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Objective Analysis
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Abstract

Many low-income countries pursue cheap-food policies in which consumers pay subsidized prices for bread, rice, and other staples. This paper addresses the issue of why different governments select different food subsidy policies, using multiple instruments rather than a simple across-the-board subsidy to provide consumers with access to cheap food. It examines the optimal structure of cheap-food policies in the context of a partial equilibrium model in which the country may be large in trade, and is able to combine import subsidies or tariffs, and output taxes or subsidies, to transfer income to consumers through the market. The model allows for a marginal opportunity cost of government revenues greater than one dollar. In addition, in the model, food aid from overseas either may be given away to the consumer, or given to the government for subsequent sale in the domestic market. The results indicate that only by happenstance will a country choose to use a pure consumption subsidy or a pure import subsidy to transfer income to consumers. In addition, an increase in international food aid does not necessarily lead the government to reduce producer and consumer prices for a commodity.

Key Words: consumer subsidies, endogenous policy, food aid, political economy.

JEL Classification Codes: F35, Q18, Q17

1. Introduction

In many less-developed countries the problem of severe absolute poverty is likely to become more serious in the next ten years (e.g., Missiaen, Shapouri, and Trostle). The sources of the problem are diverse—including war, drought, inappropriate agricultural policies, lack of physical and intellectual infrastructure, and high birth rates (Shaw). An increase in the numbers of families enduring severe poverty could give rise to a substantial increase in malnutrition. Increased concerns about this possibility have led to a resurgence of interest over the past few years in both domestic policies targeted toward alleviating hunger, and the potential role of food aid from developed countries. Farm interest groups in North America and Europe are also likely to regain interest in food-aid programs as traditional income transfer programs benefitting farmers in those regions are curtailed. This paper examines the determinants of optimal food subsidy policies and, in particular, the links between those policies, the amount and form of international food aid, and domestic food consumption.

Historically, many low-income countries have pursued cheap-food policies that subsidize prices paid by consumers for flour, bread, rice and other staples.[1] These policies have taken different forms, but they inevitably involve burdens on domestic taxpayers, domestic producers of the subsidized commodity, or both. According to the standard textbook analysis, a simple across-the-

[1] The cost of cheap-food policies as a share of total public expenditures, or even as a share of gross domestic product (GDP) can be substantial (e.g., Scobie). For instance, in 1980–1981, Egyptian food subsidies were 20 percent of total public expenditures and seven percent of GDP (Alderman, von Braun, and Sakr). In the late 1970s, Sri Lankan food subsidies amounted to about 14 percent of total public expenditure and six percent of gross national product (GNP), while similar subsidies in India and Bangladesh represented, respectively, about nine percent and between 15 and 26 percent of public expenditures (Ahmed). Also in the late 1970s, the direct costs of China's food subsidies were reported to amount to between 23 and 26 percent of government revenue (Lardy).

board per unit subsidy on all consumption funded by general tax revenues is the optimal (social cost-minimizing) way to subsidize consumers (e.g., Corden). In practice, pure consumption subsidies are rarely used. Food subsidies for low-income households through price discrimination have relied on targeting and food stamp programs, while rationing schemes (in particular, through cheap-food sales in ration shops) have been used to deal with limits on the availability of subsidized food.[2]

Policy instruments and subsidy rates have differed across countries and, within countries, also have changed over time. Consumption subsidies are often used in conjunction with other policies. This paper explicitly addresses the issue of why different governments select different general food consumption policies and, in addition, why multiple policy instruments are often chosen in preference to a simple across-the-board subsidy to provide consumers with access to cheap food. Our approach follows the literature on efficient income redistribution through commodity markets.[3]

Recently, Hoffman, Gardner, Just, and Hueth (HGJH) considered the implications of food aid to developing countries for the recipient country's optimal food subsidy program.[4] However, they assumed (*a*) the world price is exogenous (i.e., a *small-country* case), (*b*) the aid recipient country's government uses only one policy instrument—an import subsidy—to transfer income to

[2] Pinstrup-Andersen (p. 6) has identified many of the different forms of consumption subsidies used over the past four decades.

[3] Following Becker and Peltzman, (1983) the issue of efficient market-based income transfer policies has been addressed in several studies of domestic and trade policies that enhance agricultural producer incomes. Examples include Alston and Hurd; Alston, Carter, and Smith (1993, 1995); Chambers (1995); Bullock (1992, 1994, 1995); Gardner (1983, 1995); Gisser; Moschini and Sckokai; and Salhofer.

[4] The amount and form of international food aid may, conversely, be affected by domestic policies. Indeed, in the past some forms of international aid have been explicitly contingent on domestic policy. Throughout this paper, the form and amount of aid are treated as strictly exogenous.

consumers, and (*c*) all international food-aid food is given to consumers at zero cost. This paper reexamines the optimal structure of cheap-food policies in the context of a partial equilibrium model in which (*a*) the world price may be endogenous (i.e., a *large-country* case), (*b*) the country is able to combine multiple instruments—import subsidies or tariffs, and output taxes or subsidies—to transfer income to consumers through the market, and (*c*) food aid may be provided as either gifts to consumers or gifts to the government for subsequent sale to consumers. Some important differences in results emerge from using a more general set of assumptions.

2. Import Subsidies versus Consumption Subsidies: A Graphical Illustration

In standard textbook models of domestic commodity subsidies, subsidies on total consumption of an importable commodity are always preferred to import subsidies because they impose lower efficiency costs on taxpayers and producers. These models, however, assume that the opportunity cost of government spending is simply the amount of tax revenue spent. Changing this assumption has important implications for least-cost instrument choices. In this section, a simple diagrammatic model is presented to show conditions under which, given an all-or-nothing choice between a pure consumption subsidy and an import subsidy, the import subsidy will be preferred because of the efficiency costs associated with raising tax revenues.

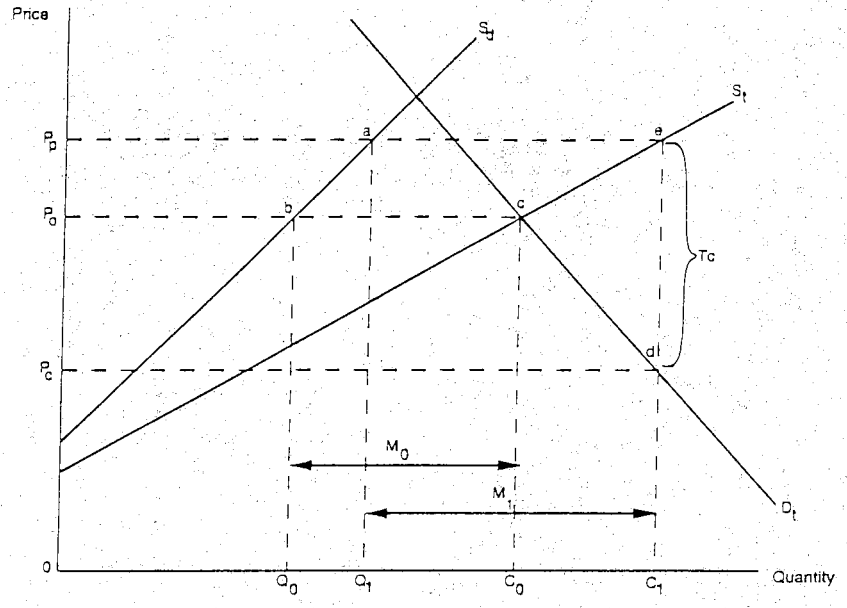
Tax revenue collections impose two types of costs on private economic agents: (*a*) out-of-pocket costs incurred by taxpayers, and (*b*) additional costs to private economic agents and the treasury, including revenue collection costs and costs of distortions in markets affected by tax policy. In addition, from the perspective of the government, increasing tax revenues also may have costs

