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Endogenizing Policy in Models of Agricultural Markets†

INTRODUCTION

Three major sets of forces dictating the dynamic path of agricultural markets can be characterized as (i) the internal system of commodity demand and supply; (ii) the linkages with other sectors, the macro and international economies; and (iii) the linkages with governmental policy intervention. Linkages can be forward (influences flowing from these sets of forces to agricultural markets) or backward (influences flowing from agricultural markets) or both. If only forward linkages matter with respect to (ii) and (iii), then conventional modelling approaches will suffice for most purposes. Conventional modelling focuses on internal supply and demand conditioned by governmental policy instruments, economic growth, interest rates, exchange rates, and so on. However, if backward linkages exist, then such frameworks are no longer sufficient. The ubiquitous nature of governmental intervention in agriculture, and the dominant role it plays in market dynamics, argue for a serious examination of the linkages, both forward and backward between economic markets and the formation of public policy.

The view expressed in this paper is that political and economic markets are both forward and backward linked. The nature of this bicausal integration contradicts conventional treatments of agricultural markets and governmental policy; it is not possible to use conventional econometric models for output and price forecasting. Differences between various short-term economic forecasts often depend less on the internal functioning of the private sector than on different assumptions of future policies. Even for the short run, forecasting, conditional on particular settings of policy instruments, is not possible if these policy instruments, in turn, depend upon the performance of economic markets.

When using models for decision or prescriptive purposes to evaluate alternative solutions to presumed market failure, one must also recognize the imperfection of policy implementation. Empirical evidence exists on both market and government failures. Policy serving the public interest must minimize the adverse effects of both types of failure. This perspective is especially important in evaluating policy reform. Given the bicausal relationship between political and economic markets, models making transparent the effects of current distortionary

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policies are not sufficient for reform. In particular, it has been shown elsewhere (Rausser and Irwin, 1987) that quantification of the feedback linkages between markets and policy formation can facilitate reform through the design of partial compensation schemes and new institutional rules.

This paper employs an approach admitting both market and government failure, distinguishing between PERT and PEST policies (Rausser, 1982). PERT policies are those forms of intervention which correct market failures by reducing transaction costs of the private economic system. The net effect of these political economy resource transaction policies is to increase the size of the pie. In contrast, PEST policies reflect political economic-seeking transfers, which lead to government failure. In the formation of these policies, interest groups compete by spending time, energy, and money on the production of pressure to influence both the design and tactical implementation of policies. Most governments employ a portfolio or mixture of PERT and PEST policies. There is a wide scope of possibilities to interchange the use of PESTs and PERTs so as to acquire and maintain political power. Moreover, a government desire to maximize political support in democratic societies means that Becker's efficient redistribution hypothesis must be rejected.

A framework for endogenizing PERT and PEST policies is developed in Rausser. It emphasizes transaction costs in an internally consistent formulation; admits a number of alternative paradigms (including the theory of state, the theory of economic regulation, the efficient government redistribution hypothesis, and the theory of interest group rent seeking and conflict resolution); and allows for the possibility of degrees of government autonomy. This paper simplifies the earlier formulation by focusing on a tractable partial equilibrium analysis. Once empirical evidence has been accumulated on the formulation advanced here, a natural generalization will be to move toward a general equilibrium framework with multiple sector and macroeconomic policies.

CONCEPTUAL FRAMEWORK

The framework developed here has three major dimensions: the level of PEST intervention, the level of PERT intervention, and the choice of the policy instrument mix. PEST policies are formally defined as those interventions that decrease social welfare and transfer income; PERT policies increase social welfare, also having some income distribution effects. The selection of the type of PEST and PERT policies is a discrete choice problem. Each selection from the set of discrete alternatives has a mixture of efficiency and equity consequences.

A number of stylized facts regarding intervention in agricultural markets have emerged. In the case of PESTs, the transfer of income to agriculture is greater the richer (or more industrialized) the country; the higher the cost of production; the fewer the number of farmers, absolutely and relative to the total population; the more price inelastic the supply or demand function; the lower the proportion of total consumer budgets spent on food; and the 'smaller' the exporting country or the 'larger' the importing country. The striking feature of PERT policies has been the overwhelming evidence of underinvestment in public goods that impinge directly upon the agricultural sector.

