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THE POLITICAL ECONOMY OF SYSTEMATIC GOVERNMENT INTERVENTION IN AGRICULTURE

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ABSTRACT

The systematic subsidization and exploitation of agriculture by developed and developing countries respectively, has generated a policy paradox for which there is no satisfactory explanation. This paper attempts to provide an explanation of this policy paradox. It first develops a simple political economy model which treats an interest group's relative political weight as endogenous. Interest groups compete in the political market to improve their relative political weight. This relative political weight appears as a parameter in the government's political preference function. The government maximizes the value of this function subject to the constraints imposed by the economic market to determine the level of a policy. The model is then estimated for wheat using data for twelve developed and thirteen developing countries from 1958 to 1987. The estimation results for developed and developing countries provide empirical support for the theoretical conjectures. The results suggest that sustainable policy reform in agriculture may not be possible if the political economy of agricultural price policies in developed and developing countries are ignored.

In nearly all countries, developed and developing alike, agricultural commodity markets are influenced by government intervention. Despite the well-documented negative economic effects of agricultural protectionism, active public intervention in agriculture has grown over time in both magnitude and complexity. As a consequence, decision-making in agriculture is becoming increasingly influenced by group politics and less so by market factors (World Bank, 1986; Winters, 1987). At the same time the budgetary costs of agricultural support programs has become a source of growing concern, and has been at the centre of attention during the Uruguay Round of GATT negotiations.

The nature of government intervention, however, is totally different in developed and developing countries. In developed countries, agricultural policies have been orchestrated to raise and stabilize farm incomes to politically acceptable levels. To achieve these objectives the developed countries have relied on distortionary domestic agricultural policies, which are often supplemented by equally distorting agricultural trade policies (World Bank, 1986; OECD, 1987).

The governments in developing countries, on the other hand, have tended to follow policies that emphasize economic development through industrialization and thus discriminate against agriculture and primary production. In general, the development strategies pursued in the developing countries are intended to (i) promote domestic manufacturing and urban industries protected by border measures, and (ii) accelerate the shift of resources out of agriculture by manipulating the internal terms of trade between agriculture and industry. In addition to discriminatory sectoral policies the developing countries have attempted to suppress producer prices of agricultural commodities through government procurement policies, export taxes, and food-rationing programs. They also maintain active exchange rate control regimes and import licensing mechanisms to subsidize manufacturing and other urban industries. This not only raises the price of inputs to farmers, but also appreciates the value of national currencies. An overvalued exchange rate means that exports are overvalued and duty-free imports are undervalued; this puts the developing agriculture in double jeopardy. Thus, while agricultural price and trade policies in most of the developed countries result in overpriced farm products, the developing countries use their public policies and institutional arrangements to make agricultural product prices and the returns to agriculture lower than they would otherwise be (Schultz, 1978; World Bank, 1986; FAO 1987).

In developing countries, farmers constitute the bulk of the population and agriculture (which contributes 25 to 40 percent of GDP) has been continuously exploited (World Bank, 1986). In developed countries, where farmers are a minority (less than 5 percent of total population,in general), agriculture is heavily subsidized and protected (OECD, 1987). While it is true that agricultural exports are the main source of tax revenues in non oil-exporting developing countries, why don't these governments tax other sectors at comparable rates? In developed countries, agriculture's contribution to the general economy, and the ratio of farm to non-farm votes have been declining; why then does the influence of farmers on agricultural policy appear to get stronger rather than weaker?

The above questions highlight a policy paradox in agriculture for which there is apparently no satisfactory explanation.[1] Traditional economic analysis uses the efficiency

[1] *Olson (1990) attempts to provide an explanation for this policy paradox. He argues that because of the inherent characteristics of developed and developing societies the opportunities for collective action, even for a relatively large group, exist in developed countries but not in developing countries. However, he does not provide any empirical evidence to support his argument.*

criterion to evaluate policy alternatives, which implies an aggregate social welfare function giving equal weight to the economic gains and losses accruing to each group (Harberger 1978). If assessed using this criterion alone, most of the observed policy choices in agriculture would appear undesirable. This implies that the policy objective function perceived by governments must not value the welfare of all groups equally. In fact, governments often manipulate the economy to improve the welfare of some groups in comparison to others. According to interest group theory, such preference biases are due to the differential political representation of various interest groups owing to their unequal capacity for collective action (Olson 1965, Peltzman 1976, Becker 1983). Although it is straightforward to estimate the economic waste associated with different policies, the effects of political pressure on policy choices are complex. Consequently, few attempts have been made to include political pressure as a variable in explaining how economic policy is made. Proposed models in the trade-theoretic literature range from majority voting (Mayer 1984) to explicit lobbying and other political expenditures, the magnitude of which determines the policy outcome (Wellisz and Wilson 1986, Young and Magee 1986, Hillman and Ursprung 1988). Zusman (1976) modelled the policy process as a bargaining game and showed that the political equilibrium is associated with the maximization of the weighted sum of the objective functions of the interest groups, where the weights, which are assumed to be constant, are the marginal strength of power over the policy-maker. Although interesting, the above models are too inflexible to be used to explain the existence of different degrees of intervention in agriculture. Moreover, there is an inconsistency in models which attempt to endogenize the policy variable but assume constant political weights in the government policy preference function.

The objectives of this article are (a) to develop an analytical framework capable of explaining the systematic pattern of government intervention in the agricultural sectors of developed and developing countries; and (b) to determine empirically the factors underlying the systematic pattern of government intervention in agriculture. The first of these objectives is pursued by developing a theoretical political economy model which treats an interest group's relative political weight as endogenous. To achieve the second objective, an empirical political economy model is specified based on the comparative static results of the theoretical model. The model is then estimated using data for twelve developed and thirteen developing countries for the wheat sector.

The Basic Model:

The model is static. It is designed to explain the causes of the systematic pattern of agricultural protection in industrialized countries and the taxation of agriculture in developing countries. The focus of the analysis is on the lobbying activities of interest groups. The underlying premise is that observed policy outcomes are the end result of group lobbying.

The model begins with a Political Preference Function (PPF) which defines government preferences for the relative well being of producer and consumer groups. It presumes that the well being of consumer and producer groups can be accurately measured by consumer and producer surpluses respectively (Gardner, 1983). The parameters of the PPF are the implicit weights placed on producer and consumer surpluses in government decisions. In a particular situation, the ratio of these weights, the relative political weight (θ), reflects the direction as well as the degree of wealth transfers from one group to another through government policy. The point of departure in this model is that it treats a group's relative political weight as endogenous.[2]

Assume linear demand and supply functions and a price support policy (that is, the policy determined price $P_s > P_o$). The government redistributes income between producer and consumer groups through an optimal choice of this policy according to its PPF. By varying the levels of P_s, different pairs of producer and consumer surpluses are generated. From these combinations of surpluses, a Surplus Transformation Curve(STC)[3] such as the curve TE_0K in figure 1 can be traced. The competitive market equilibrium occurs at the point E_0 (PS_0, CS_0) where the STC has a slope of negative one. The maximum producer surplus occurs at point $\widetilde{E}$ on the STC curve. So, the producer group participates in the political market to improve group welfare by moving somewhere between E_0 and $\widetilde{E}$ on the STC.

Since the existing legal and political system only sets the basic rules, the relative political weight of a pressure group is not predetermined (Buchanan, 1987). Given these rules, the interest groups engage in political exchanges to improve their relative political weights and thereby enhance group income or wealth. It is postulated that interest groups attempt to maximize

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[2] *Although there is a recognition of the possibility of endogenous political weights among policy analysts, no formal attempt has been made to make group political weights endogenous (Paarlberg and Abbott, 1986; Gardner, 1987b and 1989). Gardner (1987b, 1989) provides some informal discussion of endogenous political weights and Becker (1983) provides a rigorous formulation of interest group competition, showing that the political influence of each group is endogenous in the model. The relative political weight in a PPF can be thought of as the formal counterpart of the relatively abstract notion of political influence. Although the model developed in this article is different from all previous models of interest group competition, we acknowledge our intellectual debt to Becker and Gardner.*

[3] *The Surplus Transformation Curve was formulated by Gardner (1983). It shows the trade off between producers' and consumers' welfare. In particular, over the relevant range of the STC, the welfare of one group decreases at an increasing rate with an increase in the welfare of the other group (i.e.,* $\partial CS/\partial PS<0$, *and* $\partial^2 CS/\partial PS^2<0$).

producer or consumer surpluses net of lobbying costs. Assuming diminishing returns to political lobbying by groups the marginal benefit curve of lobbying is downward sloping.

Production of political pressure requires spending resources. Individuals within each group must organize, formulate a common policy position, limit free-riding, mitigate opposition, and engage in direct lobbying to produce pressure on the government. Here, one can think of total lobbying costs as the cost of donations plus the cost of fund raising. Consequently, it is hypothesized that the total cost of lobbying function is non-linear and convex, so that the marginal cost curve of lobbying is upward sloping.