in the form of lost votes and other forms of political support. At the margin, all of these types of costs may be important. Hence, the change in taxpayer surplus (*TS*) associated with changes in government spending is measured by the change in government revenue or treasury costs (*TC*) multiplied by a factor $(1 + \delta)$ that reflects both the marginal deadweight cost of taxation and any additional "political" costs perceived by the government to be associated with raising taxes (that is, $\delta \geq 0$). At the margin, therefore, a dollar of government spending involves an opportunity cost of $(1 + \delta)$ dollars of taxpayer welfare. For developed countries such as the United States and Australia, plausible estimates of such marginal deadweight costs from distortions in taxed markets range from about 7 to 23 cents (Fullerton; Findlay and Jones). In some developing countries, the costs of taxation may be even larger because of more burdensome tax structures and higher tax collection costs.

Figure 1 presents a partial equilibrium model of the market for an importable food commodity, which includes a domestic demand function (D), a total supply function (S_t), and a domestic supply function (S_d), where S_t is the sum of the domestic supply function and the import supply function (S_m), which is not explicitly shown. Competitive market clearing occurs at price P_0, and total consumption C_0 equals the sum of domestic production Q_0 and imports M_0. An across-the-board per unit consumption subsidy of T_c increases consumption to C_1 by lowering the consumer price to P_c. The subsidy raises both the domestic producer price and the import price to P_p, increasing domestic production to Q_1 and imports to M_1. Domestic producer surplus increases by area $P_p abP_0 = \Delta PS$; domestic consumer surplus increases by area $P_0 cdP_c = \Delta CS$; foreign net surplus increases by area $abce = \Delta FS$; and taxpayer surplus (TS) falls by $(1 + \delta)$ times the subsidy expenditure, which is area $P_p edP_c$ [i.e., $\Delta TS = -(1 + \delta)(P_p edP_c)$]. The net change in domestic

welfare is $\Delta NS = \Delta CS + \Delta PS + \Delta TS = -[cde] - [abce] - \delta[P_p edP_c]$. Thus, the net domestic cost of a subsidy equals the sum of (*a*) the conventional measure of the global welfare loss (triangle *cde*), (*b*) the foreign benefit, and (*c*) the excess burden associated with raising revenues from taxpayers to finance transfers.

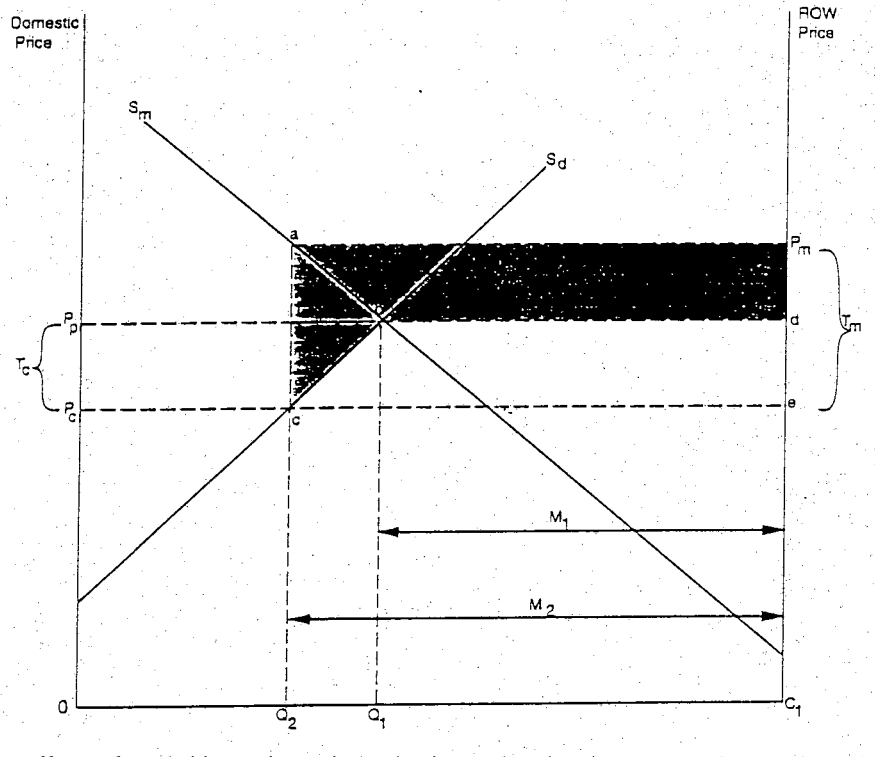
Figure 1: Effects of a Consumption Subsidy in a Large Importing Country



Comparing the effects of a consumption subsidy and an import subsidy that has equivalent effects on consumer welfare requires that total domestic consumption C_1 and the consumer price P_c be identical under both policies. The differences in welfare effects between consumption and import subsidies then result from differences in government outlays and the sourcing of consumption between domestic and foreign producers. These differences are illustrated in figure 2, where consumption-subsidy-ridden prices (P_c, P_p) and quantities (Q_1, C_1) are the same as those for the importer case in figure 1. In figure 2, S_d is the domestic supply function, S_m is the import supply

function relative to the origin at C_1, and there is no demand function because consumption is fixed at C_1.

Figure 2:"Equivalent" Import Subsidy and total consumption Subsidy for a Large Country Importer



Note: The effects of a subsidy on domestic production, rather than imports, can be seen by switching the roles of S_m and S_d.

In figure 2, under an across-the-board consumption subsidy of T_c, the equilibrium is defined by the intersection of S_m and S_d at point b, domestic production is Q_1, imports are M_1, government expenditures are $T_c \times C_1$ (area $P_p deP_c$), and the welfare effects are those shown in figure 1. A per unit import subsidy of T_m yields the same benefit to consumers as the consumption subsidy T_c. Under the import subsidy policy, the domestic producer price equals the domestic consumer price P_c, producer surplus falls (by area $P_p bcP_c$), domestic production declines to Q_2, and imports increase to $M_2 = C_1 - Q_2$ as the import price rises to P_m. The import subsidy results in government

expenditures of $T_m \times M_2$ (area $ecaP_m$). If, as in conventional analyses, there is no marginal excess tax burden ($\delta = 0$), moving from a consumption subsidy to an import subsidy reduces domestic surplus by the shaded area $dbcaP_m$ in figure 2, and the consumption subsidy is clearly preferred. However, if the marginal excess burden of taxation is positive ($\delta > 0$), the differences in subsidy expenditures between the two policies imply further differences in social cost that must be taken into account.

