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ENDOGENOUS FARM PROGRAM FORMATION

THE CASE OF THE U.S. WHEAT PROGRAM

By

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ABSTRACT

ENDOGENOUS FARM PROGRAM FORMATION :

THE CASE OF THE U.S. WHEAT PROGRAM

By

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Recognizing that the U.S. wheat programs are the outcomes of bargaining games among interest groups, the Policy Preference Function (PPF) approach is applied to endogenize wheat program formation in the U.S. Adding the political influence functions of interest groups to the PPF approach incorporates the formal structure of the political economy of U.S. wheat programs. The model focuses not only on the interdependence between wheat policies and the political influence of interest groups, but also on interactions between economic markets and political markets.

The endogenous wheat program model explains why the government offers various policy instruments in the wheat programs. The endogenous model indicates that the effects of changes in market parameters on policy instruments in the wheat programs depend not only on the distribution of the political influence function and the type of political instruments used, but also on the relative magnitude of the political process through which economic interests are translated into actual farm policies (indirect effect) and the market structure through which the real income of each interest group is affected (direct effect).

The empirical estimation of the political influence of the producer group indicates that the welfare of producers is weighted more than that of the public (consumers and taxpayers) during the sample period. The U.S wheat programs supported domestic producers at the expense of taxpayers and consumers before 1989.

However, since 1989 the wheat programs have supported the welfare of producers and consumers at the expense of taxpayers. The clear losers from recent wheat program changes are taxpayers.

The empirical results confirmed the hypothesis that the political influence of the producer group can be an indicator for measuring redistribution efficiency because the political influence of the producer group has a positive relationship with total deadweight losses.

Therefore, the empirical results suggest that the endogenizing PPF model for the U.S. wheat programs is an inappropriate approach for understanding the political process and distributional consequences with regard to the U.S. wheat programs. This result arises because of the inconsistency between the effects of the loan rate and target price programs.

Dedicated to my father

Dong Soo Kim

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CHAPTER 1. INTRODUCTION

1.1 Problem Statement

Up until about two decades ago, political factors generating actual farm policies were largely disregarded in modeling the agricultural policy formulation. The assumption was that the choices public agents made were exogenous to the economy. Thus, economic analysis assumed that the structure of the economy was invariant to the policies the government pursued (Lucas). This point of view, however, ignored the fact that both the government and the market exist in the world, and their mutual interaction influences the decision-making process of policies which, in turn, affect the production and distribution of wealth.

In the absence of government intervention, the distribution of wealth and factor allocations are determined solely by market conditions. However, government policy intervention forces a producer to respond to a combination of market prices and the farm program incentives when making production and marketing decisions. The assumption that production and distribution of wealth are determined only by market conditions does not provide an adequate explanation of how government policies are formulated nor which forces greatly affect policy-making decisions.

Recently, however, endogenous policy models have attempted to explain the process of farm policy formulation and the distributional effects of agricultural policies. Modeling endogenous government behavior provides an opportunity to review the process in which agriculture and farm programs evolved and the specific type of policy

instruments used in the programs. The endogenization of various dimensions of the wheat program as a representative commodity program[1] provides an especially good illustration, not only in understanding the economic and political forces which affect the structure and evolution of farm policies and programs, but also in predicting the political behavior related to farm policy issues.

Under the changing domestic and international circumstances a number of questions have been raised in the debate of farm policy reform. These questions include 1) how the government and associated political processes affect economic activities, 2) what the distributional effects of these activities are, 3) why governments prefer distortional farm policies, implementing high protection levels for domestic producers instead of developing more efficient farm policies with free trade, 4) why governments have difficulty making any substantial reform reducing distortional and expensive agricultural policies, and 5) why the advice of economists concerning agricultural policy instruments has been ignored so often in the agricultural policy process.

These questions have produced a growing interest in understanding the process of farm program formation. Two approaches have been developed to analyze the political economy of farm policies and the process that generates protectionism. One approach is referred to as the "social contract" approach or " social concern " approach. This approach proposes that government intervention is based on a social consensus to prevent certain groups from suffering substantial income loss and to promote various national and international goals.