The intersection between the marginal benefit and marginal cost curves of lobbying for each group depicts the optimization process in the political market. However, the success of one group's lobbying effort depends on the level of lobbying of the other group. To model the strategic nature of this process we assume the groups play a noncooperative Cournot-Nash game. Thus, the producer group chooses the lobbying expenditure, E^P, as a function of the consumer group's expenditure, E^C, thus generating a reaction function R^P (E^C). Similarly we can generate a reaction function for the consumer group, R^C (E^P). As indicated in Figure 2, there is no need to impose any restriction on the sign of the slopes of these reaction functions, although we will presume stability. The intersection of these reaction functions (E^{C*}, E^{P*}) represents a Cournot-Nash equilibrium (figure 2). Given these optimal political expenditures, the relative political weight for the producer group can be determined. For a given value of θ, that is θ^*, the Political Preference Function (assumed to be linear in PS and CS) provides a family of Political Indifference Curves (PICs) such as PIC_0, PIC_1, PIC_2 etc., in figure 1.

Since the Government maximizes the PPF subject to the economic constraint, the optimal policy intervention takes place at point E^* at which PIC_1 is tangent to the STC. The point E^* represents the political economy equilibrium in this model, an equilibrium which balances both economic and political forces(by construction). To attain this equilibrium, the government redistributes ΔCS (CS_0-CS_2) away from the consumer group and ΔPS (PS_2-PS_0) to the producer group. For each one dollar reduction of CS, the producers gain $\Delta PS/\Delta CS$ dollar increase in their welfare (Fig. 1).

According to traditional welfare economics the shape of the STC is determined by the deadweight loss to the society which is generated as the economy (due to government policy intervention) moves away from the competitive equilibrium. In this model, where θ is an endogenous variable, the efficiency implications of government policy intervention are even worse. This is because different levels of lobbying expenditures, E^P and E^C, involve different resource costs of the rent-seeking variety. Secondly, different levels of policy intervention create different deadweight loss values.

The model presented above represents two notable improvements over the Becker-Gardner model. First, it attempts to bring interest group competition formally into the political preference function thereby presenting a complete depiction of the political market. Second, unlike the Becker-Gardner model, it makes the relative political weight of a group endogenous, and it shows explicitly how competitive lobbying expenditures of different groups cause changes in the levels of a policy by changing their relative political weights.

This section translates the ideas in the preceding section into a simple algebraic model which can be used to derive the comparative static results. The model begins with the following functions:

$$W = \theta PS(t) + CS(t) \quad ; \quad \partial PS/\partial t > 0 \, , \, \partial CS/\partial t < 0 \, . \tag{1}$$

$$\theta = \theta(E^C, E^P) \quad ; \quad \partial\theta/\partial E^P > 0 \, , \, \partial\theta/\partial E^C < 0 \, . \tag{2}$$

The first function is the PPF where PS and CS are producer and consumer surpluses. The PPF is assumed to be linear and continuous in PS and CS.[4] The PS and CS are, in turn, functions of the level of some policy instrument (t) chosen by the government. In particular, government policy affects PS directly and CS inversely. The second function shows that the relative political weight of the producer group, θ, is endogenous and it depends on lobbying expenditures by producer (E^P) and consumer (E^C) groups. In particular, the relative political weight varies directly with E^P and inversely with E^C.

The government's objective is to choose 't' to maximize W(t) for given θ. The first order condition of the optimization problem is:

$$\frac{dW}{dt} = \theta PS'(t) + CS'(t) = 0 \tag{3}$$

Using the implicit function theorem gives:

$$\hat{t} = \hat{t}(\theta) \, ; \; V, \; \hat{t} = \hat{t}(\theta(E^C, E^P)) \, . \tag{4}$$

The second order condition requires:

$$\frac{d^2W}{dt^2} = \theta PS''(t) + CS''(t) < 0, \quad \text{for an interior solution} \tag{5}$$

[4] *The PPF is assumed to be linear for simplicity. The results would be valid for any PPF quasi-concave in PS and CS.*

The first order condition (3) shows that the marginal rate of substitution between producer surplus and consumer surplus is equal to the inverse of the relative political weights of the two groups. It implies that the government sets the level of a policy (t) to balance the marginal political gains and losses from the two interest groups (Becker, 1985).

Also letting, $F(t; \theta) = \theta PS'(t) + CS'(t) = 0$, totally differentiate F(.) to get:

$$\frac{d\hat{t}}{d\theta} = \frac{-PS'(t)}{\theta PS''(t) + CS''(t)} > 0 \tag{6}$$

Hence, the optimum level of policy variable (t) varies directly with the relative political weight.

Behaviour of Producer and Consumer Groups:

For each group (producers and consumers), the objective function (PS(t) and CS(t), less costs, respectively), depends on t which in turn depends on θ which in turn depends on lobbying expenditures E^C and E^P as well as various other parameters. These parameters can be summarized by the vectors X^P and X^C for PS and CS. Similarly L^P and L^C are used to represent costs. Each of the X vectors includes the characteristics of both producer and consumer groups and other characteristics common to both groups. Each of the L vectors, on the other hand, includes the characteristics of one group and some common characteristics. Each group then chooses its expenditures to maximize its net benefits for a conjectured level of the other group's expenditure. This serves as the definition of a reaction function. Thus,

$$E^P = R^P(E^C; X^P, L^P) \; ; \quad E^P = argmax \;\; PS(E^C, E^P; X^P) - C^P(E^P; L^P) \tag{7}$$

$$E^C = R^C(E^P;\ X^C,\ L^C):\quad E^C = \text{argmax}\ \ CS(E^C,\ E^P;\ X^C)\ -\ C^C(E^C;\ L^C) \tag{8}$$

Here, E^P and E^C represent units of effective lobbying expenditure with $C^P(.)$ and $C^C(.)$ as the costs of generating these expenditures. To simplify the notation, the net benefit function of the producer group (and, similarly for the consumer group) can be defined as,

$$NB^P(E^P,\ E^C;\ X^P,\ L^P)\ =\ PS(E^P,\ E^C;\ X^P)\ -\ C^P(E^P;\ L^P) \tag{9}$$

So that, (7) becomes:

$$E^P = R^P(E^C;\ X^P,\ L^P):\quad E^P = \text{argmax}\ \ NB^P(E^C,\ E^P;\ X^P,\ L^P) \tag{10}$$

In terms of the net benefit functions the above first order conditions can be written as:

$$\frac{\partial NB^P(E^P,\ E^C;\ X^P,\ L^P)}{\partial E^P} = 0 = \frac{\partial NB^C(E^P,\ E^C;\ X^C,\ L^C)}{\partial E^C} \tag{11}$$

Now, since PS=PS(t), t=t(θ) and θ=θ(E^P, E^C), the assumptions about signs given in (1) and (2), as well as the results of (6) can be used to derive:

$$\frac{\partial PS}{\partial E^P} = \frac{\partial PS}{\partial \hat{t}} \cdot \frac{\partial \hat{t}}{\partial \theta} \cdot \frac{\partial \theta}{\partial E^P} > 0 \tag{12}$$

Similarly, $\partial CS/\partial E^C>0$. Therefore, PS and CS vary directly with E^P and E^C respectively. It can also be shown that PS and CS vary inversely with E^C and E^P respectively.

The purpose of this exercise is to help in generating comparative static results. For simplicity of notation collapse vectors X and L into a single vector Z, recognizing that some elements in Z affect PS directly, others affect C^P, CS or C^C, and some affect more than one. Assuming one element Z_j changing with all other $dZ_i = 0$, the comparative statics results can be generated as follows:

$$\begin{bmatrix} \frac{\partial^2 NB^P}{\partial E^{P^2}} & \frac{\partial^2 NB^P}{\partial E^P \partial E^C} \\ \frac{\partial^2 NB^C}{\partial E^C \partial E^P} & \frac{\partial^2 NB^C}{\partial E^{C^2}} \end{bmatrix} \cdot \begin{bmatrix} \frac{dE^P}{dZ_j} \\ \frac{dE^C}{dZ_j} \end{bmatrix} = \begin{bmatrix} -\frac{\partial^2 NB^P}{\partial E^P \partial Z_j} \\ -\frac{\partial^2 NB^C}{\partial E^C \partial Z_j} \end{bmatrix} \tag{13}$$

For Cournot-Nash stability the determinant of the coefficient matrix A must be positive.[5] Comparative static results then depend on the signs of the second-order partial derivatives:

$$\frac{dE^P}{dZ_j} = \left[-\frac{\partial^2 NB^P}{\partial E^P \partial Z_j} \cdot \frac{\partial^2 NB^C}{\partial E^{C^2}} + \frac{\partial^2 NB^P}{\partial E^P \partial E^C} \cdot \frac{\partial^2 NB^C}{\partial E^C \partial Z_j} \right] \div \text{det. } A \tag{14}$$

$$\frac{dE^C}{dZ_j} = \left[-\frac{\partial^2 NB^P}{\partial E^{P^2}} \cdot \frac{\partial^2 NB^C}{\partial E^C \partial Z_j} + \frac{\partial^2 NB^C}{\partial E^C \partial E^P} \cdot \frac{\partial^2 NB^P}{\partial E^P \partial Z_j} \right] \div \text{det. } A \tag{15}$$

In order for (7) and (8) to have interior solutions, $\partial^2 NB^P/\partial E^P < 0$, and $\partial^2 NB^C/\partial E^C < 0$, and Cournot-Nash stability requires det. A>0. The signs for the remaining parts of the above expressions will depend on the application and conjectures being made.