Under the consumption subsidy policy the excess burden of taxation is $\delta T_c C_1$, under the import subsidy policy the excess burden of taxation is $\delta T_m M_2$ (or $\delta T_m [C_1 - Q_2]$), and the difference is $\delta[(T_m - T_c)C_1 - T_m Q_2]$. For a small country, this difference will always be negative (as $T_m = T_c$), and an import subsidy will involve a lower excess burden than a consumption subsidy. For a large country, because T_m must be greater than T_c, this difference may be negative or positive depending on whether government expenditures on subsidies are smaller or greater under the import subsidy. In a common scenario, with a relatively elastic import supply and only a modest fraction of consumption imported, government outlays will be much less when an import subsidy is used. In these circumstances, the all-or-nothing choice between an import subsidy and a consumption subsidy then depends on the relative sizes of the two components of deadweight costs—the additional cost of distortions in domestic production due to the import subsidy versus the cost of distortions in other markets due to greater budget outlays under the consumption subsidy. Thus, when deadweight costs of taxation are positive, an all-or-nothing choice between an import subsidy and a pure consumption subsidy as the means of transferring income to consumers may favor the selection of an import subsidy policy.

An even more efficient policy option than either a pure consumption subsidy or a pure import subsidy may be some combination of subsidies on consumption and imports (subsidizing domestic production and imports at different rates).[5] A more general analysis would allow for the joint determination of the amount transferred and the transfer instruments. In addition, the optimal settings of these instruments may be affected by international food aid, in ways that may depend on whether the food aid is given to the recipient country's government for subsequent resale to consumers, or given directly to the consumers themselves. We use a political-economy model to explore these issues.

3. A Political Economy Model

In the political-economy model, the government is assumed to take account of the welfare of three interest groups in forming its food policy: food consumers, food producers, and taxpayers. Consumer welfare and producer welfare are measured by consumer surplus (*CS*) and producer surplus (*PS*). The change in economic surplus associated with raising taxes is defined as $\Delta TS = -(1 + \delta)\Delta TC$, where ΔTC is equal to the change in government spending or treasury cost, and δ is the marginal excess burden of raising taxes, so that $1 + \delta$ is the marginal opportunity cost to the government of a dollar of government spending.[6] Thus, the government maximizes the weighted

[5] Recently, in the explicit context of the efficient redistribution hypothesis, Bullock (1995) has shown that if several interest groups are involved, an optimal set of policies for the redistribution of income will typically involve more than one policy instrument. Much earlier, Theil argued that the achievement of n policy targets would require $n - 1$ policy instruments.

[6] Here we treat δ as being fixed, exogenously. While this may be reasonable as an approximation, in some countries cheap-food policies may be important enough to have some effect on the social cost of general revenue measures to finance food subsidies. Chambers (1995) provides a general equilibrium treatment in which δ is endogenous.

sum of consumer welfare, producer welfare and taxpayer welfare, but weights consumer welfare more heavily than producer welfare. Hence its objective is to maximize

$$(1) \qquad W = \theta CS + PS - \gamma(1 + \delta)TC.$$

In equation (1), producer surplus is the numeraire, with a weight of one. The weight on taxpayer surplus (γ) may be greater or less than one, but for most of what follows, for simplicity, we assume equal weights on producer and taxpayer surplus ($\gamma = 1$).[7] The weight placed on consumer welfare (θ) is greater than one (and greater than γ) to engender consumer subsidies.

Consumer surplus (CS) is defined as the area beneath the demand curve less total expenditures on food:

$$CS = \int_0^C \mathrm{D}(u)\,du - P_c(C - F_1),$$

where C is consumption, P_c is the domestic consumer price, $P_c = \mathrm{D}(C)$ is the domestic inverse demand function, and F_1 is the amount of free "food aid" food given away to consumers. Thus total consumer food expenditures are $P_c(C - F_1)$. Producer surplus (PS) is defined as the area beneath the producer price line and above the supply curve:

$$PS = P_p Q - \int_0^Q \mathrm{S}(v)\,dv,$$

[7] Fixing $\gamma = 1$ simplifies the algebra. To evaluate the effects of $\gamma \neq 1$, loosely, using the results in the text we can reinterpret the term $1 + \delta$ as representing the combined effects of deadweight costs of taxation different from δ and a taxpayer welfare weight different from one.

where Q is domestic output, P_p is the domestic producer price, and $P_p = S(Q)$ is the domestic inverse supply curve. The treasury cost of food subsidies (TC) is

$$TC = (P_p - P_c)Q + (P_m - P_c)M - P_c F_2,$$

where M is total commercial imports (i.e., excluding food aid), P_m is the world price, and F_2 is the amount of "food-aid" food donated to the government for resale to consumers. The term $(P_p - P_c)Q$ represents subsidies on the consumption of domestic output, while the term $(P_m - P_c)M$ represents subsidies on imports. Only when $P_p - P_c = P_m - P_c$ does the country provide a uniform consumption subsidy. The term $P_c F_2$ represents treasury income from the sale of donated food, presuming the government is free to sell donated food at market prices.

In the following analysis, it is useful to assume either that all food aid is donated to consumers at zero cost (Model I) or that it is all given to the government for resale to domestic consumers (Model II). Thus, total food aid (F) equals either F_1 or F_2. These assumptions lead to alternative specifications of the government's objective function.

Model I: Aid Goes to Consumers ($F = F_1$)

First, consider optimal policy mixes when food-aid food is provided to consumers at zero cost (Model I).[8] The objective function is

[8] Here the quantity of food aid is assumed to be exogenous to government policy. This may not always be the case, as aid is often tied to political considerations. Kheralla et al., for example, have argued that aid is affected by indicators of economic performance such as the economy's growth rate. However, for the purposes at hand, in which we investigate the determinants of commodity-specific policies, the exogeneity assumption is useful.

$$\text{Maximize:} \quad W = \theta\left[\int_0^C D(u)\,du - P_c(C - F)\right] + P_p Q - \int_0^Q S(v)\,dv$$
$$- (1 + \delta)\left[(P_p - P_c)Q + (P_m - P_c)M\right],$$

$$\text{Subject to:} \quad C = Q + M + F.$$

Given the market clearing constraint that $C = Q + M + F$, the objective function in Model I is optimized with respect to only two of the three choice variables (C, Q, and M). Optimizing Model I with respect to C and Q implies a set of specific choices for consumer, producer, and import prices. These price choices identify the domestic and trade, subsidy, and tax policies for the commodity (Chambers 1992; Alston, Carter, and Smith 1993).