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[1]Because wheat is a major staple domestically and internationally, various dimensions of the wheat program are simultaneously implemented to achieve the program goals. In addition, free riding with respect to lobbying activities has been less of a problem for general commodity associations. The wheat program thus provides a good illustration in evaluating political activity in farm programs.

The second approach emphasizes the economic self-interests of those participating in the political process. The representative major paradigm of this approach is the public choice theory which is sometimes called " neoclassical political economy " (Colander). This approach has increasingly emphasized the endogenous treatment of domestic and international policies as a response to the influence of special interest groups (Maclaren, Baldwin). The main idea of this theory is that political decisions regarding policy instruments are reflections of the selfish economic interests of voters, lobbying groups, politicians, and other decision-makers. The government is regarded as an endogenous entity whose programs and policies reflect diverse interests in society. Politicians, as brokers, clear the market by allocating direct and indirect transfer payments among high and low bidders in the political market place (Downs, Buchanan, Tullock, Muller, and Olson).

When this same approach is applied to farm policies and programs, political decisions concerning farm programs are a reflection of selfish economic interests of several groups in farm policy matters. The design and tactical implementation of government farm policies can be explained by acknowledging the interest groups influencing legislators and legislative races to pursue their goals. Therefore, the political decision, as well as the policy selection and actual levels of various policy instruments chosen, is affected by the interaction between the government and the interest groups whose potential gains or losses can be substantial.

Focusing on the relationship between the farm programs and redistributive efficiency, Gardner has argued that government transfer policies are affected by the efficiency with which the government transfer program redistributes income. In addition, since the transformation of economic policies can be explained by competition among

interest groups, efficient policies survive over alternative policies since a Pareto-superior policy would attract more political support (Becker).

Although there has been growing concern in understanding the process of farm program formulation and its redistributional effects, there are only a few models of farm programs which have included both economic markets and political markets as a rationale for endogenous policy formulation. Focusing mainly on the impact of the political process on the farm programs' decision-making, even fewer studies take into account the interaction between the economic and political markets as well as the distributional effects of redistributive agricultural policies. Many recent studies, which focus on the social cost of redistributive agricultural policies, show why it is important to estimate the distributional consequences and the efficiency effects of agricultural policies. However, most of those studies have neglected to consider both the political influence of interest groups in the political market and the economic efficiency of transferring wealth from one group to other groups. Given the role of political markets in transferring wealth, it is of interest to investigate the distributional consequences of government policy as well as the efficiency consequences.

As Muller has argued, the positive public choice theory provides more meaningful insight than any alternative models not only in estimating the trade-off in gains and losses resulting from farm programs but also in evaluating and predicting political behavior (Muller). Thus, it is necessary to endogenize both private and public behavior under the paradigm of the public choice theory rather than to extend the model to completely different approaches such as the social contract framework. In other words, economists should integrate political factors into their microeconomic optimizing framework in order to expand the already substantial contribution toward understanding

the policy making process. In so doing, they should also include in their models the various imperfections that characterize real economic and political markets. What is needed, therefore, is to endogenize the political process when developing a farm policy program model.

1.2. Objectives of the Study

This study models the process of farm policy formulation for wheat by treating economic and political forces as endogenous variables in the policy process. Specifically, the main objective of the study is to develop an endogenous model regarding U.S. domestic wheat programs. This model will be used to evaluate optimal wheat policies. More specifically, the model will 1) estimate and evaluate the optimal levels of wheat policies, 2) estimate which factors affect the optimal wheat policies, 3) estimate the relative political influence (or power) of the producer group as an interest group, and 4) examine the effects of economic variables on political parameters by using comparative static analysis.