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[5] *Stability implies that if either group deviates from an equilibrium, the optimal response of the other group brings (E^C, E^P) back to the original equilibrium. A necessary and sufficient condition for this to hold locally is that the absolute value of the slope of the consumer group's reaction function is greater than that of the producer group's reaction function, at the equilibrium.*

For example, suppose the producer group becomes more efficient in raising funds in the sense that the marginal cost of increasing expenditure falls (i.e., $\partial^2 NB^P/\partial E^P \partial Z_j > 0$, for a change in some particular characteristic Z_j). Assume Z_j has no effect on NB^C, thus $\partial^2 NB^C/\partial E^C \partial Z_j = 0$. Then, $dE^P/dZ_j > 0$ but the sign of dE^C/dZ_j depends on the slope of the reaction function. If R^C is downward sloping ($\partial^2 NB^C/\partial E^C \partial E^P < 0$), then $dE^C/dZ_j < 0$ and the result is that E^P increases and E^C decreases. Hence θ increases, t increases, and PS rises while CS falls. However, a more interesting case results when the reaction functions are upward sloping. If R^C is upward sloping, then $dE^C/dZ_j > 0$. This is natural, since improved efficiency in lobbying for the producer group increases its expenditure ($dE^P/dZ_j > 0$); if the consumer group reacts directly with respect to the producer group's expenditures (i.e., $\partial^2 NB^C/\partial E^C \partial E^P > 0$), E^C will rise as well.[6] Thus, the combined effect on θ is uncertain, as is it on t. However, if $\partial^2 NB^C/\partial E^C \partial E^P = 0$, then $dE^C/dZ_j = 0$. As a result, E^P increases, E^C remains unchanged, θ and t increase. Thus PS rises and CS falls. Similarly, if the consumer group becomes more efficient in the sense that its marginal cost of increasing expenditure declines (i.e., $\partial^2 C^C(E^C; R^C)/\partial E^C \partial R^C_i < 0$, or $\partial^2 NB^C/\partial E^C \partial Z_i > 0$), then E^C increases and E^P falls. As a result both θ and t decrease. Thus CS rises and PS falls.

The above comparative statics results can be derived graphically as well. For the sake of brevity, only one case is considered. Figure 3 assumes that the reaction functions of both producer and consumer groups are downward sloping. This implies that the political expenditures made by the two groups have some offsetting effects. In particular, when E^P increases, this makes

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6. As a benchmark we use:

$$\frac{\partial^2 NB^C}{\partial E^C \partial E^P} = \frac{\partial^2 NB^P}{\partial E^P \partial E^C} = 0$$

E^C less effective. As a result optimal E^C falls.

If the producer group becomes more efficient in lobbying, its optimal lobbying expenditures will increase for any level of expenditure made by the consumer group (as its marginal cost curve shifts to the right). So, the reaction curve of the producer group is shifted upward (from $R^P(E^C)$ to $R^{P'}(E^C)$), and the equilibrium position will change from e_0 to e_1. Since the consumer group reacts negatively with respect to changes in E^P, the reaction curve of the consumer group shifts downward (from $R^C(E^P)$ to $R^{C'}(E^P)$) and the new equilibrium is at e_2. At e_2, $E^P_2 > E^P_0$ and $E^C_2 < E^C_0$. The combined effect on θ is positive.

Figure 4 assumes that the reaction functions are upward sloping. This implies that political expenditures made by the two groups have some complementary effects, so that when E^P increases, E^C becomes more effective. So, optimal E^C also increases. In this situation, because of improved efficiency in lobbying the reaction function of the producer group shifts to the left. Since the consumer group reacts positively with respect to changes in E^P, its reaction function shifts to the right and the equilibrium position moves from e_0 to e_2. At e_2, $E^P_2 > E^P_0$ and also $E^C_2 > E^C_0$. The combined effect on θ is uncertain. Depending on the relative magnitudes of the shifts in the two reaction functions θ can increase, decrease or remain unchanged. When $\partial^2 NB^C/\partial E^C \partial E^P = 0$, the comparative static result is as shown in Figure 5. The reaction function of the consumer group is a vertical line at E^C_0, an upward shift of R^P generates a new equilibrium e_1 with higher E^P. Thus, at e_1, $E^P_1 > E^P_0$, but E^C remains unchanged. So, the combined effect on θ would be positive. Thus, t increases, PS increases and CS falls. These results can be summarized as:

> *PROPOSITION 1: A group that becomes more efficient in lobbying will be able to raise its benefits relative to the other group.*

What happens to the equilibrium conditions when group size changes? This is a tricky issue because at low levels of expenditures scale economies are important and free riding is not a major problem in a very small group. So, a modest increase in the size of a small group (up to *a critical maximum*) would be expected to increase its net marginal benefits from lobbying. Once a group exceeds this critical size, scale economies become unimportant and free riding increasingly troublesome.

Assume that the size of producer and consumer groups at the original equilibrium exceed such a critical maximum. Then, if the size of the producer group increases it would have no impact on its marginal benefit function because an increase in 't' is a public good for the producer group. However, it will increase the marginal cost of raising funds to spend on lobbying. So, the effect of an increase in group size is to reduce the effectiveness of its lobbying expenditures. Assuming that an increase in the size of the producer group will not affect the net benefits of the consumer group, the result is that E^P decreases, E^C increases or remains unchanged (depending on the slope of the reaction functions); thus, θ decreases, as does t. Thus, CS increases and PS falls. These results can be summarized as:

> *PROPOSITION 2: There is an inverse relationship between the size of a group and the levels of per capita policy benefit from lobbying it enjoys.*

This proposition implies that a politically more successful group tends to be smaller than its rival group. Contrary to the popular view that small groups have only a few votes and are at a disadvantage politically, this proposition appears to be consistent with the observed policy intervention in agricultural commodity markets in developed and developing countries.

As the percentage of total income per farm earned from a commodity increases the organizational and free riding costs in the producer group decreases. So, the marginal cost of increasing expenditure falls (i.e., $\partial^2C^P(.)/\partial E^P\partial R_j^P<0$). Assuming that this does not affect the marginal net benefit function of the consumer group, E^P increases, E^C decreases or remains unchanged, θ increases, and t increases. Consequently, PS increases and CS falls. Similarly, the higher the proportion of total income spent on the commodity by the consumer group, the lower the marginal cost of increasing expenditures (i.e., $\partial^2C^C(.)/\partial E^C\partial R_j^C<0$). Assuming that this does not affect the benefit function of the producer group, E^C increases, E^P decreases, θ decreases, and t decreases. Consequently, CS increases and PS decreases. These results can be summarized as:

> *PROPOSITION 3: The lower the share of income per farm coming from the protected commodity or the higher the share of income spent on the commodity, the lower the policy benefits of lobbying for the producer group.*

Up to this point, the comparative statics analysis has concentrated on the characteristics of individual groups. The following section presents the comparative statics analysis that result from changes in some common characteristics. In particular, the effects of changes in agriculture's comparative advantage, international terms of trade and the share of imports financed by agricultural exports are analyzed.

Changes in the comparative advantage of agriculture affects the decision making of both producer and consumer groups. Suppose comparative advantage in agriculture declines. Since this makes agriculture worse off than the rest of the economy, the producer group becomes more cohesive in its efforts to lobby the government. As a result, the marginal cost of increasing lobbying expenditures falls (i.e., $\partial^2C^P(.)/\partial E^P\partial R_j^P<0$). At the same time, it becomes harder for the consumer group to increase expenditures because of the common perception that agricultural producers are already worse off. So, the marginal cost of increasing expenditure increases ($\partial^2 C^C(.)/\partial E^C \partial R_j^C > 0$), for the consumer group. Thus, E^P increases, E^C decreases, θ increases, and t increases. So, PS increases and CS falls. This result can be stated as:

PROPOSITION 4: There is an inverse relationship between agriculture's comparative advantage and the lobbying benefits to the producer group.

Although this proposition comes close to the prescriptions of the bureaucratic power model (Niskanen, 1971) in which the above relationship is due to government's desire for rent extraction from agriculture, the interest group interpretation seems more realistic in a democracy.

When international terms of trade turn against agriculture, irrespective of whether the country is a net exporter or a net importer of agricultural products, it makes agriculture worse off relative to the rest of the economy. Consequently, the producer group can be expected to intensify its lobbying efforts. As a result, the marginal cost of increasing lobbying expenditure falls for the producer group. The marginal cost of increasing lobbying expenditure increases, however, for the consumer group. The combined effect is that E^P increases, E^C decreases, θ increases and t increases. Consequently, PS increases and CS falls. This result can be stated as:

PROPOSITION 5: There is an inverse relationship between agriculture's international terms of trade and the policy benefits of lobbying for the producer group.