Differentiating the objective function with respect to Q and C yields:[9]

$$(2) \qquad \partial W/\partial Q = -P_p\left[1 + \delta(1 + 1/e)\right] + P_m(1 + \delta)(1 + 1/e_m) = 0,$$

and

$$(3) \qquad \partial W/\partial C = P_c\left[(1 + \delta)[\eta - (1 - f)] + \theta(1 - f)\right](1/\eta) - P_m(1 + \delta)(1 + 1/e_m) = 0,$$

where $f = F/C$ is the fraction of total domestic food consumption satisfied by food aid, e is the own-price elasticity of domestic supply, e_m is the own-price elasticity of import supply, and η is the absolute value of the own-price elasticity of domestic demand. Equations (2) and (3) yield the following expressions for relative price ratios among P_p, P_c, and P_m:

[9] The results are obtained by recognizing that, from the market-clearing constraint, $dC/dM = 1$, and $dQ/dM = -1$.

$$(4) \qquad \frac{P_p}{P_m} = \frac{(1+\delta)[1+(1/e_m)]}{1+\delta[1+(1/e)]},$$

$$(5) \qquad \frac{P_p}{P_c} = \frac{\eta(1+\delta)+[\theta-(1+\delta)](1-f)}{\eta[1+\delta[1+(1/e)]]},$$

and

$$(6) \qquad \frac{P_m}{P_c} = \frac{\eta(1+\delta)+[\theta-(1+\delta)](1-f)}{\eta(1+\delta)[1+(1/e_m)]}.$$

These results imply: (*a*) if $P_p/P_c > 1$ (< 1), consumption of domestic product is being subsidized (taxed); (*b*) if $P_m/P_c > 1$ (< 1), import consumption is being subsidized (taxed);[10] (*c*) if $P_p/P_m = 1$, the subsidies on domestic production and imports are equal; and (*d*) if $P_p/P_m > 1$, imports are subject to a tariff relative to domestic production (or domestic production is subsidized relative to imports), but if $P_p/P_m < 1$, domestic production is taxed relative to imports.[11]

Some special cases provide useful insights about the implications of the model. First, consider the standard case in which consumer welfare, producer welfare, and taxpayer costs are weighted equally in the government's objective function; that is, $\theta = 1$ and $\delta = 0$. From equations (4) through (6), it follows that $P_p = P_c$, and $P_p/P_m = P_c/P_m = 1 + 1/e_m$. This is the standard result that welfare is maximized when domestic producers and consumers face the same price, and an optimal

[10] Notice that a pure import subsidy, as assumed by HGJH, requires $P_p/P_c = 1$ as well. In equation (5), this requires $\delta = 0$ and $\theta = 1$, which would rule out consumer subsidies altogether.

[11] The required subsidies, domestic taxes, and tariffs could be implemented explicitly by a country's excise and internal revenue services or implicitly through, say, the operations of parastatal marketing entities.

tariff of $1/e_m$ is levied on imports. Now suppose consumer welfare is weighted more heavily than producer welfare ($\theta > 1$), but $\delta = 0$. From equations (4)–(6), $\frac{P_p}{P_m} = 1 + \frac{1}{e_m}$,

$$\frac{P_m}{P_c} = \frac{1 + (\theta - 1)(1 - f)/\eta}{1 + (1/e_m)},$$

and

$$\frac{P_p}{P_c} = 1 + (\theta - 1)(1 - f)/\eta.$$

In this case, if the importing country is "large" and has monopsony power in trade ($e_m < \infty$), an optimal tariff of $1/e_m$ is levied on imports relative to domestic production. However, regardless of whether the country has market power in international markets, $P_p > P_c$ and domestic consumption is subsidized relative to domestic production because consumers are relatively influential ($\theta > 1$) and food aid does not constitute all of domestic consumption ($f < 1$). In the small-country case ($e_m = \infty$), when $\delta = 0$, producer and import prices are equal ($P_p = P_m$) and the optimal policy is a pure consumption subsidy.

For a large country ($e_m < \infty$), even when $\delta = 0$, an import tariff is optimal. The optimal tax rule is reflected by a distortion in the ratio of the producer to import price (P_p/P_m), which is independent of the degree of preference for consumer welfare represented by θ. Conversely, the rate of consumer subsidy relative to producers is independent of the elasticity of supply of imports: the price ratio (P_c/P_p) is the same for small and large countries alike. Combining these two effects, domestic consumption is subsidized relative to imports ($P_c < P_m$) only if $1/e_m < (\theta - 1)(1 - f)/\eta$. As

noted above, when the country is small ($e_m = \infty$) and $\theta > 1$, this condition will always be satisfied. When the country is large, however, the government's preference for consumer welfare must be sufficiently large to offset its preference for tariff revenues. Clearly, as the government's preference for consumer welfare increases (and θ increases), the import tariff it charges declines. Nevertheless, in the large-country case, the domestic production subsidy will be larger than the import subsidy (as imports are taxed relative to the domestic producer price). Hence, in summary, when $\delta = 0$, it follows that $P_p > P_m$, $P_p > P_c$, and $P_c \gtrless P_m$.

This special case also provides a useful insight about the role of food aid in determining optimal domestic and trade polices. When the share of consumption provided as food aid (f) increases, the subsidy provided to consumers on domestic output declines (P_p/P_c declines). There is a common-sense economic explanation for this result. As food aid in the form of free food to consumers increases (that is, f increases), at any given level of P_c, consumer surplus is increased because total consumer expenditures on the commodity decline, as free food is substituted for purchased food. The government's optimal policy is then to redistribute some of the initial increase in consumer welfare resulting from the free food to other groups. In this special case, in both the small-country and large-country scenarios, taxpayers are the beneficiaries of the transfers as subsidies on domestic production and imports decline.

In the small-country case, producer welfare is unaffected as the producer price remains equal to the import price, which itself remains unchanged as imports are displaced by food aid because e_m is infinite. In the large-country case, producer welfare declines. Assuming a constant import supply elasticity, it is optimal for the country to levy a constant proportional import tariff relative to domestic production [from equation (4), $P_p = (1 + 1/e_m)P_m$]. However, the increase in free food aid

displaces some imports and therefore reduces both the import price and the domestic producer price. These large-country effects of food aid on producer welfare are captured in the simulation results presented below.

Now consider the more general case described by equations (4)–(6), where $\delta > 0$ and $\theta > 1$. Equation (4) demonstrates that the ratio of P_p to P_m is not affected by the government's intensity of preferences for consumers, as θ does not appear in this expression. Indeed, P_p/P_m is determined uniquely by the deadweight costs of taxation (δ), and domestic and import supply elasticities (e and e_m). From equation (4), if $(1 + \delta)/\delta > e_m/e$, then P_p exceeds P_m and imports are subject to a tariff relative to domestic output. If the country is small ($e_m = \infty$), this result implies that $P_p < P_m$; that is, domestic production will be taxed relative to imports. The reason is straightforward. Given equal weights on the welfare of producers and taxpayers, a dollar of treasury costs counts for more than a dollar of domestic producer surplus, and a (Ramsey-type) tax on domestic output is optimal. Moreover, as δ increases, the size of the tax also increases so that P_p falls relative to P_m.[12]

The ratio of the producer price to the consumer price (P_p/P_c) depends on θ, δ, f, e, and η. From equation (5), $P_p > P_c$ if $[\theta - (1 + \delta)](1 - f) > \delta/e$. Thus, domestic output is subsidized only if the government prefers consumers to taxpayers by a sufficiently large amount; that is, θ must be greater than $(1 + \delta)$ and by more than $\delta/[(1 - f)e]$. If consumer welfare and taxpayer costs are weighted equally ($\theta = 1 + \delta$), producers will be taxed relative to consumers, since δ/e is strictly positive. Note also that, as f (food aid) increases, the ratio of P_p to P_c falls. Again, this result is obtained because, as f increases, consumer surplus rises and the government's optimal response is

[12] From equation (4), $\partial(P_p/P_m)/\partial\delta = -(1/e)(1 + 1/e_m)/r^2$, where $r = 1 + \delta(1 + 1/e)$. This derivative is clearly negative, as e, e_m, and r^2 are positive.

to transfer some of the benefits of increased aid to taxpayers (through lower consumer subsidies) and to producers (through higher producer prices).