The second objective of this study is to investigate and measure the distributional effects of wheat policies, focusing on the interconnections between the political influence of interest groups and the redistribution efficiencies under policy alternatives. Specifically, this study will 1) estimate the changes in producer surplus (PS), consumer surplus (CS), taxpayer loss (TL), total deadweight loss and marginal deadweight loss under various agricultural policies, 2) examine the relation between the slope of the surplus transformation curve and the political influence of the interest groups, and 3)

investigate the relation between the changes in consumer surplus, producer surplus, taxpayer loss, total deadweight loss and marginal deadweight loss.

1.3. The Organization of the Study

This study is composed of five chapters. Chapter 2 reviews the literature concerning the economic aspects of government political behavior and outlines the main concepts of past studies. Chapter 3 describes a theoretical model for endogenizing domestic farm program formulation. Section 3.1 addresses the issues necessary for model specification; section 3.2 discusses the assumptions of political economy models. The changes in costs and benefits from domestic farm programs and optimal farm policy formulation are derived under the assumed policy options in sections 3.3 and 3.4, respectively. In section 3.5 the comparative static analysis which examines the effects of changes in market parameters on the optimal values of policy instruments is discussed. Based on the empirical data, Chapter 4 test the hypotheses derived from comparative static analysis. Section 4.1 reviews a history of U.S. farm programs since 1973. Section 4.2 estimates the political influence of the producer group. Section 4.3 evaluates the estimated political influence of the producer group. Section 4.4 examines the relationship between policy instruments and the political influence of the producer group using actual data. Section 4.5 estimates political behavioral equations for target price / deficiency payment, loan rate, and acreage reduction program. Section 4.6 investigates the distributional effects resulting from the domestic wheat programs. Section 4.7 examines the relationship between the political influence of the producer group and

redistribution efficiency of the domestic wheat programs. Chapter 5 contains a brief summary, policy implications of this study, and concluding remarks.

CHAPTER 2. REVIEW OF LITERATURE

2.1. The Social Concern Approach and the Self-interest Approach

A number of different models in economics, political science, and agricultural economics address endogenous governmental behavior. Although a number of models of political economy have been classified by different points of view, the political economy of American agricultural policy can be characterized by two commonly used approaches. One approach is the "social concerns" approach, (also known as "social insurance" or "self-willed government" approach); the other approach is the "self-interest" approach (or "clearing-house government" approach)[2].

Both approaches agree that the reason government intervention takes place in the market is that government implements public policies to achieve desired distributions of income if market mechanisms fail to do so. It is widely believed that the purpose of government intervention is to correct the market failure and redistribute income to less favorable groups from more favorable groups. Although a study (de Gorter et al) suggests that government intervention, with a multiplicity of economic policies, can be classified as either productive or predatory, these classifications seem to be rather ex-post classifications to policy outcomes after government has intervened to correct the economic market failure. However, the self-interest and social contract models of

[2]Paarlberg(1989) has classified the political economy of American agricultural policy into three approaches: an ethnocentric approach, a more cosmopolitan public choice approach, and a social contract approach.

political economy take different positions on understanding the economic and political forces that lead governments to intervene in the market and on the role of government.

The self-interest approach, which emphasizes the economic self-interests of the actors participating in the political process, has treated the government as a clearing house for interest groups in a diverse society. The social contract approach takes a position that not only does government intervene according to a social consensus so as to prevent some groups from suffering substantial income losses and promote various national and international goals, but also views government as an all-powerful, benevolent dictator.

The important frameworks that show some basic tenets of the social concern approach include John Rawls' theory of justice, Harsanyi's social welfare function, and the social insurance framework, etc. According to John Rawls' theory of justice, a set of principles should be applied to the development of the basic structure of society. The first principle is that the moral underpinning of the social contract rests on the nature of the decision process taking place within the original position in which the decision maker knows nothing about his tastes, income, ability and etc. The second principle is that all principles suggested should be embedded in the social contract. Recently, Rawls (1971) argued that the universal person ought to focus attention on those individuals who are the worst off and do the best that is possible. Rawls' approach does not require cardinal utilities but does require that the utility level be comparable. His reasoning leads to the famous " Maximin " criterion which states that social and economic inequalities should be arranged to maximize the well-being of the least well-off and to ensure equality of opportunity. Thus, the Rawls' principles are arguments in favor of the contractarian approach (Mueller).