Highly distortionary, commodity-specific policies are widely used to achieve income transfers in developed countries. Economists generally are critical of these policies and recommend their replacement by 'decoupled' transfers or by what are historically referred to as 'lump sum', distortion-free income transfers. The possibility of this change, along with the stylized facts noted above, should be formally incorporated into any framework endogenizing government behaviour.

Consider a democratic government in which politicians or political parties compete for support, defined as votes, popularity ratings in polls, or the like. In order to achieve and maintain power in a pluralist democracy, politicians seek to maximize popular support. This is accomplished by choosing the level of PEST and PERT expenditure policies (represented by the vector; $G = [G_S\ G_R]$), the levels of PEST and PERT regulatory policies (represented by the vector $P = [P_S\ P_R]$), and the mix of instruments represented by m. The regulatory policies are subsumed in the price equivalent variable, P, which may differ from the price path generated in the absence of regulatory intervention. Note that G and P can be jointly determined, for example, deficiency payments in the United States change the dynamic price path and place a burden on taxpayers via G_S.

For simplicity, initially assume two interest groups,[1] composed of n_f producers and n_c consumers/taxpayers. The groups' economic well-being is described by specific performance measures. The government has M policy instrument mixes from which to make a discrete choice, that is, m = 1, . . ., M. Each policy mix results in a different level of support and group welfare. Policy instrument mixes, which include regulatory and expenditure policies, result in alternative levels of efficiency, or social deadweight loss.

The probability of an individual member from an interest group supporting the government is given by S_f and S_c. As in the formulations advanced by Olson (1965) and Becker (1983), each group engages in lobbying or pressure activities, denoted by L_f and L_c for the agriculture and consuming sectors. Accordingly, the government is presumed to select P, G, and m so as to maximize its utility:

$$\underset{P,G,m}{\text{Max}}\ U = U(S; s) \tag{1}$$

where S is a measure of total political support and s is a vector of socio-political characteristics of the government in power. Total support, in turn, is given by:

$$S = S(n_f \bullet S_f,\ n_c \bullet S_c) \tag{2}$$

where support from group members is generated by

$$S_f = S_f\{F[(P|m), w, G], L_f, L_c\}, \tag{3}$$

and

$$S_c = S_c\{C[(P|m), Y, G], L_f, L_c\}. \tag{4}$$

The function $F(\bullet)$ represents the agricultural sector's performance measure, $C(\bullet)$ represents the consumers' performance or welfare measures, and L_f and L_c are the political pressures exerted by each group. Under risk neutrality, $F(\bullet)$ could be the profit function of an individual farmer:

$$F = \pi[P|m, w, G] - (1 - \lambda)G/n_f - e_f \tag{5}$$

with w representing a vector of input costs, $(1 - \lambda)$ is the cost share vector borne by the agricultural sector for any 'expenditure' PEST or PERT policies contained in vector G, and e_f is the expenditure per caput on organizing and maintaining lobbying efforts by producers. $C(\bullet)$ can be represented by the indirect utility function:

$$C = V_1[P|m, G] + V_2[I - \lambda G/n_c - e_c], \tag{6}$$

where I is income per caput, λ is the cost share vector borne by taxpayers of any PEST or PERT expenditure policies, and e_c is the consumer counterpart to e_f. The usual properties of the functions U, S_f, and S_c are assumed, yielding choices fulfilling well-known axioms of consistent decision making. Moreover, a noncooperative equilibrium between the government and the interest groups is assumed, where each of the three groups takes the reactions of others as given (a Nash equilibrium).

Lobbying corresponds to rent-seeking activities, taking the form of organizing support, mitigating opposition, and pressuring politicians. Part of the resources in L are allocated directly to politicians; part to campaigns, advertising, and the like; and part to organization and the control of free riding. As a result, individual members' support in equations (3) and (4) are functions of aggregate lobbying pressure, L. Individual functions can be represented by:

$$L_f = L_f(e_f \bullet n_f, n_f, x_f, m), \tag{7}$$

and

$$L_c = L_c(e_c \bullet n_c, n_c, x_c, m) \tag{8}$$

where the vectors x_f and x_c represent factors affecting the ability of groups to pressure each other and politicians. In the literature, factors that have been isolated include group heterogeneity, firm/household size, geographic dispersion, and communication costs.[2] Organization and enforcement costs are presumed to rise with a number of members in a particular group; that is, dL_f/dn_f, $dL_c/dn_c < 0$ (Becker, 1983).