As the share of total imports financed by agricultural exports increases, agriculture receives more prominence in policy making and the marginal effectiveness of producer group's expenditure increases. On the other hand, the marginal effectiveness of the consumer group's expenditure decreases. Consequently, E^P increases and E^C decreases; thus θ increases and t increases. The result is that PS increases and CS falls. This result can be stated as:

PROPOSITION 6: There is a direct relationship between the share of total imports financed by agricultural exports and the benefits to the producer group.[7]

Although some of the results (for example, the effects of group size and improved lobbying efficiency) obtained here are similar to those obtained by Becker (1983), Findlay and Weillisz (1982), and Gardner (1987a), the modelling approach used to derive them is quite different. Unlike the Becker-Gardner model, this model accommodates both positively and negatively sloped reaction functions and derives comparative statics properties for changing group characteristics as well as some common characteristics.

The Empirical Model:

The political economy model presented above is applied to twelve developed and thirteen developing countries. The twelve developed countries are: Australia, Canada, Denmark, France, West Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States. The thirteen developing countries are: Argentina, Bangladesh, Brazil, Chile, Colombia, Egypt, India, Mexico, Pakistan, Paraguay, Peru, Syria and Turkey. The choice of this particular group of countries, rather than a different group (perhaps with richer regional diversity) is based on the availability of a reasonably long time series of data.

The empirical model is developed in two steps. First, the implicit relative political weights are retrieved and the explanatory variables like agriculture's comparative advantage, agriculture's

[7] *This proposition clearly applies to countries that perceive foreign exchange shortages (i.e., most of the developing countries). However, if the politics of policy making in agriculture are taken into account, it applies equally to developed countries. This is because an increase in the share of imports financed by agricultural exports would make the producer lobby much stronger politically.*

share in the economy (in employment or in GDP), agriculture's international terms of trade, imports financed by agricultural exports and the share of food in disposable income are specified for each country. Then a politico-econometric model is specified with the relative political weight as the dependent variable. Since changes in the relative political weight cause changes in the optimum policy choice, the endogeneity of the political weight implies endogenous policy.

Given the absence of country specific information on group lobbying expenditures the direct estimation of the relative political weight is not possible. Alternatively, the Revealed Preference Approach is used to retrieve the implicit weights based on observed prices. According to the Revealed Preference Approach government maximizes the PPF and reveals its preferences (i.e., the weights) through its choice of policies. To retrieve the implicit political weights, assume a linear PPF such as:

$$W = \theta \Delta PS + \Delta CS - T \tag{16}$$

where θ is the relative political weight for the producer group, ΔPS and ΔCS are the changes in producer surplus and consumer surplus respectively and T is the loss to taxpayers resulting from the price support policy.[8] The government sets the minimum producer price at P_s which results in output Q_s and the market clears at price P_d. The simplified PPF can be written as:

$$W = (\theta - 1)\Delta PS - DWL \tag{17}$$

Now assume linear supply and demand functions such as:

[8] *This political preference function is slightly different from the PPF used in the theoretical model. The loss to taxpayers is included to account for the wide variety of policy scenarios in the wheat market.*

$$S = a + bP_s \; ; \; \Lambda, \quad D = c + dP_d \; . \tag{18}$$

Using these functions and after a few manipulations the PPF in (17) becomes:

$$W = \frac{1}{2}(P_s - P_0)\;[(\theta - \frac{b}{d})Q_0 + (\theta - 2 + \frac{b}{d})(a + bP_s)] \tag{19}$$

The first order and the second order conditions for a maximum are

$$\frac{dW}{dP_s} = \frac{1}{2}[\theta - \frac{b}{d})Q_0 + (\theta - 2 + \frac{b}{d})(a + bP_s)] + \frac{1}{2}b(P_s - P_0)(\theta - 2 + \frac{b}{d}) = 0 \tag{20}$$

and,

$$\frac{d^2W}{dP_s^2} = b(\theta - 2 + \frac{b}{d}) < 0 \tag{21}$$

From the first order condition, the following expression for θ can be derived:[9]

$$\theta = 1 + \varepsilon\frac{(P_s - P_d)}{P_s} \; ; \tag{22}$$

where ε is the domestic elasticity of supply. Assuming that each country is small and cannot

[9] *To estimate θ the particular form of policy does not matter. What matters is the resulting prices.*

influence the world price, the P_d in the above equation can be replaced by the border price.[10] The producer and border prices are observable and estimates of supply elasticities are also available. Therefore, the implicit political weight for the producer group relative to that of the consumer group can be calculated.

Data and Estimation:

Although the model could be used to illustrate the causes of systematic government intervention for any commodity, wheat has been chosen for this study because wheat is the most important agricultural commodity traded internationally and the world wheat market is affected by massive policy intervention (IWC, 1988; OECD, 1987 and Harwood and Baily, 1990). The producer price of wheat is measured as the average farm-gate price of wheat per tonne in U.S. dollars received by farmers. This price includes direct government payments but excludes indirect taxes such as the value-added tax. The border price of wheat is measured as the f.o.b. unit export value or the c.i.f. unit import value, depending on whether the country is an exporter or importer of wheat. Finally, the estimates of supply elasticities were obtained from USDA (1989c).

There are six observations for each country which are calculated for each five-year interval from 1960 to 1985. Hence, the data spans the time period from 1958 to 1987. Each observation represents an average of five years, with the reported year as the mid point. For

[10] *This is a simplifying assumption. However, it imposes a constraint on the estimated weights by assuming away the demand side distortions in domestic wheat markets. Although the political weights for the developed countries would not be biased because of very low demand side distortions, those for the developing countries would be under estimated. These biases could have been avoided by using a more general framework along the line of Sarris and Freebairn (1983) to estimate the relative political weights of the producer group. Such an approach is not pursued here because of its higher information requirements.*

example, the estimate reported for 1985 is actually an average of the estimates of 1983 to 1987. The five-year average is used to avoid year to year fluctuations in prices which could be due to yearly changes in weather conditions or other random factors. A detailed description of data sources of producer and border prices of wheat is given in Appendix A while Appendix B presents a brief empirical specification of the explanatory variables used in the analysis.

Four alternative model specifications (A to D) relating the relative political weight of wheat farmers to the set of independent variables are presented. As shown in table 1, each specification corresponds to a different set of explanatory variables.

Models A to D, as specified in table 1, are estimated for developed and developing countries. To take into account the effects of regional differences in wheat price policies in the analysis, several dummy variables are also used in the regression.[11]

To avoid functional form mis-specification, a flexible functional form based on the Box-Cox transformation is used. However, as Spitzer (1982) has shown the estimated variance-covariance matrix of a Box-Cox model is conditional on the optimum value of the Box-Cox parameter and is biased downward. Strictly speaking, the standard errors cannot be used for hypothesis testing. Since hypothesis testing is an important part of this research, a scaling procedure suggested by Spitzer (1984) which makes the t-ratios on the β coefficients scale invariant, has been applied to the data sets prior to estimation. Owing to that scaling procedure, the estimated regression coefficients are point elasticities, evaluated at the geometric means. All equations are estimated within a static single equation framework using SHAZAM 6.2.

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[11] *Models A to D were also estimated without dummy variables and all F-values were statistically significant. To economize space those results are not reported here.*

Estimation Results: Developed Countries

The maximum likelihood estimates of the models for developed countries are reported in table 2. The first four regressions estimate models A to D with three intercept dummies to represent the regional differences in wheat price policy in the European Community (EEC), in Japan (JAN) and in Sweden and Switzerland (NAL) which are known as militarily non-aligned. Regressions (5) to (8) include the three intercept dummies plus three EEC slope dummies with respect to LABPDR, FCENDR and FDEDI.

The estimated models fit the data reasonably well, as indicated by the values of $\bar{R}^2$, ranging from 0.72 to 0.75. The F-values are all significant at the 1 percent level. Because of the pooled cross-section time series nature of the data set conventional serial correlation tests are not meaningful and an attempt to test for time-wise autocorrelation and cross-sectional heteroskedasticity (Kmenta, 1986, pp. 616-625) failed due to insufficient data points in each cross-section.

The coefficients of the labour productivity ratio (LABPDR), the factor endowment ratio (FCENDR) and agriculture's international term's of trade (ITTOAG) are all negative (as expected) and significant. The coefficients of the NAL dummy are all positive and significant at the 1 percent level. However, those of JAN and the EEC are all negative and unexpected.

The signs of the coefficients of all the explanatory variables in models A and C (i.e., regressions 5 and 7) are consistent with their theoretical expectations, after the three EEC slope dummies are incorporated in the analysis. The explanatory power of these two models also improves slightly. The results of these regressions provide empirical support to the theoretical conjectures developed by the analytical model (Table 3).

Although it is not possible to discriminate between the two alternative measures of agriculture's comparative advantage based on either the value of $\bar{R}^2$ or the significance of their coefficients, a closer look at the estimated coefficients in table 2 shows that the absolute values of the estimated coefficients of the labour productivity ratio are much higher than those of the factor endowment ratio across all equations. This implies that the relative political weights are more responsive to changes in the labour productivity ratio than to changes in the factor endowment ratio. This supports the observations made by Honma and Hayami (1986) in explaining the structure of agricultural protection (NPC) in industrial countries.