Hochman and Rogers (1969) developed a theoretical framework in which the rich give to the poor because the poor's utility is a segment of the rich's utility function. Given such a utility function, the rich would receive the highest marginal utility from giving a dollar to the poorest individual. Consequently, the rich would be eager to support transfer schemes.

Based on the intuitive notion that certain social choices ought to be made impartially, Harsanyi (1955) reintroduced the Benthamite concept of social welfare. This concept showed that if all individuals were uncertain about their future utility and if they behaved so as to maximize expected utility, individual preference would be postulated by a social welfare function (SWF) that specially placed more weight on individuals with lower utility levels. In the case in which the SWF is the generalized utilitarian form, the derived SWF is summation of weights, reflecting the marginal contribution of individual utility to social welfare, multiplied by individual utilities. This concept is called " Harsanyi's welfare function " or " just social welfare function ". Similarly, according to Corden's conservative social welfare function, the government attaches small weights to groups whose incomes increase but large weights to groups who suffer income losses (Corden).

Imperfect markets and moral hazards prevented the emergence of private markets that could spread the risk of disastrously low incomes. Thus, social insurance formulations (Musgrave's prudent humanitarian model) were suggested. Individuals with a low risk of income interruption were presumed to be sufficiently prudent to insure themselves against such outcomes. They were also presumed to be sufficiently humanitarian to finance partially income-replacement benefits for less prudent individuals. In the prudent humanitarian model, social insurance emerged as a device to

force compulsory saving on the less-prudent and low-income individuals and to protect the prudent, high-income individuals. The political market might provide such insurance through voting processes (Rausser and Lattimore).

Thurow (1975) argued that the well-being of individual workers was tied directly to a normative appraisal of relative incomes. Thus, any substantive change in relative income over time needed a major " social shock " to incur changes in normative values.

Bonnen and Browne (1989) applied the concept of transaction cost to explain piecemeal adjustments of U.S. agricultural policy. They argued that changes in agricultural policies result in high costs of obtaining information about agricultural issues because of confusing beliefs and complex rights held by farm program participants. The changes in farm policies also require the high costs of negotiating and enforcing specific agreement on policy reform among many specialized agricultural interests (Veeman).

Paarlberg (1989) and Tweeten (1989) argued that the social contract approach should be extended to the political economy of U.S. farm policy. Because autonomous governments have to act relatively freely from social constraints (Paarlberg, 1989), a major factor explaining government intervention was the ability of well organized farm interest groups to exploit widespread farm fundamentalism beliefs held by the general public which was entitled to such beliefs (Tweeten and Coggins).

The simple application of the social contract approach as an alternative to the public policy formulation had limitations however. First, it over-emphasized changes in normative value judgments such as justice, morals, and ideology to effectuate any substantive change in government policies. Taking normative positions in diagnosing a farm problem and recommending remedies without explicitly making value judgments could result in dangerous policy alternatives (Gardner, 1987). In addition, their naive

models, depending only on normative value judgments, did not 1) identify the economic and political forces that affected the structure and the evolution of government policies, 2) explain the process of how farm policies were formulated, and 3) explain and predict political behavior of government policies. Second, it focused mainly on the worst-off individuals and groups in society. Thus, this approach always predicted the redistribution of income to low income individuals from high income individuals. Third, most studies of this approach neglected the analysis of distribution effects resulting from the policy intervention.