Equations (1) to (8) can be examined from a number of perspectives. Endogenous government behaviour can be investigated in *structural* form by equations (1) through (8); in *constraint structure* form (typically represented by the performance measure transformation frontier) by equations (5) and (6); in *instrument behavioural equations* form (often defined as the *policy reaction functions*) by the derived decision rules for P and G for a given m; and in *reduced form* of equations (1) to (8), which specify a *governing criterion function* of the group performance measures and a politician's performance measure, conditional upon lobbying efforts.

The relationship between the political objective function and interest group performance measures may be found in Rausser *et al.* (1982), Peltzman (1976), and Brock and Magee (1978), among others. The response of voters through popularity and election studies are used to analyse support functions. Popularity ratings measure the electorates' attitudes (Hibbs, 1987, and Frey and Schneider, 1978). Election functions measure the responses to the current policy through voting (Kramer, 1971, Arcelus and Meltzer, 1975, Tufte, 1975, Stigler, 1973 and Bloom and Price, 1975). The role of ideology, party, and personality in the political utility function has been investigated by Kalt and Zupan (1984) and Peltzman (1984). Legislative procedures, agenda setting, and the role of geography along with the distribution of costs and benefits have been examined by Weingast *et al.* (1981), Wilson (1980), Downs (1957), Kau and Rubin (1979), and Kau *et al.* (1982) Legislative voting behaviour of US Congress on dairy price supports has been investigated by de Gorter (1983) and on successive Farm Bills by Lee and Tkachyke (1987).

The influences of lobbying and relative group pressure have been studied by numerous authors, principally Olson and Becker. Olson emphasizes factors affecting the ability of interest groups to organize and control free riding. In his framework, group size, geographic dispersion and the asymmetry of economic gains and losses across members (along with sanctions and selective incentives) explain pressure and hence the selection of policy. Becker has extended Olson's framework by analysing factors that affect the relative influence of groups: comparative lobbying efficiency, deadweight loss of redistribution, and group size. Voters and politicians in his framework are assumed to be passive. Lobbying activities have also been studied extensively in the United States by Jacobson (1980) and Adamany (1977).

In US agriculture policy, Gardner (1987) has analysed the Becker framework extensively while lobbying has been investigated by de Gorter. Empirical frameworks advanced include those of Chappel (1982) and Rausser *et al.* Studies have also focused on the reaction functions (Lindbeck, 1976; Rausser and Stonehouse, 1978 and Reed and Ladd, 1983). The reduced form, or governing criterion function, specification has been used with revealed preference methodology to infer trade-off weights among performance measures (Rausser and Freebairn, 1974; Zusman, 1976; Sarris and Freebairn, 1983; Paarlberg and Abbott, 1986 and Beghin and Karp, 1988). For all of these perspectives, the decision rules for the choice variables (P, G, and m) are critical. The following discussion gives a sketch of the determination for these choice variables.

Determination of PESTs (P_S, G_S)

To determine the optimal level of direct income transfer subsumed in P_S, for a given level of regulatory PERT policy, expenditure PERT policy G_R, lobbying pressure L, and policy instrument type m, the necessary conditions for a maximum of political utility is

$$\frac{U_{S_f}}{U_{S_c}}\;\frac{n_f}{n_c}\;\frac{S_{f\Pi}}{S_{cv}} = \frac{-(V_{1P_s} + V_{2Y} Y_G\, G_{p_s}/n_c)}{\Pi_{p_s} - (1-\lambda_s)\, G_{p_s}/n_f}\,, \tag{9}$$

where Y is the after-tax and lobbying expenditure per caput income. The left-hand side of (9) represents the marginal rate of political substitution between the two performance measures (profits and indirect utility). It is the ratio of marginal contributions of welfare change on each group's political support weighted by the marginal evaluation of political utility of changes in support. This value is reflected in the shape and position of the political indifference curve.

The shape and position of the transformation frontier for a given policy instrument mix are represented by the right-hand side of expression (9). This is the ratio of the marginal contribution of a change in P_s to the performance measures F and C. Equilibrium is insured by convexity of the political indifference curve (political support increases as a function of each group's economic welfare at a decreasing rate) and concavity of the transformation function over the relevant range (that is, PEST-imposed deadweight losses increase at an increasing rate with the distance from the competitive equilibrium in the absence of market failure).