The ratio of the import price to the domestic consumer price (P_m/P_c) depends on θ, δ, η, e_m, and f. From equation (6), $P_m > P_c$ if $\eta(1 + 1/e_m) < [\theta - (1 + \delta)](1 - f)$. Thus, imports are subsidized only if consumer welfare is weighted more heavily than treasury costs in the government's objective function ($\theta > 1 + \delta$). Even then, there is no guarantee that domestic consumption of imports will be subsidized, although this becomes more likely as domestic demand becomes more inelastic (η decreases) and the supply of imports becomes more elastic (e_m increases). In addition, as food aid becomes a larger proportion of domestic consumption, the likelihood that food imports will be subsidized declines. This occurs because, as noted above, the government becomes less willing to subsidize consumption at the margin (via subsidies on imports and domestic output).

An interesting question concerns the circumstances under which it is optimal for a country to implement a pure import subsidy program, so that $P_p < P_m$ (imports are subsidized) and $P_p = P_c$. The first condition, $P_p < P_m$, requires $(1 + \delta)/\delta < e_m/e$, or equivalently, $(1 + \delta)/e_m < \delta/e$. This condition is satisfied if the country is small ($e_m = \infty$) and $\delta > 0$, which is the case modeled by HGJH. However, unless $\theta = 1$ and $\delta = 0$ (which would mean no consumer subsidies), the second condition, $P_p = P_c$, will be met only by happenstance; $P_p = P_c$ if and only if $[\theta - (1 + \delta)](1 - f) = \delta\eta/e$. Thus, even in the small-country case, it is unlikely that the optimal policy will be a pure import subsidy. If, as noted above, θ is sufficiently large and $\delta > 0$, a small country will subsidize domestic consumption relative to both imports and domestic production, but at different rates. It is quite possible, however, that domestic production will be taxed relative to domestic consumption.

Model II: Aid Goes to the Government ($F = F_2$)

The effect of food aid on incentives for the recipient country's agricultural sector has been a controversial issue. The above results indicate that when food aid takes the form of free food to consumers, an increase in food aid will not always cause producer prices to fall. Often, however, food aid is donated to the recipient country's government which is free to sell the food to domestic consumers. This situation is represented in Model II in which the government's objective function is

$$\text{Maximize: } W = \theta\left[\int_0^C D(u)\,du - P_c C\right] + P_p Q - \int_0^Q S(v)\,dv - (1+\delta)\left[(P_p - P_c)Q + (P_m - P_c)M - P_c F\right]$$

$$\text{Subject to: } C = Q + M + F.$$

As with Model I, the government's optimal policies are reflected in its optimal choices of P_p, P_c, and P_m. The optimal values for these prices are identified by differentiating the objective function for Model II with respect to Q and C (again recognizing that when the quantity of food aid is exogenous, the choices of Q and C also determine M because $C = Q + F + M$). The first-order conditions for the solution of Model II are as follows:

$$(7) \qquad \partial W/\partial Q = -P_p\left[1 + \delta(1 + 1/e)\right] + P_m(1+\delta)\left[1 + 1/e_m\right] = 0,$$

and

$$(8) \qquad \partial W/\partial C = P_c\left[(1+\delta)(1 - 1/\eta) + \theta/\eta\right] - P_m(1+\delta)\left[1 + 1/e_m\right] = 0.$$

Notice that the quantity of food aid (represented by F or f above) does not appear in these expressions and plays no direct role in determining optimal subsidy policies. From equations (7) and (8), the following expressions are obtained for relative price ratios among P_p, P_c, and P_m:

$$\left(\frac{P_p}{P_m}\right)^{II} = \frac{(1+\delta)\left(1+\frac{1}{e_m}\right)}{1+\delta\left(1+\frac{1}{e}\right)}, \tag{9}$$

$$\left(\frac{P_c}{P_m}\right)^{II} = \frac{\eta(1+\delta)\left(1+\frac{1}{e_m}\right)}{\theta+(1+\delta)(\eta-1)}, \tag{10}$$

and

$$\left(\frac{P_p}{P_c}\right)^{II} = \frac{\theta+(1+\delta)(\eta-1)}{\eta\left[1+\delta\left(1+\frac{1}{e}\right)\right]}. \tag{11}$$

The effects of the different mechanisms for providing aid can be identified by subtracting the optimal price ratios obtained under Model II from those obtained under Model I:

$$\left(\frac{P_p}{P_m}\right)^{II} - \left(\frac{P_p}{P_m}\right) = 0, \tag{12}$$

$$\left(\frac{P_m}{P_c}\right)^{II} - \left(\frac{P_m}{P_c}\right) = \frac{f\left|\theta-(1+\delta)\right|}{\eta(1+\delta)\left(1+\frac{1}{e_m}\right)}, \tag{13}$$

and

$$(14) \qquad \left(\frac{P_p}{P_c}\right)^{II} - \left(\frac{P_p}{P_c}\right) = \frac{f\left|\theta - (1+\delta)\right|}{\eta\left[1+\delta\left(1+\frac{1}{e}\right)\right]}.$$

First, note that if $f = 0$, then there is no difference in the optimal policy choices across the two models. Second, also note that if consumers and taxpayers receive equal weights in the government's objective function ($\theta = 1 + \delta$), then there is also no difference in the optimal policy choices across the two models as the preferences do not differentiate between consumers and taxpayers. Third, note that the relationship between the domestic producer price (P_p) and the world price (P_m) is independent of the way in which food aid is provided [equation (12)]. The degree to which imports are subject to a tariff or subsidy relative to domestic production depends only on the supply elasticities and the deadweight cost of taxes and these are invariant to the mechanism for providing food aid.

This is not the case with respect to consumer subsidies either in relation to imports or domestic production. From equations (13) and (14), it follows that if the government places a greater weight on consumer welfare than tax revenues ($\theta > 1 + \delta$) and receives food aid ($f > 0$), then $(P_m/P_c)^{II} > P_m/P_c$, and $(P_p/P_c)^{II} > P_p/P_c$. Consumption of both imports and domestic production are more heavily subsidized (or are less taxed) when taxpayers receive the initial benefits from food aid. This makes sense. As we noted above, when consumers receive more free food the government may reallocate some of the increase in the country's net wealth toward taxpayers and producers. When the initial incidence of the wealth increase is on taxpayers, the government may reallocate some of

the wealth increase to consumers through larger subsidies (or lower taxes) on domestic production and imports.