Estimation Results: Developing Countries

The maximum likelihood estimates of relative political weight function for developing countries based on the black market exchange rates are reported in table 4. Three dummy variables are incorporated to represent the regional or national differences in wheat price policies in Argentina (ARG), in three Asian countries, Bangladesh, India and Pakistan (ASN) and in Egypt (EGD). The value of $\bar{R}^2$ varies between 0.52 to 0.56. The F-statistics are all significant at the 1 percent level. The coefficients of the labour productivity ratio (LABPDR), the factor endowment ratio (FCENDR), agriculture's share of employment (ASOLAB) and agriculture's international terms of trade (ITTOAG) are all negative but only those of the first two variables are significant. The coefficient of the share of imports financed by agricultural exports (IMFBAE) is positive and significant. The coefficients of the dummy variables are all negative and significant.

Two interesting observations can be made from the results reported in tables (2) and (4). First, the labour productivity ratio, agriculture's international terms of trade and the share of food in disposable income are the most important factors influencing the relative political weights in developed countries (equations 5 and 7 in tables 2 and 3), while the factor endowment ratio, agriculture's international terms of trade and the share of imports financed by agricultural exports are the most important factors affecting the relative political weights in developing countries (Tables 4 and 5). Second, while the labour productivity ratio appears to be a better measure of agriculture's comparative advantage in developed countries, the factor endowment ratio appears to be the better alternative for developing countries. This is perhaps due to the fact that agriculture in developed countries is highly capital intensive and that the scarcity of agricultural land is more severe in developing countries.

Concluding Comments:

The systematic subsidization and exploitation of agriculture by developed and developing countries respectively, has generated a policy paradox for which there is no single satisfactory explanation. This article has developed a simple political economy model to provide a potential explanation of this policy paradox. The results of the theoretical model suggest that the process of policy formulation is very important in understanding and explaining observed government policies. In particular, the perceived policy paradox in agriculture is largely explained once the political aspects of agricultural policy making in developed and developing countries are taken into account. Interest group lobbying activities affect the relative political weight in the PPF and thereby affect government policy decisions. Changes in industry and group characteristics affect lobbying activities. In the context of this model, policy reform in agriculture implies changing the forces that condition government behaviour, i.e., changing the relative political weight in the PPF. Attempts of policy reform in agriculture will fail if the underlying political strength of interest groups reflected in this weight remains unchanged. Therefore, an important implication of this model is that sustainable policy reform in agriculture is not possible if the political economy of agricultural price policies in developed and developing countries are ignored.

The empirical model identifies a number of factors responsible for systematic government intervention in the wheat market. The results imply that in developed countries the comparative advantage shifted away from agriculture and the relative contribution of agriculture in employment and GDP declined. At the same time the share of food in consumers disposable income was declining. While the simultaneous decline in agriculture's comparative advantage and the relative contraction of agriculture made the producer group's lobbying activities in these countries much stronger, the declining share of food in disposable income made consumers less interested in resisting agricultural protectionism. Thus while the demand for protective agricultural policies has gone up the political costs of supplying these policies have declined. As a result there is systematic policy protection for wheat farmers in developed countries.

The empirical results for developing countries imply that agriculture's comparative advantage has improved and agriculture has become more important as the financier of merchandise imports, although its relative contribution to GDP slightly declined. The relative prosperity of agriculture compared to the general economy in these countries made urban consumers much stronger politically. Although farmers are still in the majority, numbers prohibit their effective political organization. Thus, since the political costs of providing policy support to urban consumers did not change, a systematic exploitation of wheat producers is observed in developing countries.

The relative political weights were negatively related to changes in international terms of trade for agriculture both in developed and developing countries. This implies that harmonization of domestic agricultural price policies in developed and developing countries will help reduce instability in international markets.

Finally, a word of caution. The theoretical model presented in this paper is simple and the proposition derived from it are tentative, although government intervention in the wheat sectors of developed and developing countries provide empirical support to those propositions. Future research will investigate the validity of these propositions for other agricultural commodities traded internationally. Another direction that merits investigation is the integration of uncertainty of the benefits from lobbying into this political economy model.

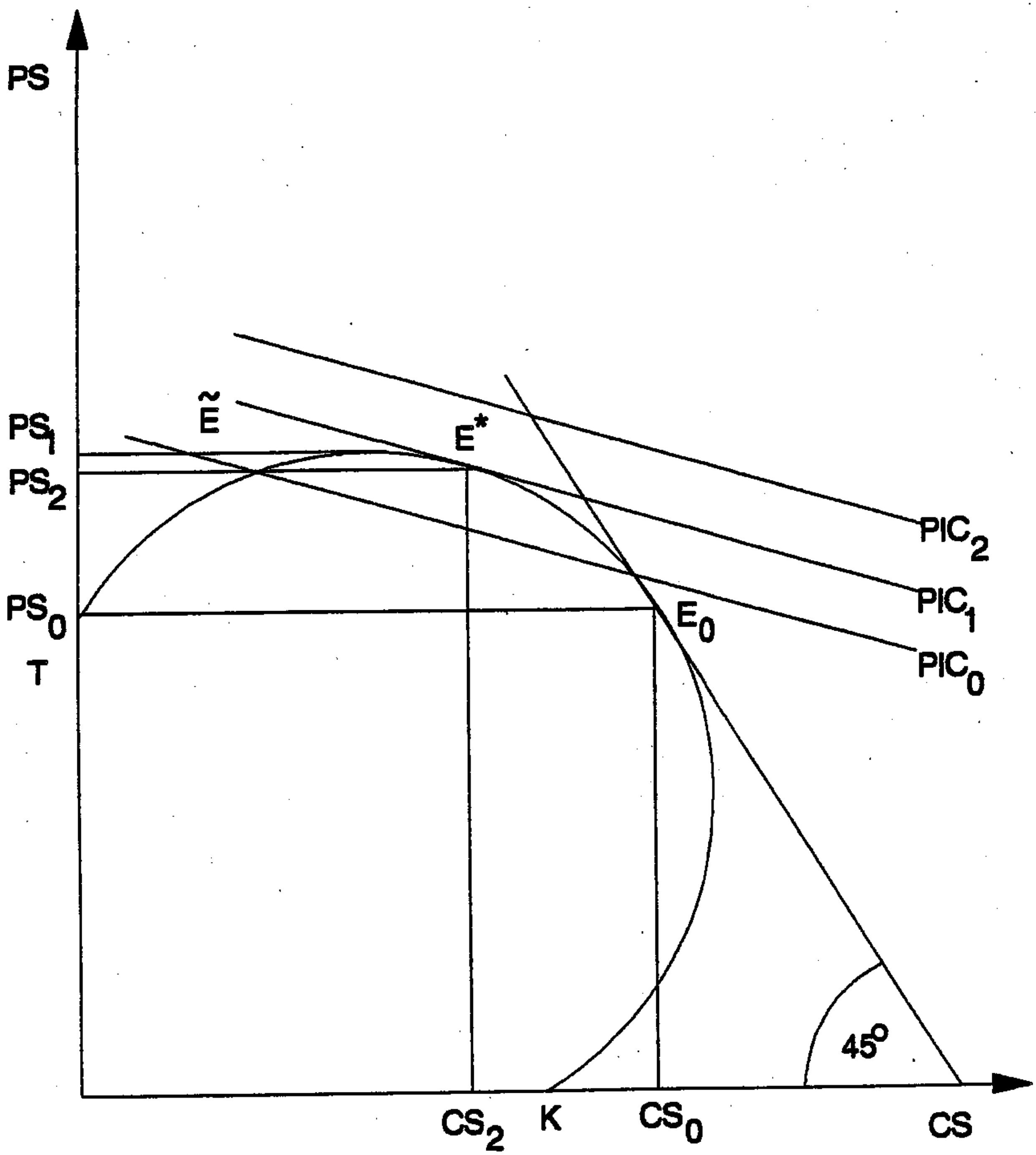

Figure 1 Political Economy Equilibrium.