Since policy alternatives make someone or some groups better off and others worse off, it is necessary to measure the gains and losses resulting from policy options. As long as the performance of the theory is concerned, the positive theory of public choice is justified 1) in explaining and predicting political behavior of redistributive farm policies, 2) in providing consistency between the behavior of actors in markets and in the policy process, and 3) in analyzing the distributional impacts of farm policies. Consequently, the positive theory of public choice provides a theoretical base in addressing the basis of endogenous governmental behavior. The main idea of the positive theory of public choice is that political decisions regarding government policies are reflections of conflicting interests between economic interest groups such as voters, lobbying groups, politicians, or other economic organizations. In political markets, in which policies can be supported directly at the ballot box or indirectly by public campaign funds to political parties, votes play a role much like dollars in conventional economic markets. Since politicians attempt to satisfy voters' demands to increase their probability of reelection, politicians as brokers clear the market by allocating direct and indirect transfer payments among high and low bidders in the political market place. Thus,

political behavior is driven by the "political invisible hand" : public policy choices reflect the public's preferences just as market prices and output reflect society's demand for market goods.

In general, the public choice theory has emphasized the identification of factors determining government intervention. For example, the public choice theory has been applied to determine why inefficient redistribution policies and/or protectionism are implemented instead of efficient transfer policies. Reviewing primary models and frameworks in the public choice theory leads to understanding which factors play important roles in government intervention. Self-interest coalitions, voting mechanisms (majority voting or probabilistic voting), dominant classes, regulatory power, rent-seeking activities, competition among interest groups, redistribution efficiency, and the efficiency of group effectiveness are listed as factors affecting government intervention.

According to the self-interest coalition framework (Dawn, Buchanan, and Tullock), every individual was presumed to be interested in redistributing income from one group to another group. Thus, individuals had the incentive to form coalitions in order to express their demand to politicians. Politicians are motivated by votes and therefore satisfy these demands in order to increase their probability of election. Government and political parties became vote maximizers in the self-interest coalition framework just as producers are profit maximizers. There was a presumption that voter coalitions with vote trading would lead to a redistribution from low-income families to upper income families.

While the self-interest coalition framework is interested in forming coalitions, the majority voting framework neglects voter coalitions or voter trading. The majority voting framework asserts that 1) the government is seeking to maximize the " majority " defined

by the number of potential voters in the beneficiary group, 2) the decision-making is done at the point where marginal expected gain in votes is equal to marginal expected loss in votes, and 3) redistribution income in a democracy moves from the tails of the income distribution to the center (Director's law of income distribution). Majority voting would not exhibit the true preference of the voters under the unrestricted domain of preferences and alternatives. But when some constraints are imposed, (for example, if it is assumed that preferences are single peaked), the outcome of majority voting can represent the true preferences of the voters (Starrett).

Since actual policies are rarely decided by direct majority voting, the probabilistic voting model (Brock and Magee) provided a theoretical alternative to the traditional median voter model. Lobbyists maximized expected returns from their political investments while each party set its policy so as to maximize the probability of election. The probabilistic voting model, however, drew the conclusion that neither the parties nor the lobbying groups got everything they wanted in an endogenous political equilibrium. Thus, each player's optimal behavior depends on the actions of the other three players.

In contrast to individual actions of economic agents, the collective action of coalitions or interest groups addresses such a question as do rational individual decisions result in inefficient outcomes in the collective action. Generally, rational individuals often cannot produce public goods that depend on collective contribution. Olson(1965) examined the economic aspects of collective actions based on the economic theory of rational and selfish individual behavior. Olson argued that rational and selfish individuals or groups cannot produce the collective goods because of the free-rider problem. But if the membership of a group was small or if the benefits from a particular policy were unevenly distributed, an interest group was more likely to overcome the free-

rider problem and raise the funds needed for effective lobbying because members of a small group could monitor each other's decisions and make their own choices contingent.

The theory of the state argues that the dominant capitalist classes, which are composed of groups of economic agents, make use of their monopoly power to transfer wealth through the state. Thus, the dominant classes have increased shares of wealth and income relative to other classes. An increasing concentration of wealth results in expanded inequality over time. However, there are a number of problems and internal inconsistencies in the theory of the state. First, it is hard to define precisely the dominant class and its formation and maintenance as an effective coalition. Second, the nature of monopoly power can be seriously questioned. For example, monopoly power is not able to explain shifts in demand. Treating local and state governments as extensions of central governments is another weakness (Rausser and Lattimore).