The above results indicate that observed consumer food subsidies will be larger when the treasury is the initial beneficiary of food aid. This does not mean that consumers are better off if the government is permitted to sell food-aid food to domestic consumers, though it does imply, at least in the small-country case, that food consumption will be larger. This result is obtained in the small-country case because P_m is exogenous and, from equation (13), the ratio of P_m to P_c is larger when the government sells food-aid food rather than being required to give it to consumers for free. Thus, P_c must be lower and domestic consumption higher when international food-aid food is sold by the government. Whether consumer welfare is higher when the government markets food-aid food is another matter. Food aid distributed freely to consumers may mean higher market prices but, quite possibly, a lower food bill because some of the food is freely available to consumers.

4. Simulation Models

The models presented above provide several interesting insights about the structure of optimal food subsidy policies and the impacts of food aid on those policies. However, they do not show whether the form that food aid takes impacts the size of the effect on aggregate welfare and its distribution among domestic consumers, domestic producers, and taxpayers. To address these questions, a simple simulation model is constructed in which domestic demand, domestic supply, and import supply are assumed to be linear functions of price. The model is used to derive some comparative static results, and some numerical simulations using particular values for parameters. The details of the structure of the model and some comparative static results are presented in the appendix. It

is important to note that the results are conditioned by the assumed linear functional forms as well as the particular parameter values.

The most important unresolved questions concern the distributional impacts of the different forms of food aid. The assumption of linear supply and demand equations yields several analytical results. First, consumer surplus must increase when food aid is given to either consumers or the government. For this to be true, consumption must increase when the food aid is given to the government, but it may fall when the food aid is given to consumers directly. The provision of food aid may lead to a fall in the consumer subsidy rate (when the food aid is given to consumers) or it may not (when the food aid is given to the government). As noted above, producers lose as a result of the provision of food aid in a large country, but not in a small country. In the large-country case, producer losses are greater when food aid is given to consumers rather than the government. These results are reflected in the simulations described below, along with additional results on total welfare and its distribution.

Model parameters are as follows. At the initial equilibrium, domestic consumption is set equal to 100 units. Imports are 20 percent and domestic production is 80 percent of domestic consumption. Finally, price elasticities for domestic demand and domestic supply are set equal to –0.5 and 1 for the initial levels of consumption and output, and the domestic consumption price equals 100. The effects of each type of food aid are examined for both a small country and a large country. In the large-country case, at the initial (pre food-aid) equilibrium the import supply price elasticity is assumed to be 10. In both cases, the amount of food aid is equal to five percent of the initial consumption level (five units of food). Also, in both cases, four different model parameterizations are investigated, involving different combinations of the marginal cost of

government spending $(1 + \delta)$ and the weight for consumer welfare relative to taxpayer and domestic producer welfare (θ), namely: (*a*) $\theta = 1.0$ and $1 + \delta = 1.0$, (*b*) $\theta = 1.1$ and $1 + \delta = 1.0$, (*c*) $\theta = 1.1$ and $1 + \delta = 1.05$, and (*d*) $\theta = 1.3$ and $1 + \delta = 1.20$. In each scenario, the weight on subsidy expenditures $(1 + \delta)$ is less than or equal to the weight on consumer welfare, but not by too much.[13]

Simulation results for the small-country case are presented in table 1, while the large-country results are found in table 2. In each table, the effects of introducing the different forms of food aid in an economy with no distortions can be seen in the first set of three columns, with economic surpluses in the first four rows and price ratios, which can be interpreted as tax/subsidy combinations, in the last two rows. The effects of introducing political preferences that favor consumers are shown in the next set of three columns, and the effects of adding deadweight losses from taxation in the subsequent set of three columns. The last three columns show results with larger weights on both government spending and consumer welfare.[14]

The main qualitative difference between the large- and small-country cases (as noted in section 3 and the appendix) concerns producer welfare which, regardless of the form of aid, is expected to fall in the large-country case, but not in the small-country case. The simulations provide the additional result that, as would be expected, total domestic welfare increases with increases in either form of aid. Interestingly, the provision of food aid worth 500 (at the prices that would

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[13] Recall that if θ is less than $1 + \delta$, then consumer welfare is weighted less heavily than taxpayer welfare and consumers may be taxed relative to both domestic producers and importers. As a result, the country's optimal policy would not include food subsidies in the first place. The second-order sufficient conditions require $\theta < 2(1 + \delta)$. Hence, the parameters must satisfy $(1 + \delta) < \theta < 2(1 + \delta)$. But our requirement for reasonable values for food subsidies requires even narrower bounds.

[14] These outcomes are all consistent with the theoretical results presented above and, in particular, equations (12) through (14) which show the differential effects of the two mechanisms for providing food aid on relative prices.

maximize unweighted welfare) increases welfare by more than 500 in every instance, indicating that the adjustments in response to the food aid lead to a reduction in some domestic distortions (perhaps simply deadweight losses from taxation).[15] In the small-country case, the benefits from food aid provided to the government are all taxpayer benefits; the linear objective function means there is no shifting of incidence to consumers or producers in this instance. In the large-country case there was some shifting of incidence with gains to consumers financed partially by losses to producers.

The quantitative distribution of benefits differs to some degree between the two forms of aid and in response to changes in other parameters in intuitively plausible ways. In summary, consumers prefer food aid to be given to them rather than the government, even though they may end up consuming less food. Taxpayers prefer food aid to be given to the government rather than consumers. Only in the large-country case do both consumers and taxpayers benefit from food aid, regardless of the form in which it is given. Producers are unaffected by food aid in the small-country case, and prefer the aid to be given to the government in the large-country case, since their losses are smaller than when the aid is given to consumers. National benefits from food aid differ, depending on the form of aid in interaction with other parameters (that determine the policy settings) in ways that are not completely understood.

5. Conclusion

Cheap-food policies are common and economically important in many less-developed countries. Conventional analysis may suggest that the least-cost cheap-food policy would be a pure

[15] Taxpayer and total surplus would change, even without any change in policy, since taxpayer surplus is given by $(1 + \delta)$ times subsidy expenditure.

consumption subsidy, financed by an efficient general tax policy. As suggested by the arguments of Moschini and Sckokai, if we can separate the financing and spending decisions, ad hoc trade-distorting policies would be undesirable income transfer mechanisms: a lump-sum tax to finance consumption subsidies would avoid distortions in trade while not involving any distortions in other markets. Indeed, if lump-sum taxes were available, they would be a relatively efficient source of funds for all types of public goods; the next-best alternative may be a uniform tax on all goods or a set of Ramsey-type taxes.

On the other hand, a realistic assessment of policies ought to recognize that lump-sum taxes are not available and the so-called efficient taxes are not being used as general revenue measures. Thus it may be possible, in a "third-best" world, to do better than the "second-best" policy prescription (consumer subsidies from general revenues) which ignores the possibility that, at the margin, a tax on the commodity market of interest may be a lower-cost source of funds than general revenue measures. This possibility seems to be particularly likely in the case of less-developed countries where general revenue measures are relatively inefficient. Transfers through commodity markets arise because, in fact, lump-sum taxes are no more available than are lump-sum transfers. Thus, actual policy choices may make more economic sense than a conventional theoretical viewpoint would suggest.

