46 | .70 | .20 |

| 1971 Market Prices, c/long-ton |            |               |                  |           |          |             |       |      |            |            |
| Export Price FOB Tema, \( P_{FT} \) |            |               |                  |           |          |             |       |      |            |            |
| 360\(^g\) | 191\(^f\) | 161\(^f\) | 68\(^f\) | 40\(^f\) | (110)\(^y\) | (70)\(^f\) | (173)\(^f\) | 243\(^f\) | 85\(^f\) | 27 |
| Tema Wholesale Price \( P_{W} \) |            |               |                  |           |          |             |       |      |            |            |
| 349\(^g\) | 191\(^k\) | 185\(^k\) | 92\(^k\) | 66\(^m\) | 162\(^k\) | 118\(^b\) | 218\(^a\) | 282\(^m\) | 64\(^a\) |

| Proportion of \( P \) Represented by Foreign Exchange, \( a \) |            |               |                  |           |          |             |       |      |            |            |
| Low | .13\(^j\) | .17\(^p\) | .07\(^j\) | .19\(^j\) | .10\(^p\) | .23\(^q\) | .23\(^q\) | .38\(^q\) | .19\(^p\) | .24\(^p\) |

| 1971 Social Prices, c/long-ton |            |               |                  |           |          |             |       |      |            |            |
| Export Value FOB Tema, \( P_{V} \) |            |               |                  |           |          |             |       |      |            |            |
| 618 | 328 | 280 | 117 | 69 | 157\(^l\) | 120 | 299 | 417 | 146 |
| Optimum Producer Price Tema, \( P_{P} \) |            |               |                  |           |          |             |       |      |            |            |
| 586 | 305 | 273 | 104 | 64 | 157\(^w\) | 119 | 240 | 383 | 135 |
| Optimum Change Price (\( P^* \) for exports) |            |               |                  |           |          |             |       |      |            |            |
| 237 | 114 | 86 | 12 | - 2 | (5) | (1) | (22) | 101 | 71 |
| Optimum tariff \( T^*P_{P} \) |            |               |                  |           |          |             |       |      |            |            |
| 47 | 50 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 |

| Rate of Subsidy (Tax), \( P^*P^/P_o \) |            |               |                  |           |          |             |       |      |            |            |
| 68 | .60 | .46 | .13 | .03 | (-.03) | (.01) | (.10) | .36 | 1.11 |

| \( \Delta \)Exports (\( \Delta \)Imports), '000 long-tons |            |               |                  |           |          |             |       |      |            |            |
| Low | 7 | 5 | 2 | 3 | - | (5) | (3) | (-6) | 39 | 12 |
| High | 14 | 10 | 3 | 6 | - | (11) | (3) | (-14) | 55 | 20 |

| NSB, '000 c/Year |            |               |                  |           |          |             |       |      |            |            |
| Low | 1,157 | 308 | 95 | 57 | - | 32\(^w\) | 1\(^w\) | 361 | 2,664 | 531 | 5,206 |
| High | 2,124 | 718 | 147 | 101 | - | 63\(^w\) | 1\(^w\) | 878 | 3,770 | 874 | 8,676 |

Sources: See following four pages.
TABLE A -- SOURCES


c. Rough estimate of copra-equivalent. Total output of coconuts in 1970 from source given in a. This was converted to copra at a ratio of 1:8 (derived from Dalton and Famiyeh [6]).

d. Based on 1970 total production (from source given in a) increased by 5% per year average growth over 1966-1970.


g. Unless otherwise noted demand elasticities are from Bussink [5, pp. 208-211].
h. Supply elasticities come from a variety of sources. Estimates
coffee and cola nuts are based on coffee and cocoa supply
elasticities reported by Bateman [2, p. 251] for Ghana, Colombia
and Brazil. No estimates were available for copra, oranges,
bananas and pineapples so arbitrarily low elasticities were
selected. Guinea corn, rice, and maize elasticities are based
on estimates reported by Krishna [11, pp. 506-507] for India,
Pakistan, Indonesia and the Philippines. The estimates for
groundnuts are based on Parikh [14] for India.

i. Derived from UNFAO Monthly Bulletin of Agricultural Economics
and Statistics, February, 1972; Commonwealth Secretariat
Tropical Products Quarterly, August 1971-March 1972; and
Averaging c.i.f. prices at European ports for the three months
following the three peak Ghanaian harvest months for each crop
and deducting ocean freight (based on Conference rates) yields
estimated export prices f.o.b. Tema (Ghana) in foreign currency.
These were converted to cedis at the 1971 official exchange rates.