The theory of regulation, in which the representative economists are Stigler and Peltzman, suggested that regulatory power determined the distribution of wealth and factor allocation. The government made use of regulation to favor powerful interest groups and disfavor less powerful groups. The costs of applying political pressure limit the size of interest groups and affect the size of transfers to such groups. Stigler provided empirical evidence of interest group pressure across U.S industries. In explaining regulation, Peltzman also investigated the politics of price-entry regulation to generate a number of testable hypotheses. Peltzman argued that the regulator chose both the support and transfer amount. Although the theory of regulation yielded a set of hypotheses for empirical testing, it dealt with only restricted components of the policy-setting process due to the fact that it concentrated only on legislative behavior to the economic policies formulation.

Krueger (1976) introduced " rent seeking " as a determinant in the redistribution of wealth; she defined rent seeking as the competition for rents that accompany most forms of pre-existing government intervention or regulation. In addition, she developed a simple model of competitive rent seeking for the case when rents originated from quantitative restrictions placed upon international trade. Given the framework in which the process for resolving conflicting goals between interest groups were permitted, interest groups competed over the distribution of income through " pork-barrel " policies. Since the rent-seeking activities reflected the underlying economic and political structure, a game theoretic approach was employed in analyzing the interaction of political and economic structures. Zuman (1976) applied cooperative game theory as an analytical tool, while Brock and Magee (1978), as well as Findlay and Wellisz (1982), applied noncooperative game theory.

Rent-seeking activities are regarded as wasting resources. In general, two views of analysis exist with respect to a government's choice of economic policies and the welfare possibilities those policies generate. Rausser and Foster (1990) suggested the PERT (Political Economy Resource Transaction) - PEST (Political Economic Seeking Transfer) dichotomy. PERT is a positive game view, emphasizing the reduction of transactional costs as the means of increasing welfare. For example, investments in science and technology are included in PERT. PEST is a negative sum game view (at best, a constant sum game) emphasizing government's failure.

Similarly, de Gorter et al (1992) classified government's policies as either productive or predatory policies. Predatory policies were designed primarily to redistribute income between groups in society while productive policies were defined as those policies that corrected for market failures and thereby increased social welfare. An

important example of a productive policy is publicly funded research. Rent-seeking activities and the directly unproductive profit-seeking (DUP)[3] activities introduced by Bhagwati were included in the negative sum game view because rent seeking and DUP activities did not create wealth but merely transferred existing wealth between groups or individuals (Tullock, 1982; Tollison, 1982; Bhagwati, 1982). Krueger calculated that in India in 1964, total rents amounted to 7.3 percent of GNP. In 1968 in Turkey, quota rents were calculated to be about 15 percent of GNP. Adding the values of the resources used in rent-seeking with the usual deadweight losses from policy intervention was supposed to provide a more realistic estimate of the cost of policy. Thus, competitive rent-seeking for import licenses entailed an extra cost in addition to the welfare cost that would be incurred if the same level of imports was achieved through tariffs. If rent seeking costs were considered in the model, tariffs and quotas with equivalent market impact had unequal efficiency impacts (Brock and Magee). However, rent-seeking has been severely criticized for a number of reasons. They include its " hidden " (political) ideological agenda, i.e, it supports a minimalist position on government economic activity; the difficulty of distinguishing between profit-seeking, which is socially beneficial, and rent seeking; and the presumption that lobbying expenditures are wasted when some dissemination of information can be socially useful (Samuels and Mercuro).

Becker (1983) attempted to unify the view that governments correct market failures with the view that they favor the politically powerful by presenting a theory of competition among pressure groups for political influence. He addressed the following

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[3]DUP is defined as activities that use real resources to produce pecuniary returns but do not produce goods or services that increase a utility function.

arguments: 1) the transformation of economic policies can be explained by competition among interest groups, 2) an efficient policy survives over alternative policies since a Pareto-superior policy would attract more political support, 3) political equilibrium depends on the efficiency of each group in producing pressure, the effect of additional pressure on their influence, the number of persons in different groups, and the deadweight cost of taxes and subsidies, and 4) since efficiency depends on the extent of deadweight losses associated with proposed policies, public policies with lower deadweight losses are, ceteris paribus, more likely to be adopted.