Our comparative static results show how the optimal policy mix is unlikely to involve a pure consumption subsidy, especially when the country has little capacity to affect world prices for the commodity. Our exploration of the effects of foreign aid on the country's least-cost cheap-food policy also shows that the size and distribution of the benefits from food aid depend importantly on

the size of the country in trade, and whether the aid is given to consumers or the government in the first instance.

In the small-country case, it is not optimal to distort producer prices relative to import prices, even when subsidizing consumers, unless there are deadweight costs of raising subsidy revenues elsewhere in the economy, regardless of whether food aid is being provided. But even in this case, the form of the aid determines how (indeed whether) the government subsidy policy should adapt to reoptimize the domestic distribution of welfare. Introducing deadweight losses from general revenue measures (i.e., $\delta > 0$) does not change the two key general results. Namely, when the country cannot affect world prices, producers do not benefit (or lose) from international food aid regardless of the way in which it is given, and consumers can only benefit when the aid is given to them directly. In the large-country case, many of the small-country results are retained once the role for optimal tariffs is recognized and understood. In reflection of the role of market power in trade in modifying the optimal domestic distortions, now producer and consumer welfare are affected by both forms of aid, but differentially.

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Appendix:
A Linear Model

A.1. Algebra of the Model

Case I: Food Aid to Consumers

The supply and demand equations are given as follows:

Domestic Demand (D): $P_c = d_0 - d_1 C$;

Domestic Supply (S_d): $P_p = s_0 + s_1 Q$;

Import Supply (S_m): $P_m = m_0 + m_1 M$;

Food Balance: $C = Q + F + M \Rightarrow M = C - F - Q$.

The measures of welfare of different groups are given as follows:

Producers: $PS = 0.5 s_1 Q^2$;

Consumers: $CS = 0.5 d_1 C^2 + P_c F = 0.5 d_1 C^2 + d_0 F - d_1 CF$;

Taxpayers: $TS = (1 + \delta) TC$, where TC is the government expenditure;

Tax Cost:

$$\begin{aligned} TC &= (P_p - P_c)Q + (P_m - P_c)M \\ &= s_0 Q + s_1 Q^2 - d_0 Q + d_1 CQ \\ &\quad + m_0 M + m_1 M^2 - d_0 M + d_1 CM \\ &= s_0 Q + s_1 Q^2 - d_0 Q + d_1 CQ \\ &\quad + m_0 (C - F - Q) + m_1 (C - F - Q)^2 - d_0 (C - F - Q) + d_1 C(C - F - Q) \\ &= s_0 Q + s_1 Q^2 - d_0 Q + d_1 CQ + m_0 C - m_0 F - m_0 Q \\ &\quad + m_1 C^2 + m_1 F^2 + m_1 Q^2 + 2m_1 FQ - 2m_1 FC - 2m_1 CQ \\ &\quad - d_0 C + d_0 F + d_0 Q + d_1 C^2 - d_1 CF - d_1 CQ \\ &= s_0 Q + s_1 Q^2 + m_0 C - m_0 F - m_0 Q + m_1 C^2 + m_1 F^2 + m_1 Q^2 \\ &\quad + 2m_1 FQ - 2m_1 FC - 2m_1 CQ - d_0 C + d_0 F + d_1 C^2 - d_1 CF. \end{aligned}$$

We choose Q and C to maximize $\{W = \theta CS + PS - (1 + \delta)TC\}$ by setting:

$$dW/dC = \theta dCS/dC - (1 + \delta)dTC/dC = 0,$$

and

$$dW/dQ = dPS/dQ - (1 + \delta)dTC/dQ = 0.$$

The elements of these equations are:

(A.1) $dPS/dC = 0, \quad dPS/dQ = s_1Q;$

(A.2) $dCS/dC = d_1(C - F), \quad dCS/dQ = 0;$

(A.3a) $dTC/dC = m_0 - d_0 + 2(d_1 + m_1)C - (2m_1 + d_1)F - 2m_1Q;$

(A.3b) $dTC/dQ = s_0 - m_0 + 2(s_1 + m_1)Q + 2m_1F - 2m_1C.$

Substituting these elements into the first-order conditions above yields:

(A.4) $dW/dC = \theta d_1(C - F) - (1 + \delta)[m_0 - d_0 + 2(d_1 + m_1)C - (2m_1 + d_1)F - 2m_1Q] = 0$

$\Rightarrow$ $2m_1Q + \theta d_1C/(1 + \delta) - \theta d_1F/(1 + \delta) - m_0 + d_0 - 2(d_1 + m_1)C + (2m_1 + d_1)F = 0$

$\Rightarrow$ $2m_1Q - [2(d_1 + m_1) - \theta d_1/(1 + \delta)]C = m_0 - d_0 - [2m_1 + d_1 - \theta d_1/(1 + \delta)]F;$

(A.5) $dW/dQ = s_1Q - (1 + \delta)[s_0 - m_0 + 2(s_1 + m_1)Q + 2m_1F - 2m_1C] = 0$

$\Rightarrow$ $-[2(s_1 + m_1) - s_1/(1 + \delta)]Q + 2m_1C = s_0 - m_0 + 2m_1F.$

Equations (A.4) and (A.5) are of the form:

(A.6) $AQ - BC = H;$

(A.7) $-KQ + LC = J,$

where

$$A = 2m_1, \quad B = 2(d_1 + m_1) - \theta d_1/(1 + \delta), \quad H = m_0 - d_0 - [2m_1 + d_1 - \theta d_1/(1 + \delta)]F;$$

$$K = 2(s_1 + m_1) - s_1/(1 + \delta), \quad L = 2m_1 = A, \quad J = s_0 - m_0 + 2m_1F.$$

The solutions for Q and C are given by solving (A.6) and (A.7):

(A.8) $Q = (AH + BJ)/(A^2 - BK)$;

(A.9) $C = (AJ + KH)/(A^2 - BK)$.

These can be obtained by substituting the values for the slopes and intercepts of supply and demand, the welfare weight (θ), the deadweight loss parameter (δ), and the amount of food aid (F) into the above equations.