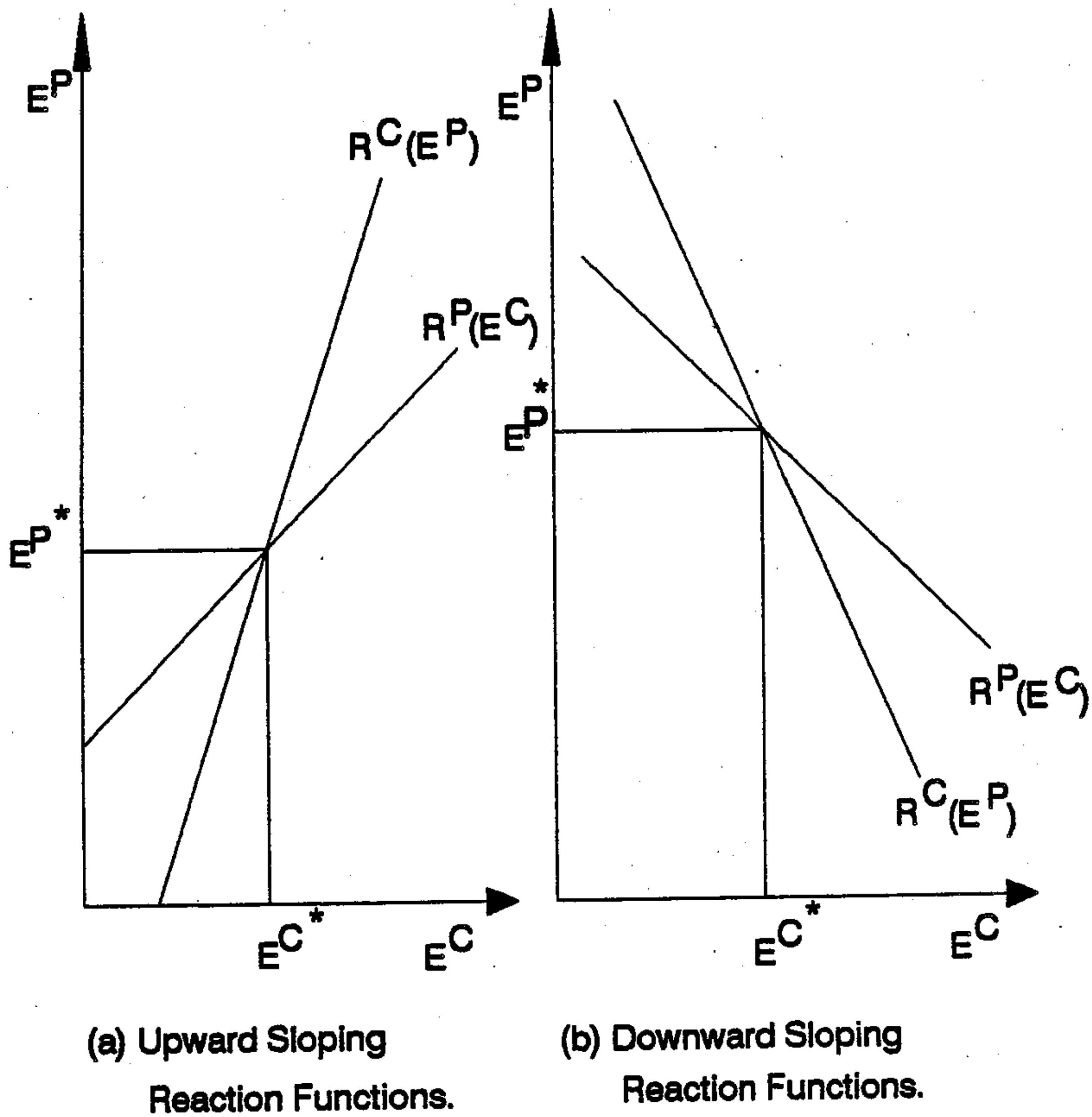

Figure 2 The Game Component of the Model.

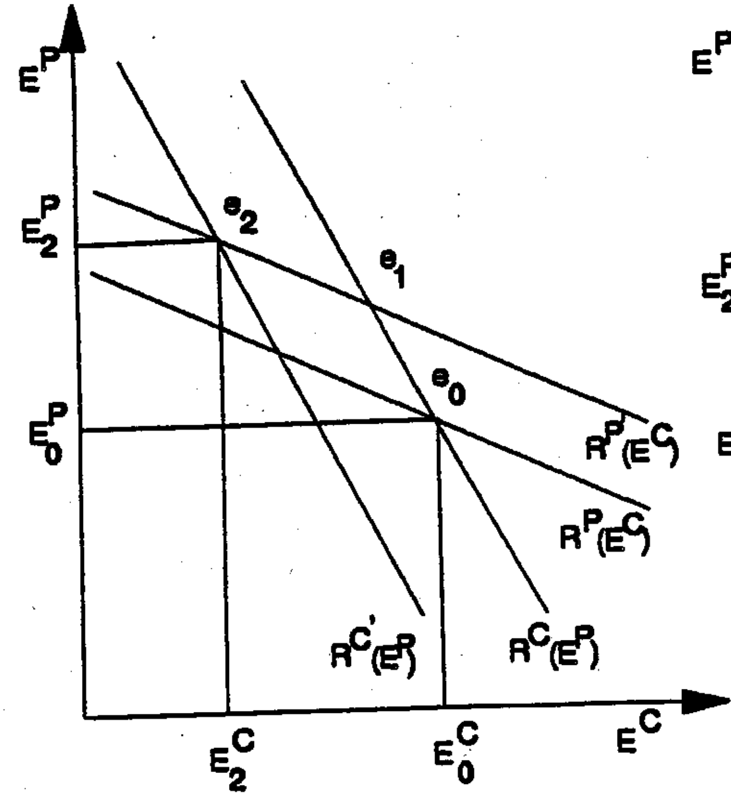

Figure 3 Positive Effects of Improved Efficiency of Lobbying.

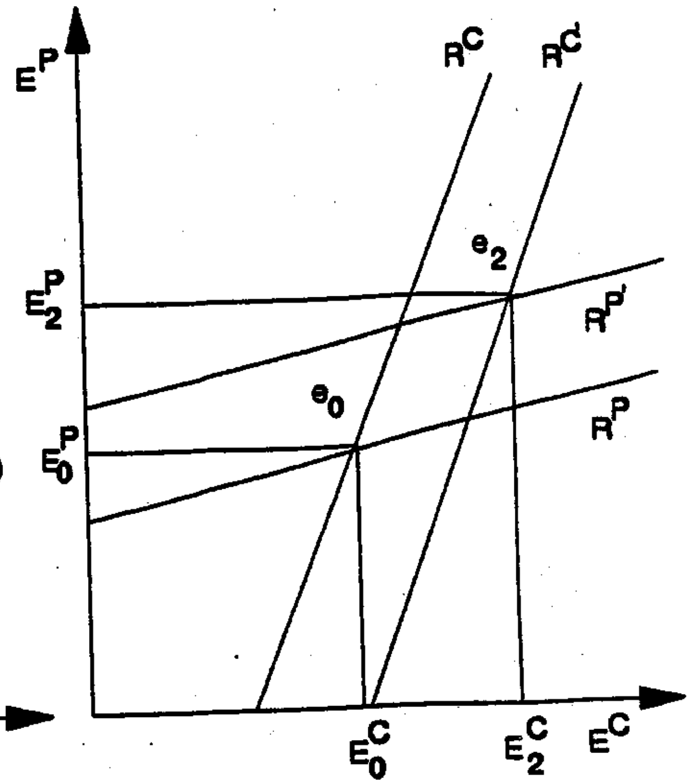

Figure 4 Uncertain Effect of Improved Efficiency of Lobbying.

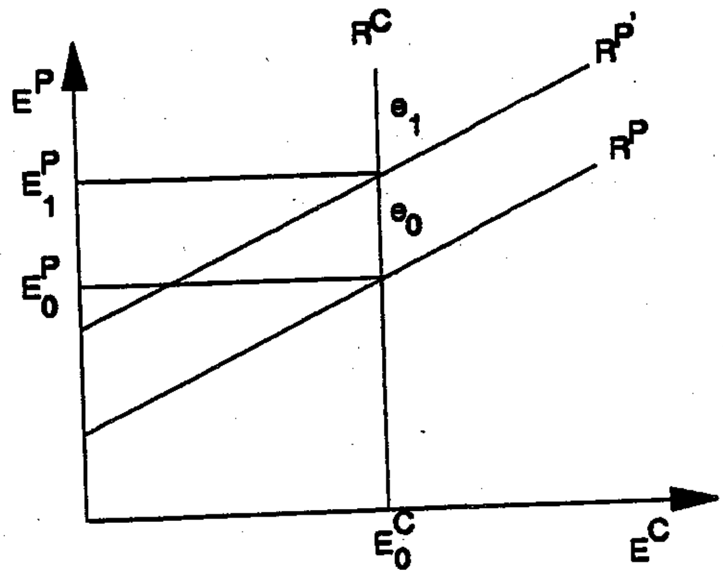

Figure 5 Effects of Improved Efficiency: the Benchmark Case.

Table 1 Alternative Specifications of the Relative Political Weight Function.

Model	Feature
A	θ = f(LABPDR, ASOLAB, ITTOAG, IMFBAE, FDEDI)
B	θ = f(FCENDR, ASOLAB, ITTOAG, IMFBAE, FDEDI)
C	θ = f(LABPDR, ASOGDP, ITTOAG, IMFBAE, FDEDI)
D	θ = f(FCENDR, ASOGDP, ITTOAG, IMFBAE, FDEDI)

θ = the relative political weight of wheat farmers;
LABPDR = the labour productivity ratio;
FCENDR = the factor endowment ratio;
ASOLAB = agriculture's share in employment;
ASOGDP = agriculture's share of GDP;
ITTOAG = agriculture's international terms of trade;
IMFBAE = imports financed by agricultural exports; and
FDEDI = the share of food in disposable income.