The decision rule for P_s depends on four major groups of influences:

1. *Interest group size.* The greater the relative membership of a group, the greater is the potential political support it has to offer. Although organizing and other costs may grow, the larger the group, the greater the influence in obtaining favourable outcomes through either voting or popularity polls.
2. *Government's preference structure.* The preference across the interest groups, summarized in U_{sf}/U_{sc}, reflects the sociopolitical characteristics of the politicians (seniority, ideology, party affiliation, and so on) and the structure of the political process (bureaucracy's role, legislature versus executive agenda-setting rules, and so on).
3. *Economic well-being and political support.* The relationship between the economic performance for each interest group and its corresponding political support is affected by geographical representation and the distribution of the burden and the benefits of alternative policy settings. A rural bias often develops with pluralism because the distribution (that is, geographic concentration or diffuseness) of cost and benefits corresponds to the distribution of influence (Ferejohn and Rundquist, 1975 and Weingast *et al.*,1981). Geographical representation in some nondemocratic, developing societies results in an urban bias. Lipton (1977) argues that the urban population is often strategically located to affect political support for authoritative regimes. In many instances, a wide dispersion of the cost burden and the concentration of benefits results in greater political response from the group to which PEST transfers are made. This group receives greater benefits per caput and hence has more incentive to exercise influence and to be well informed on the effects of alternative policy settings (Downs, 1957).

4. *Transformation frontier among performance measures.* The economic characteristics of supply and demand for the commodity or sector under examination is reflected in the transformation frontier. For example, in the context of raising producer prices, a higher Π_{p_s} (that is, a more inelastic supply function) will result in a higher level of P_s. A lower food share in consumer's aggregate expenditure results in a lower V_{p_s} and, hence, a higher P_s. Higher consumer incomes lead to higher prices, the extent depending on the shape of the consumer utility function, the marginal utility of income, and the sensitivity of budget cost (reflected by G_{Ps}). Similarly, input cost increases affect positively the setting on PEST regulatory policies, the degree depending on the input substitution possibilities and the share of fixed costs.

The right-hand side of expression (9) also reflects the marginal deadweight loss of redistribution. In term of a particular commodity market (where consumers bear the entire expenditure cost burden, $\lambda = 1$), if $n_f\pi_{Ps} = 1$ and $Y_G G_{Ps} = -1$, then the deadweight loss is zero and a lump-sum, or decoupled income transfer, scheme is in place. The marginal excess burden (deadweight loss) of taxation is given by the term Y_G and depends on the *method* of taxation. From (9), the higher the deadweight loss for consumers/taxpayers (producers), the lower (higher) the level of intervention P_s.

Several factors affecting redistribution's deadweight loss can be identified. A more elastic demand or supply results in a larger deadweight loss per unit of income transferred. Hence, a testable hypothesis is that products with inelastic demands, such as wheat and fluid milk, obtain more intervention than more elastic products, such as beef or speciality crops. Furthermore, the domestic loss of transfer is higher for an exporter than for an importer. This differential is magnified if a country is 'large' on world markets because exporters subsidizing production will reduce world prices, thereby exacerbating transfer costs. Large importers, on the other hand, may even improve their terms of trade. Hence, being an importer can facilitate the 'efficiency' of redistribution. One expects, therefore, that levels of intervention will vary according to import *versus* export status of a commodity and according to whether the country is large or small in markets for a particular commodity. Note that the level of deadweight loss is affected by the policy instrument m. In fact, each of the terms on the right-hand side of (9) is conditional on the choice of instrument.

The Determination of PERTs (P_R, G_R)

A PERT policy shifts the opportunity set outward by reducing transactions costs and correcting for market failures. The new equilibrium's position depends on the source of the market failure, the characteristics of supply and demand, and the level and type of instruments used. Over some range of its provision, however, the welfare of both interest groups improve. Nonetheless, under some conditions, one group may lose as a result of P_R and/or G_R. One hypothesis regarding R&D underinvestment in agriculture is the following: an inelastic demand with $\lambda_R = 1$ (that is, taxpayers financing G_R) results in a producer welfare loss compared to no intervention. Given that the political weight for the agriculture sector is greater than that for the consumer/taxpayers, public policy provides less R&D than is socially optimal. Nevertheless, the provision of some R&D still may harm farmers and benefit consumers/taxpayers. The latter group gains less than they would have obtained in the absence of political opposition and less than would be best for society. When PESTs are introduced which benefit producers, however, they are more willing to allow more public investment in R&D. In essence, this mixture of PERTs and PESTs puts consumers in the position of compromising on the level of R&D (underinvesting) and bribing farmers through compensation schemes such as price supports so that the degree of underinvestment in R&D will be lessened.