Case II: Food Aid to the Government

In this case, the welfare maximization problem is:

Maximize: $W' = \theta CS' + PS + (1 + \delta)TC'$,

where

$$PS = 0.5s_1Q^2;$$

$$CS' = 0.5d_1C^2;$$

$$TC' = (P_p - P_c)Q + (P_m - P_c)M - P_cF = TC - P_cF$$

$$= s_0Q + s_1Q^2 + m_0C - m_0F - m_0Q + m_1C^2 + m_1F^2 + m_1Q^2$$

$$+ 2m_1FQ - 2m_1FC - 2m_1CQ - d_0C + d_1C^2.$$

The elements are:

(A.1′) $dPS/dC = 0, \quad dPS/dQ = s_1Q$;

(A.2′) $dCS'/dC = d_1C, \quad dCS/dQ = 0$;

(A.3a′) $dTC'/dC = m_0 - d_0 + 2(d_1 + m_1)C - 2m_1F - 2m_1Q$;

(A.3b′) $dTC'/dQ = s_0 - m_0 + 2(s_1 + m_1)Q + 2m_1F - 2m_1C$;

(A.4′) $dW'/dC = \theta d_1C - (1 + \delta)[m_0 - d_0 + 2(d_1 + m_1)C - 2m_1F - 2m_1Q] = 0$

$\Rightarrow$ $2m_1Q - [2(d_1 + m_1) - \theta d_1/(1 + \delta)]C = m_0 - d_0 - 2m_1F$;

(A.5′) $dW/dQ = s_1Q - (1 + \delta)[s_0 - m_0 + 2(s_1 + m_1)Q + 2m_1F - 2m_1C] = 0$

$\Rightarrow$ $-[2(s_1 + m_1) - s_1/(1 + \delta)]Q + 2m_1C = s_0 - m_0 + 2m_1F$.

These are again linear equations, now of the form:

(A.6′) $AQ - BC = H'$;

(A.7′) $-KQ + LC = J$,

where $H' = m_0 - d_0 - 2m_1F$, and the other parameters are unchanged. Thus,

(A.8′) $Q' = (AH' + BJ)/(A^2 - BK)$;

(A.9′) $C' = (AJ + KH')/(A^2 - BK)$.

A.2. Comparative Statics of the Model Solution

Case I: Food Aid to Consumers

To examine the effects on the optimal solutions, and their economic welfare consequences, we differentiate with respect to the quantity of food aid given to consumers directly (F_1) as follows:

(A.10) $$\frac{\partial Q}{\partial F_1} = \frac{2m_1 d_1}{A^2 - BK} \leq 0 \text{ as } m_1 \geq 0,$$

where

$$A^2 - BK = 4m_1^2 - \left[2d_1 + 2m_1 - \frac{\theta d_1}{1+\delta}\right]\left[2s_1 + 2m_1 - \frac{s_1}{1+\delta}\right] < 0;$$

(A.11) $$\frac{\partial C}{\partial F_1} = \frac{4m_1^2 - \left[d_1 + 2m_1 - \frac{\theta d_1}{1+\delta}\right]\left[2s_1 + 2m_1 - \frac{s_1}{1+\delta}\right]}{A^2 - BK} \lessgtr 0 \text{ if } \theta > 1 + \delta;$$

(A.12) $$\frac{\partial CS}{\partial F_1} = P_c + d_1(C - F_1)\frac{\partial C}{\partial F_1} > 0,$$

where

$$d_1 = \left|\frac{\partial P_c}{\partial C}\right|;$$

(A.13) $$\frac{\partial PS}{\partial F_1} = s_1 Q \frac{\partial Q}{\partial F_1} \leq 0,$$

where

$$s_1 = \frac{\partial P_P}{\partial Q}.$$

Case II: Food Aid to the Government

To examine the effects on the optimal solutions, and their economic welfare consequences, we differentiate with respect to the quantity of food aid given to the government for sale to consumers (F_2) as follows:

(A.14) $$\frac{\partial Q}{\partial F_2} = \frac{2 m_1 d_1 \left[2(1+\delta) - \theta\right]/(1+\delta)}{A^2 - BK} \leq 0, \text{ since } \frac{1}{2}\theta < 1 + \delta;$$

(A.15) $$\frac{\partial C}{\partial F_2} = \frac{2 m_1 s_1 \left[2(1+\delta) - 1\right]/(1+\delta)}{A^2 - BK} \geq 0;$$

(A.16) $$\frac{\partial CS}{\partial F_2} = d_1 C \frac{\partial C}{\partial F_2} \geq 0,$$

where

$$d_1 = \left| \frac{\partial P_c}{\partial C} \right|;$$

(A.17) $$\frac{\partial PS}{\partial F_2} = s_1 Q \frac{\partial Q}{\partial F_2} \leq 0,$$

where

$$s_1 = \frac{\partial P_P}{\partial Q}.$$

Table 1. Welfare Implications of Food Aid Given to Consumers (F_1) versus Government (F_2) in a Small Country

	Consumer Welfare Weight (θ) and Deadweight Loss from Taxation (δ)											
	θ = 1; δ = 0			θ = 1.1; δ = 0			θ = 1.1; δ = 0.05			θ = 1.3; δ = 0.2		
	0	F_1	F_2	0	F_1	F_2	0	F_1	F_2	0	F_1	F_2
Changes in Economic Welfare:												
Consumer Surplus (CS)	10,000	10,500	10,000	12,346	12,617	12,346	11,025	11,425	11,025	11,901	12,216	11,901
Producer Surplus (PS)	4,000	4,000	4,000	4,000	4,000	4,000	3,645	3,645	3,645	2,939	2,939	2,939
Taxpayer Surplus (TS)	0	0	500	–2,469	–2,228	–1,969	–738	–631	–213	–1,205	–973	–605
Net Domestic Surplus (NS)	14,000	14,500	14,500	13,880	14,389	14,376	13,932	14,439	14,457	13,635	14,182	14,235
Price Ratios:												
P_m/P_c	1.000	1.000	1.000	1.286	1.268	1.286	1.111	1.105	1.111	1.222	1.209	1.222
P_p/P_c	1.000	1.000	1.000	1.286	1.268	1.286	1.061	1.055	1.061	1.048	1.036	1.048

Note: The columns denoted "0" refer to a situation with no food aid.

Table 2. Implications of Food Aid Given to Consumers (F_1) versus Government (F_2) in a Large Country (Import Supply Elasticity = 10)

	Consumer Welfare Weight (θ) and Deadweight Loss from Taxation (δ)											
	θ = 1; δ = 0			θ = 1.1; δ = 0			θ = 1.1; δ = 0.05			θ = 1.3; δ = 0.2		
	0	F_1	F_2	0	F_1	F_2	0	F_1	F_2	0	F_1	F_2
Changes in Economic Welfare:												
Consumer Surplus (CS)	9,570	10,295	9,784	11,264	11,856	11,516	11,146	10,822	10,378	10,329	10,983	10,579
Producer Surplus (PS)	4,355	4,176	4,176	4,749	4,546	4,566	4,262	4,083	4,092	3,798	3,636	3,649
Taxpayer Surplus (TS)	103	74	585	–2,073	–1,938	–1,627	–416	–394	61	–210	–177	288
Net Domestic Surplus (NS)	14,028	14,545	14,545	13,940	14,463	14,454	13,992	14,511	14,531	13,917	14,443	14,517
Price Ratios:												
P_m/P_c	0.93	0.94	0.94	1.134	1.140	1.153	1.005	1.013	1.018	1.053	1.059	1.068
P_p/P_c	1.00	1.00	1.00	1.242	1.236	1.251	1.047	1.045	1.051	1.007	1.003	1.013

Note: The columns denoted "0" refer to a situation with no food aid.