Table 2 Maximum Likelihood Estimates of Relative Political Weight Function: Developed Countries

Reg.	Untransformed Explanatory Variables							Explanatory Variables Transformed by λ							
Equn	Const.	EEC	JAN	NAL	SD1	SD2	SD3	LABPDR	FCENDR	ASOLAB	ASOGDP	ITTOAG	IMFBAE	FDEDI	$\bar{R}^2$
1	1.863**	-0.006	-0.03	0.04**	-	-	-	-0.138**	-	0.003	-	-0.200**	-0.009	-0.071	0.73
	(9.58)	(-0.81)	(-0.81)	(3.98)				(-3.471)		(0.223)		(-2.436)	(-0.659)	(-0.846)	
2	1.126**	-0.001	-0.05**	0.04**	-	-	-	-	-0.028**	0.005	-	-0.227*	-0.007	0.178	0.73
	(7.74)	(-0.26)	(-2.93)	(6.80)					(-3.702)	(0.520)		(-2.338)	(-0.685)	(2.048)	
3	2.016**	-0.01	-0.04	0.05**	-	-	-	-0.153**	-	-	-0.003	-0.182*	-0.004	-0.080	0.73
	(10.03)	(-1.04)	(-1.77)	(7.25)				(-4.143)			(-0.211)	(-2.340)	(-0.203)	(-1.038)	
4	1.067**	-0.001	-0.05**	0.03**	-	-	-	-	-0.029**	-	-0.0004	-0.225*	-0.004	0.212**	0.72
	(7.65)	(-0.17)	(-3.21)	(6.90)					(-4.206)		(-0.375)	(-2.259)	(-0.347)	(2.657)	
5	3.539**	-0.3**	-0.11	0.10**	0.01*	-	0.003	-0.232**	-	-0.045	-	-0.122*	0.021	-0.114*	0.75
	(12.10)	(-2.54)	(-1.91)	(2.37)	(2.23)		(1.92)	(-4.698)		(-1.174)		(-2.269)	(1.046)	(-2.345)	
6	1.237**	-0.02	-0.06**	0.04**	-	0.002	0.001	-	-0.033**	0.006	-	-0.236**	-0.004	0.120	0.72
	(7.53)	(-1.08)	(-3.03)	(6.27)		(0.97)	(0.82)		(-3.779)	(0.617)		(-2.428)	(-0.392)	(1.207)	
7	3.27**	-0.3**	-0.09	0.10**	0.01**	-	0.01*	-0.223**	-	-	-0.056	-0.125*	0.028	-0.117*	0.75
	(12.28)	(-2.62)	(-1.64)	(2.77)	(2.42)		(2.01)	(-5.462)			(-1.403)	(-2.249)	(1.248)	(-2.266)	
8	1.166**	-0.02	-0.06**	0.04**	-	0.001	0.001	-	-0.035**	-	-0.002	-0.228*	0.0003	0.156	0.72
	(7.46)	(-1.06)	(-3.19)	(6.34)		(0.86)	(0.89)		(-4.083)		(-0.173)	(-2.306)	(0.021)	(1.657)	

Where SD1, SD2 and SD7 are EEC slope dummies with respect to LABPDR, FCENDR and FDEDI respectively. The figures in the parentheses are asymptotic t-values. * and ** indicate statistical significance at 5 and 1 percent levels respectively.

Table 3 Estimation Results in Light of Theoretical Conjectures: Developed Countries.

	Explanatory Variables						
EQUN. #	LABPDR	FCENDR	ASOLAB	ASOGDP	ITTOAG	IMFBAE	FDEDI
1	A	-	I_R	-	A	I_R	I_A
2	-	A	I_R	-	A	I_R	I_R
3	A	-	-	I_A	A	I_R	I_A
4	-	A	-	I_A	A	I_R	R
5	A	-	I_A	-	A	I_A	A
6	-	A	I_R	-	A	I_R	I_R
7	A	-	-	I_A	A	I_A	A
8	-	A	-	I_A	A	I_R	I_R

Where, A = Accepted, R = Rejected, I_A *= Insignificant with an expected sign, and* I_R *= Insignificant with an unexpected sign.*

Table 4 Maximum Likelihood Estimates of Relative Political Weight Function: Developing Countries (Black Market Exchange Rates)

	Untransformed Explanatory Variables				Explanatory Variables Transformed by λ						
Equations	Const.	ARG	ASN	EGD	LABPDR	FCENDR	ASOLAB	ASOGDP	ITTOAG	IMFBAE	$\bar{R}^2$
1	7.134** (8.66)	-5.139** (-4.31)	-2.351** (-3.03)	-4.223** (-5.32)	-0.001* (-2.07)	-	-0.001 (-0.24)	-	-0.003 (-0.53)	0.0005* (2.63)	0.52
2	7.356** (9.11)	-5.366** (-4.65)	-2.805** (-3.69)	-4.794** (-6.04)	-	-0.0003** (-3.21)	-0.0001 (-0.03)	-	-0.003 (-0.66)	0.0007** (3.51)	0.56
3	7.070** (8.93)	-5.190** (-4.33)	-2.234** (-2.43)	-4.211** (-5.31)	-0.001* (-2.08)	-	-	-0.003 (-0.33)	-0.002 (-0.48)	0.0006** (2.47)	0.52
4	7.355** (9.46)	-5.275** (-4.51)	-2.923** (-3.23)	-4.815** (-6.06)	-	-0.0003** (-3.21)	-	0.001 (0.15)	-0.003 (-0.68)	0.0007** (3.20)	0.56

The figures in the parenthesis are asymptotic t-values.
* and ** indicate statistical significance at 5 and 1 percent levels respectively.

Table 5 Estimation Results in Light of Theoretical Conjectures: Developing Countries (Black Market Exchange Rate).

	Explanatory Variables					
EQUN. #	LABPDR	FCENDR	ASOLAB	ASOGDP	ITTOAG	IMFBAE
1	A	-	I_A	-	I_A	A
2	-	A	I_A	-	I_A	A
3	A	-	-	I_A	I_A	A
4	-	A	-	I_R	I_A	A

Where, A = Accepted, R = Rejected, I_A = Insignificant with an expected sign, and I_R = Insignificant with an unexpected sign.

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APPENDIX A: SOURCES OF PRICE DATA AND SUPPLY ELASTICITIES

The estimation of the relative political weights for wheat producers requires data on producer prices, border prices and the supply elasticity of wheat in each country. The following sections provide a detailed description of this data along with their sources.

Producer prices of wheat are measured as the average price received by farmers (US $/mt), including government direct subsidies such as deficiency payments (United States) or incentive payments (as in Japan since 1975), but excluding indirect taxes such as the value-added tax. The producer price of wheat in the United States is measured as the average market price plus price support payment (in 1963), domestic certificate payments (from 1964 to 1973 and in 1977), export certificate payments (in 1964 and 1965), and deficiency payments (in 1978 and 1981-87). Data on the average market price and various support payments are taken from Cochrane and Ryan (1981) and from the USDA, *Wheat: Background for 1990 Farm Legislation*. The producer price of wheat in Canada is calculated as the realized pool price of No. 1 Canadian Western Red Spring wheat less the cost of transportation (crow rate) and handling, plus Western Grain Stabilization Act payments (in 1977-78 and 1983-87), plus Special Canada Grain Programme payments (1986 and 1987). Data on the realized pool price are taken from the Canadian Wheat Board, *Annual Reports*. Data on the costs of transportation and handling are from Agriculture Canada while the data on WGSA and SCGP payments are taken from Agriculture Canada, *Western Grain Stabilization: Annual Report 1987-88*. The producer price of wheat in Australia is calculated as the weighted average of export and domestic wheat prices with the proportion of wheat sold in the domestic and export markets as the weights.[12] Data on

[12] *A direct income support payment of A$ 13.47 per metric ton is added to this price in 1986.*

domestic and export prices are taken from the Bureau of Agricultural and Resource Economics, *Quarterly Review of the Rural Economy* and *Agriculture and Resources Quarterly* and also from Australian Wheat Board, *Annual Reports*. Data on the domestic use and exports of wheat are taken from the USDA, *Wheat: Situation and Outlook Yearbook, 1990*. For European countries the producer price of wheat is measured as the weighted average price of wheat received by farmers for all types and all sales. The producer price of wheat for the European countries are primarily from the USDA, *Agricultural Statistics of the European Community, 1960-85*, supplemented by data from the OECD, *Agricultural Statistics 1955-1968* and the Food and Agriculture Organization, *Prices of Agricultural Products and Selected Inputs in Europe and North America*, and EUROSTAT, *Agricultural Price Statistics*. The producer price of wheat in Japan is calculated as the government purchase price of wheat which includes direct production subsidies since 1975. Data for Japan are primarily from the *Statistical Yearbook of Japan*, supplemented by data from the Bureau of Agricultural and Resource Economics, *Japanese Agricultural Policies*. The producer prices of wheat reported in local currencies were converted to US dollars using the average exchange rates for each year published by the International Monetary Fund, *International Financial Statistics Yearbook*.

The producer prices of wheat for the group of developing countries are mainly from the FAO, *Statistics on Prices Received by Farmers* and the data bank of the Statistics division, supplemented by data from the FAO, *Production Yearbook*, the International Wheat Council, *World Wheat Statistics*, Calegar and Schuh (1988), Scobie (1983) and the USDA, *Estimates of Producer and Consumer Subsidy Equivalents*. The producer price of wheat reported in domestic currency was converted to US dollars, first by using the average official exchange rates for each year published by the IMF, *International Financial Statistics Yearbook*. Since most of the countries in this group are known for their foreign exchange control regimes with consequent over-valuation of exchange rates (World Bank, 1986; Cowitt, 1986), the prices in local currencies were also converted to US dollars using the average black market exchange rates for each year published in *Pick's Currency Yearbook* and the *World Currency Yearbook*. Note however, black market exchange rates are only available since 1961.