According to Gardner's efficient redistribution theory (1983), efficiency in redistribution measured in terms of deadweight loss generated per dollar of economic surplus transferred between consumers and producers of a commodity resulting from government intervention could explain policy variations over time and across commodities. By considering the ability to redistribute efficiently as well as the effectiveness of political organization, Gardner indicated which farm commodities had received the most government support since 1930. To explain both the influence of the political market and the efficiency of policies, Gardner used both elasticities and a number of political-economic proxies such as number of producers, the concentration index of the commodity, lagged farm income, lagged relative prices, and the share of the commodity exported. Gardner also developed the Surplus Transformation Curve (STC) concept which demonstrated the welfare trade-offs inherent in income transfer programs. Since STCs were the government's income redistribution constraints, the optimal policy was the tangent point of the highest attainable STC and some social welfare indifference curve. Another study (Babcock et al) also listed the efficiency of farm programs and

the effectiveness of political organizations as important forces in determining redistribution policies.

Many studies, focusing mainly on the social costs of redistributive agricultural policies, have examined the market distortion and inefficiency caused by farm programs and have investigated distributional effects of current and alternative farm programs by using partial equilibrium analysis and sensitivity analysis (Gardner; Babcock; Schmitz and Chambers; Cramer; Lianos and Rizopoulos; Cramer et al; Anderson and Hayami). After reviewing the main theories and frameworks in political economy models, the factors determining government intervention can be summarized as shown in Table 2.1.

Table 2-1 The Factors Determining Government Intervention in Political Economy Models

self-interest approach	social contract approach
- self-interest coalition	- changes in normative value
- majority voting	< major theories >
- dominant classes	- principles of Rawls' justice
- regulatory power	- Corden's social welfare function
- rent-seeking activities	- Harsanyi's social welfare function
- competition among interest groups	- social insurance framework
- redistribution efficiency	

2.2. The Review on Applications to Agriculture

So long as policy issues are resolved by the voting of elected representatives, individual voters attempt to form coalitions to exert pressure on policy-makers with others who share their interests. The essence of the political problem, thus, is the resolution of the conflict arising between various groups attempting to influence policy makers to adopt a policy that will maximize the group objective function. In other words, political economic equilibrium is a solution to the corresponding bargaining game in which both government and interest groups are involved. The solution to this bargaining game can be represented as 1) a maximization problem of solving the political preference function which is a weighted sum of the group's objective functions, where weights depend on the relative political power of the groups or as 2) a game theoretic framework which regards public policies as the equilibrium outcome of a cooperative game among interest groups and the policy maker. The bargaining process between pressure groups and the policy maker often leads to enforceable agreements among the players making plausible the use of cooperative game solutions (Shubik; Beghin).

The Political Preference Function (PPF) approach was introduced by Rausser and Freebain (1974). They provided a formal basis for specifying and evaluating the resulting set of policy preference functions. The PPF, which treated the resulting set of preferences as parameters, provided decision-makers with rational policy outcomes conditional on the representation of policy preferences (revealed policy preference). Thus, the set of policy preference functions constructed using the suggested framework might best be regarded as an imperfect, but nonetheless, plausible means for assisting in the analysis of public decision making (Rausser and Freebain). Integrating political

factors into the model and maximizing the political preference function provided the optimal set of government policy instruments. Consequently, public policy choices were treated as the outcome of maximization subject to constraints (Gardner).

Rausser and Foster (1990) defined the PPF and government support function, and argued that the relative weight on each group in the PPF was determined by an index of the relative costs of political organization. The weights reflected the degree of relative wealth transferred from one group to another.

Oehmke and Yao (1990) listed the change of producer surplus, consumer surplus, and government budget as the performance measures of PPF and argued that the government placed more weight on the welfare of wheat producers relative to consumer's welfare and budget expenditure in making decisions about agricultural policies.