Another example of such compensation is found with pesticide regulations that increase the cost of production. Government compensates with price-support payments. It chooses the level of pesticide regulation such that the marginal political benefit from consumers/taxpayers *plus* the marginal benefit from the agricultural sector in increasing price supports *equals* the marginal political cost from agriculture of regulation *plus* the marginal cost from the consumer/taxpayers in increasing price supports.

There are many possibilities for politically optimal mixtures of PEST and PERT policies. Unequal political weightings between interest groups plus the substitutability of policy types may well explain both the existence of PESTs and the underinvestment in PERTs.

The determination of policy instrument mix (m)

Governments face a joint discrete choice on the policy instrument mix (m). The formulation advanced here allows for political support to be conditional on the type of instrument employed. Define

$$\frac{dS_f}{dF} = \beta_{1m} \text{ and } \frac{dS_c}{dC} = \beta_{2m}$$

for m = 1, . . ., M instrument mixes. The common case in industrial countries is where $\beta_{1m} > \beta_{2m}$; hence, it follows that transfers are made to producers.

For example, consider a binary choice, m = 1, 2, where

$$\beta_{11} > \beta_{12}, \text{ and } \beta_{21} \lesseqgtr \beta_{22}.$$

The transformation of economic welfare into political support varies across policy instrument types as does the deadweight loss per unit of income transferred from one sector to another. Government will choose the instrument mix, m, that corresponds to the optimal trade-off in political support; that is, the trade-off between the loss in support due to the production inefficiency of the instrument and the gain in support due to the political efficiency of the instrument.

The β's may vary across instrument types because of voter ignorance or the concealment of policy effects. Politicians do not necessarily choose the efficient policy instrument just as they do not necessarily choose the social optimum level of P_R. This formulation on instrument choice does not assume a dichotomy between 'means' and 'ends'. The transfer of income is often viewed as an objective or end. Here, however, it is the means to the ultimate objective, namely, maximizing the probability of re-election. Therefore, choosing the optimal setting on a PEST policy is not a separable process from choosing the instrument mix.

Characteristics of differing instruments include their visibility, their effect on marginal versus inframarginal voters, imperfect information (for both voters and politicians) regarding the distribution of social costs and differential information (between competing interest groups and/or the government). Many economically inefficient instruments sustain political power. An example of such a strategy in agriculture would be the choice of price supports over lump-sum transfers. Producer groups (and government) have emphasized food self-sufficiency, which appeals to the public's nationalistic or patriotic sentiments. Furthermore, direct income transfers would appear to be a 'welfare' payment and so would dramatically decrease political support from producers. Accordingly, farmers and politicians provide selective information on the virtues of commodity policy to reach their objectives co-operatively.

In general, maximization of political support can result in greater deadweight loss for a given level of income transfer. Even if $\beta_{21} > \beta_{22}$ it is not necessarily the case that politicians choose the most efficient instrument (m = 2) on its corresponding transformation frontier, depending on the relative size of β_{11} to β_{12}.

The impact of political pressure L

The political support function is also affected by the level of pressure brought by each group. The level of pressure exerted is affected by the ability of a group to organize and control free-riding (Olson, 1965) as well as the *relative* efficiency of providing pressure (Becker, 1983). Becker's competition among pressure groups and relative influence model is captured by the impact of L_f and L_c in expressions (3) and (4). Pressure influences the outcome of PERT and PEST policies and the choice of instrument, m, independent of the other factors discussed affecting political support. Many authors argue that smaller groups result in more pressure (that is, they may be more effective in L) but also note that groups can lose in effectiveness through voting (or popularity poll) where small numbers are a detriment.

EXTENSIONS AND MODIFICATION

Many countries' agricultural policies maintain distinctly different producer and consumer prices (Byerlee and Sain, 1986). In the foregoing framework, the number of interest groups may be expanded to include taxpayers as a separate group from consumers. Consider the case where the producer price P_1 is greater than the consumer price P_2, both of which are greater than the world price P_w. Incorporating this into the foregoing model generates the following reaction functions:

$$\overset{}{P_1^*} = P_1^*(\overset{(-)}{P_2^*}, \overset{(+)}{Y}, \overset{(+)}{w}, \overset{(+)}{P_w}) \tag{10}$$

$$P_2^* = P_2^*(\overset{(-)}{P_1^*}, \overset{(+)}{Y}, \overset{(+)}{P_w}). \tag{11}$$

where the arithmetic signs above the variables represent their effects on prices. In equation (11) an increase in the producer price P^*_1 increases profits and taxpayer budget costs such that P^*_2 declines to compensate consumers. In this fashion, the marginal conditions for a political equilibrium is maintained in the balancing of producer, consumer and taxpayer economic welfare.