Border prices of wheat are measured by fob unit export values (US $/mt) for the United States and Argentina, and by the cif unit import values (US $/mt) for the importing countries (Japan, the European countries except France and Sweden and the twelve developing countries).[13] The border price of wheat in Canada is measured as the pool price for No. 1 Canada Western Red Spring wheat, in store Thunder Bay or Vancouver, less the costs of transportation and handling, less the WGTA freight rate subsidy (1971-1987). Data on the pool price are from Canadian Wheat Board, Annual Reports and the data on WGTA subsidy are from Agriculture Canada, *Orientation of Canadian Agriculture, vol. II.*, Harvey (1981) and the USDA, *Estimates of Producer and Consumer Subsidy Equivalents*. The border price of wheat in Australia is measured as gross realisations from export sales by pool, on Australian Standard Wheat basis, and are collected from Australian Wheat Board, Annual Reports, and the Bureau of Agricultural and Resource Economics, *Agriculture and Resources Quarterly*. The border price of wheat for France is the export price for EC standard wheat, fob Rouen, for sales to third countries, and are taken from the International Wheat Council, *World Wheat Statistics*. The border price of wheat in Sweden is the export price of milling wheat, and are taken from the International Wheat Council, *World Wheat Statistics*. For all other European countries, the border price of wheat is

[13] *When only a small volume is traded, proxy border prices are used. This exception includes India and Mexico in 1984 and 1985, when regional average import prices have been used as proxies.*

measured as the cif import price of U. S. No. 2 Soft Red Winter Wheat, at Rotterdam. Data on cif: Rotterdam price are primarily from the International Wheat Council, *World Wheat Statistics*, supplemented by the IWC, *Report for the Crop Year 1987/88*. All other border price data are obtained from the FAO, *Trade Yearbook*.

Finally, the estimates of supply elasticities are taken from the USDA, *Economic Implications of Agricultural Policy Reforms in Industrial Market Economies*. These elasticities have been used in the Static World Policy Simulation Model (SWOPSIM) of USDA in 1986/87.

APPENDIX B: EXPLANATORY VARIABLES USED IN THE ANALYSIS

The variables used in the empirical analysis to explain the variations in the relative political weights of wheat farmers are: (i) indexes of comparative advantage in agriculture; (ii) shares of agriculture in the total economy; (iii) agriculture's international terms of trade; (iv) the share of imports financed by agricultural exports, and (v) the share of food in disposable income. A brief empirical specification of these variables is presented below. It also describes the data used to construct these variables along with their sources.

Comparative Advantage in Agriculture:

Two alternative indices of agricultural comparative advantage used in this study are: (i) a labour productivity ratio; and (ii) a factor endowment ratio. The labour productivity ratio is defined as the ratio of labour productivity in agriculture to labour productivity in the total economy, both measured in real terms. The factor endowment ratio is defined as the ratio of agricultural land per farm worker to average capital endowment per worker in the total economy.

Labour productivity in agriculture in real terms is measured as total agricultural output (net of seeds and feed), in terms of wheat units per active people in agriculture. Following Hayami and Ruttan (1985), total agricultural output in terms of wheat units are estimated for each country, from the index of agricultural output published by the FAO, *Production Yearbook*. For the group of developed countries, data on total population, total labour force and total active people in agriculture are obtained from the OECD, *Labour Force Statistics* and *Historical Statistics*, supplemented by data from the International Labour Organization, *Yearbook of Labour Statistics* and *Labour Force Estimates and Projections 1950 to 2000, vol. IV*. For the group of developing countries, data on total population, total labour force and total active people in agriculture are obtained from the IMF, *International Financial Statistics* and the FAO, *Production Yearbook*. These data were supplemented by data from the ILO, *Yearbook of Labour Statistics* and *Labour Force Estimates and Projections 1950 to 2000, vols. I, II and III*.

Labour productivity in the total economy is measured as the average GDP at 1975 constant prices per active people in the economy. For the group of developed countries, the data on GDP at 1975 constant prices is converted to US dollars by purchasing power parities obtained from the OECD, *National Accounts, vol. I*. Since purchasing power parities for Australia, Canada, Sweden and Switzerland before 1967 are not available from the OECD, the GDP data for these countries for 1960 and 1965 are taken from Anderson et al., (1986). For the group of developing countries, the data on GDP in local currencies are taken from the IMF, *International Financial Statistics Yearbook*, supplemented by data from the United Nations, *Statistical Yearbook for Latin America* and *Statistical Bulletin for Latin America*, and the Government of Pakistan, *Pakistan*

Economic Survey and *Statistical Yearbook of Pakistan.*[14] These GDP figures are converted to US dollars by using official exchange rates published by the IMF, *International Financial Statistics yearbook*, and also by using black market exchange rates published in the *Pick's Currency Yearbook* and the *World Currency Yearbook*. The GDP figures thus obtained are then expressed at 1975 constant prices using the United States GNP deflator reported in the IMF, *International Financial Statistics yearbook*. Finally, the labour productivity ratio obtained for each country is expressed as an index with the value of US in 1975 as the base.

Agricultural land per farm worker is measured by the sum of arable land and land under permanent crops, meadows and pastures per active people in agriculture. Data on agricultural land per farm worker are taken from the FAO, *Production Yearbook*. The real GDP data used to calculate the labour productivity ratio in the total economy, are also used to calculate real GDP per capita, with total population data taken from the sources mentioned above. The factor endowment ratio thus obtained is expressed as an index with the US value in 1975 as the base.

Agriculture's Share of the Total Economy:

Two alternative measures of agriculture's share of the total economy are used in this study: (i) agriculture's share of employment defined as the ratio of total active people in agriculture to total labour force in the economy, and (ii) agriculture's share of GDP defined as the ratio of agricultural output to total GDP at 1975 constant prices. For the group of developed countries, data on agriculture's share of employment and GDP are mainly obtained from the OECD, *National Accounts: Detailed Tables, vol. II.*, *Historical Statistics* and *Labour Force*

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[14] *Before 1971 Bangladesh was the Eastern province of Pakistan. So, the GDP figures of Bangladesh from 1957 to 1971 are those of East Pakistan separated from the total GDP figures of Pakistan.*

Statistics, supplemented by data from the ILO, *Labour Force Estimates and Projections 1950 to 2000, vol. IV*, and the Bureau of Agricultural and Resource Economics, *Quarterly Review of the Rural Economy*. For the group of Latin American countries (i.e., Argentina, Brazil, Chile, Colombia, Mexico and Peru) except Paraguay, data on these two variables are taken from Elias (1985), supplemented by data from the FAO, *Production Yearbook*. Data for Paraguay are mainly from the United Nations, *Statistical Yearbook for Latin America*, supplemented by data from the FAO, *Production Yearbook*. For other developing countries in the sample, data on agriculture's share of employment and GDP are obtained from the FAO, *the State of Food and Agriculture* and *Production Yearbook*, supplemented by data from Ikram (1980), *Statistical Yearbook of Pakistan*, *Statistical Yearbook of Bangladesh* and the ILO, *Labour Force Estimates and Projections 1950 to 2000, vols. I and III.*

Agriculture's International Terms of Trade:

Agriculture's international terms of trade is defined as the ratio of the world unit export value index for agricultural products to the world unit export value index for manufactured goods. For the group of developed countries, data on the unit export value index for agricultural products are taken from the FAO, *Trade Yearbook* and *the State of Food and Agriculture*. Data on the unit export value index for manufactured goods are from the United Nations, *Statistical Yearbook*, supplemented by data from the UN, *International Trade Statistics Yearbook*. These data are available for individual developed countries in the sample, with the exception of Australia and Denmark. For Australia and Denmark, average figures for developed market economies have been used. For the group of developing countries, data on world export unit values for agricultural products are not available for each country; instead, regional unit export value indexes have been used for countries in respective regions. These data are also taken from the FAO, *Trade Yearbook* and *the State of Food and Agriculture*. Data on the world unit export value index for manufactured goods for developing market economies from 1970 to 1987 are obtained from the United Nations, *International Trade Statistics Yearbook*. The data for the period prior to 1970 has been extrapolated from those of developed market economies. The ratio thus obtained is expressed as an index with the US value in 1975 set at 100.

Share of Imports Financed by Agricultural Exports:

This variable represents agriculture as the financier of imports, and is defined as the ratio of total agricultural exports (fob) to total merchandise imports (cif). The data on both of these variables for each country in the sample are obtained from the FAO, *Trade Yearbook*. Finally, this ratio is converted to an index with the US value in 1975 set at 100.

Share of Food in Disposable Income:

This variable is defined as the ratio of total expenditures on food (both at home and away from home) to total disposable income. Data on these variables for the United States are taken from the USDA, *Food: Consumption, Prices and Expenditures*, and *Food: Consumption, Prices and Expenditures, 1966-87*. Data for Canada are from Agriculture Canada, *Handbook of Food Expenditures, Prices and Consumption*. Data for Japan are from Japan Bureau of Statistics, *Japan Statistical Yearbook*. Data for all other developed countries in the sample are from the OECD, *National Accounts: Detailed Tables, vol. II*. The ratio of food expenditures to disposable income thus obtained is converted to an index with the US value in 1975 set at 100. Because of data unavailability, this variable is only used in the model estimation for developed countries.