j. Derived from Dalton and Faniyeh [6] and adjusted for transport
and packaging costs to Tema.

k. Domestic cost f.o.b. Tema is assumed to equal the 1971 average
export price.

l. Calculated by shadow pricing imports differently from transport
which has a domestic component.
m. Based on average harvest-time wholesale prices (three lowest months) in Accra (Tema) during 1971, as reported in "Food Situation Report--1971," Accra: Economics and Marketing Division, Ministry of Agriculture. These prices were increased by 10% to cover packaging costs for export (based on advice from Black Star Lines).

n. Based on same source given in m. No adjustment for export packaging costs was required since domestic production is being compared to the alternative of imports.

o. Price that would prevail without imports.

p. Based on Kuranchie [12]. The foreign exchange component for groundnuts was used for cola nuts; yams for bananas; and tomatoes for pineapples.

q. Taken from Gilbert [8, Tables 3a and 3b]. Estimates for maize are assumed to apply to guinea corn also.

r. See Section I.D for definitions. Rs was estimated to be £1.75/U.S.$ (see Romer and Stern [15, Ch. 3], while the official exchange rate was £1.02/U.S.$.

s. Calculated as the sum of equations (7) and (8). For subsistence crops, this is a misnomer.

t. Calculated using equation (6).
u. Same source as in f. This is the average value of exports to China who is not a member of the International Coffee Agreement (ICA). Since Ghana sold her entire ICA quota allotment in 1971 additional sales would have to be made at below average prices to non-member countries.

v. Since $P_o > P_w^R - \alpha r$, the optimum producer price is $P_w^R$ and $P^* = P_o - R^R_w$.

w. Calculated as $\frac{1}{2}(\Delta S + \Delta D)P^* + \alpha r P_o \Delta S$ in the case of increased imports.

x. From Haessel [9].

y. These prices are for Tamale (Northern Region). The import price is from the same source as (i) and includes transport costs to Tamale. The value for $P_o$ is from source m. Tamale is used as a base point because most guinea corn is grown and consumed in Northern Ghana and transport costs between Tema and the north are significant. The domestic price ($P_o$) at Tema was $\text{¢}196 and the social import price was $\text{¢}112 per long ton. This would suggest substantial imports would be desirable.
APPENDIX TABLE B

FISCAL IMPLICATIONS OF THE EXPORT SUBSIDIES

<table>
<thead>
<tr>
<th></th>
<th>Increases in Tariff Revenue&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Percent Self-Financing&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Deficit&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Deficit as Percent of Recurrent Budget&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$T^W$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Estimates</td>
<td>15%</td>
<td>2.2</td>
<td>34</td>
<td>4.3</td>
</tr>
<tr>
<td>$\Delta G = \mathcal{C}6.5 \text{ M}$</td>
<td>22%</td>
<td>3.2</td>
<td>50</td>
<td>3.3</td>
</tr>
<tr>
<td>$\Delta Fx = \mathcal{C}14.6 \text{ M}$</td>
<td>30%</td>
<td>4.4</td>
<td>68</td>
<td>2.1</td>
</tr>
<tr>
<td>High Estimates</td>
<td>15%</td>
<td>3.7</td>
<td>33</td>
<td>7.6</td>
</tr>
<tr>
<td>$\Delta G = \mathcal{C}11.3 \text{ M}$</td>
<td>22%</td>
<td>5.5</td>
<td>49</td>
<td>5.8</td>
</tr>
<tr>
<td>$\Delta Fx = \mathcal{C}24.8 \text{ M}$</td>
<td>30%</td>
<td>7.4</td>
<td>66</td>
<td>3.9</td>
</tr>
</tbody>
</table>

a. Calculated as $\Delta T = \Delta Fx.T^W/100$.

b. Calculated as $100\Delta T/\Delta G$.

c. $\Delta G - \Delta T$.

d. Calculated as $100(\Delta G - \Delta T)/G$ where $G = \mathcal{C}345.7 \text{ M}$ is the recurrent government expenditure in Ghana in the 1970-71 financial year as reported by Mensah [1971]. This figure does not include debt servicing.
REFERENCES