If substitutes in supply and demand are prevalent, then the reaction functions (10) and (11) must be expanded to include substitute-supply prices and substitute-demand prices, respectively. In the case of supply, changes in the substitute price has a positive effect on the government-controlled price because an increase in opportunity cost is similar to an increase in input costs. An increase in the substitute price in demand will harm consumers, and a lower controlled consumer price will compensate.

Assuming a 'small' country, the above analysis is symmetric for an importer and exporter with

$$p_w \gtreqless p_2 \gtreqless p_1.$$

The relaxation of this assumption, where policies affect the terms of trade (that is, P_w is endogenous), will change the level and distributions of welfare benefits. For example, a large importer can manipulate prices such that domestic welfare improves with much, or all, of the budget costs recovered through tariff revenue or quota rents. This facilitates domestic income transfer schemes. On the other hand, an exporter's price policies that affect world price will transfer welfare *to* the rest of the world.[3]

In some countries, transaction costs are quite different for distinct groups (for example, larger farmers, smaller farmers, processors, exporters, high-income consumers, low-income consumers, taxpayers as distinct from consumers, and so on). Much insight can be gained by extending the framework to multiple interest groups. The generalization to N interest groups and any number of external shocks, and including multiple supply and demand substitutes, can be formalized using game theory (Harsanyi, 1963 and Zusman,1976). Using the axiomatic framework advanced by Thomson (1981) and Friedman (1986), a formal model of the bargaining process among interest groups, including an autonomous government, can be shown to lead to the governing criterion function. In essence, the weighted objective function of the revealed preference model is a corollary of the co-operative game solution in which the weights express the bargaining power of alternative interest groups.[4]

CONCLUDING REMARKS

The dynamic path of agricultural markets is often highly distorted by governmental intervention. Internal country distortions, as well as their spillover effects on world markets, are driven by the implementation of PEST policies. These PEST policies are combined with PERT policies, and the resulting mix reflects the 'governing criterion' function and the equilibrium conditions in political economic markets of each country. The selection and implementation of various policy instruments may be represented as rational decision rules which form the basis for endogenous policy determination.

Numerous research hypotheses can be derived from the simple partial framework advanced in this paper. Many perspectives can be taken in analysing endogenous government behaviour, including the structural form, the constraint structure form, the policy reaction function form, and the governing criterion function form. For each of these perspectives, we as a profession have a long road to travel. This road will be full of detours – some contrived, some wasteful, some unanticipated, some insightful. If we fail to travel this path, the opportunities for institutional reform of agricultural policies throughout the world will be dramatically diminished. The current pressures for agricultural reform will prove insufficient unless political economic considerations are squarely addressed. If these considerations are confronted explicitly, the probability of significant reform will be enhanced. Political economic conditions in various countries can be effectively altered through (i) transparency and the reduction of information cost related to current policy; (ii) partial compensation schemes for those who lose from the transition to a new policy and are based on the governing criterion function; and (iii) the introduction of new institutions that will enhance the credibility of government reform actions and facilitate the maintenance of reforms once they have occurred.

NOTES

[1]Benchley's Law of Distinction is relevant in determining the appropriate number of economic interest groups: '*There are two kinds of people in this world; those who believe the world can be divided into two kinds of people and those who don't.*'

[2]Note that L_f and L_c are not functions of the regulatory policies. In particular, optimality requires $(dF/dP)\,(dP/dL_f) = 1$; $(dC/dP)\,(dP/dL_c) = -1$.

[3]Hence, it should be no surprise that the levels of intervention are higher, *ceteris paribus*, in Japan compared to the United States, or that the degree of intervention in the EC has moderated somewhat in the 1980s as they switched from being an importer to being an exporter.

[4]The game theoretic formulation seeks the solution that minimizes the Nash product modified to include some reference point g, that is,

$$\prod_{i=1}^{n} [V_i - g(\cdot)_i]$$

where $V = (V_1, V_2, \ldots, V_n)$ is an element of the payoff set and one argument of $g(\cdot)$ is the conflict point. Following Thomson (1981), the solutions to this problem may be based on reference points where each interest group is presumed to compare the proposed payoff not only to the conflict payoffs but also to other potential payoffs called reference points. Specifically, if the payoff set is compact and convex, the following conditions are necessary and sufficient for defining a solution:

$$H(V^*_1, V^*_2, \ldots, V^*_n, Z) = 0$$

$$a(Z)_i[V^*_i - g(\cdot)_i] = a(Z)_j[V^*_j - g(\cdot)_j], \text{ for all } i, j$$

whereas $a(Z)_i$ is the derivative of H with respect to V_i evaluated at V^*; H is the frontier of the payoff set. The $a(Z)_i$ represent the bargaining power coefficients of the n interest groups. They are normalized such that they sum to one. It can be shown that maximizing the above Nash product is equivalent to maximizing the following weighted sum of performance measures

$$\text{Max}[a(Z)_1\ V_1 + a(Z)_2\ V_2 + \ldots\ a(Z)_n\ V_n]$$

which is nothing more than the governing criterion function.

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DISCUSSION OPENING – GRANT M. SCOBIE

Almost a decade ago I discovered endogenous policy modelling. As a result of some work in this field I even published a paper with that title. However I soon saw that my crude attempts were very inadequate. That sense of inadequacy has been reinforced by the exciting and comprehensive paper we have had from Rausser and de Gorter. This is the stuff from whence we make our mincing steps forward, and I believe they are to be congratulated.

There can scarcely exist a single area of interest to the profession in which the visible hand of government does not appear. Our ability to understand the process of agricultural growth, of technological change, of trade negotiations and of environmental relations will be seriously hampered if we do not have the conceptual apparatus with which to integrate the political markets with the economic markets. Naive analyses of market failure that prescribe a role for the state continue to dominate much of our analysis. Only slowly are we coming to appreciate that substituting government failure for market failure is hardly a recipe for success. The paper helps us sharpen our thinking about the interactions between economic and political markets.

I intend to leave comments on the formal modelling aspects of the paper to others far more qualified than I. Rather, in my role as discussion opener I will raise four points that may stimulate others to pursue.

First, PERTS on policies which reduce transactions costs among private agents may often be those which simply create a legal framework for the enforcement of contracts. I suspect many of the 'institutional innovations' that arise do so because it pays some groups of individuals to collaborate with others and reduce transaction costs, for example, the covenanting of titles on new definitions of property rights may emerge between individuals with no explicit role of the state other than the provision of a system of tithing and enforceable contracts. PERTS, then, should presumably encompass a very broad area and not be thought of as just specific interventions.

Second, in the process of policy reform, in such areas as stabilization and structural adjustment, the issue of sequencing is often crucial, if the policies are to be credible and politically sustainable. Different sequences of reforms will create different time paths of rents and changes in welfare for different groups. While the paper has helped me think about the comparative static equilibrium mix of policies, I find it more difficult to see how these different time paths associated with both the mix and the timing of policies can be addressed.

Third, the authors recognize the importance of 'policy uncertainty'. I wonder, however, where this is captured in their scheme. Economic agents will react to this, as witnessed by capital flight on low levels of domestic investment. Is it reflected in the 'constraint structure' – the performance measure transformation frontier?

Finally, I have the impression that 's' (the vector of socio-political characteristics) in equation (l) is a potentially powerful variable, and one on which we might have to rely heavily. It might be argued, in fact, that it should be endogenous; although at that point we would have a much more general and ambitious model of the political system than even the authors contemplated. However governments do change and areas of varying colours and stripes do come and go. In fact, in applying the PEST/PERT framework to the small South Pacific Islands from whence I come, I find I need that variable to explain how a social democratic government adjusted agricultural policy by eliminating overnight the transfers that the rural sector had been capturing. For a long period there had been incipient levels of subsidies often through rediscount lines at the Central Bank. In the late 1970s and early 1980s these subsidies grew and took more explicit forms. New Zealand seemed to be on a path consistent with the model presented by the authors and the paper by Anderson and Tyers. Like other OECD countries, agricultural protection was increasing over time. But then we had a total reversal. In fact the agricultural section is now significantly taxed, as other markets are not fully liberalized. What, then, among the variables in the paper has changed to bring about such a result? Transactions and lobbying costs, structure of the industry – these things do not change abruptly. Is 's' then a catchall-shifter – another name for our ignorance? I welcome the authors' comments.