The PPF approach was extended to an international commodity trade model (Sarris and Freebairn; Paarlberg and Abott). To endogenize domestic farm policies, Sarris and Freebairn (1983) modeled the world wheat market as a Cournot oligopoly in which the world price is determined by the interaction of all countries' excess supply and demand curves. They explicitly acknowledged the relative political strength of interest groups in the policy process. The government maximized a country's weighted objective function reflecting the welfare of lobbying groups and revealed policy preference through the weights attributed to the different objectives. They obtained a Cournot-Nash equilibrium solution by calculating the first-order conditions of a weighted objective function for each country and argued that policy factors such as the relative strength of various pressure groups should be treated as endogenous rather than exogenous.

Paarlberg and Abbot (1986) applied the general equilibrium framework suggested by Thursby and Jensen (1983) to determine endogenously the policies based on conjecture by policy-makers. They assumed that a policy maker has a criterion function (revealed preference function) which was defined as the weighted sum of the welfare of wheat producers, users of wheat products for human consumption, livestock producers who use wheat as feed, private stockholders and taxpayers. An oligopoly model of the international wheat market was specified to determine the implicit policy weights attached by respective governments to the five groups operating in wheat markets. They empirically showed that the weights of each group relative to that of producers were significantly different from unity during the period 1960-77 in U.S.

Gallagher (1988) argued that public decisions concerning community policy would approximate the outcome of a bargaining problem whose solution was acceptable to the public in terms of commodity prices and budgets but actually favored producers. Since the objective of government was to maximize producer surplus subject to the public cost constraint, the Lagrangian multiplier in the model was interpreted as the efficiency of a policy solution.

Other studies stated that the PPF approach did not provide a formal structure of the political economy underlying the objective function of the policy-maker (Zusman and Amiad; Beghin). Thus, Harsanyi (1963) and Zusman (1976) suggested the cooperative game theory which provided a formal model of the bargaining process among interest groups and the policy maker. The game theoretic framework had been applied to the political economy of food price policies in Israel (Zusman and Amiad) and Senegal (Beghin and Karp). Zusman and Amiad (1977) emphasized the solution to the corresponding bargaining game as the political economic equilibrium. A game

theoretical approach was employed in formulating the political structure, which combined with the economic structure, to yield a model of a political economy. They identified the group's objective functions and estimated weights which depended on the political power of the groups.

Studies which have applied the game theoretic approach to market power and strategic behavior in modeling international trade between industrial organizations or trading countries' negotiations are discussed below:

Karp and Macalla (1983) emphasized the limitations of previous static trade models and applied a Nash noncooperative difference game to the world corn market. This approach contained the appealing feature of incorporating interdependent policy-making among the major players in a given market in which policies determined by one player affected the welfare of all other players. The dynamic model that they used indicated that the welfare gain from the imposition of the optimal taxes were less than previously indicated in static solutions.

The theory of trade negotiation analyzed by the game theory is found in Mayer and Copeland. Mayer (1981) developed a simple theoretical framework which assumed a two-good world consisting of two large countries, each taking the other's tariff as given in order to examine the outcomes of tariff negotiations. He emphasized the importance of country size, negotiation rules, and domestic interest groups in determining the general nature of possible tariff agreements. Mayer argued that, in the presence of interest groups, negotiations generally would not lead to free trade. Copeland (1989) modelled a two-stage game for trade policy between governments. That is, governments chose a negotiable trade barrier in the first stage of the game which was cooperative. The level of this barrier was treated as a binding commitment in the second stage of the

game where the non-negotiable trade barrier was chosen non-cooperatively. According to this study, given government's weight to protect producers, low tariffs would force consumers to use other, more costly, instruments which might result in welfare losses. Thus, Copeland drew the conclusion that consumer interests do not necessarily lie in obtaining zero tariff levels.

Beyond the extension of the PPF and the game theoretic approach to the international trade issues, some studies focused on the addition of political variables to agricultural trade policies. This approach provided a political economy framework to the issues of agricultural protectionism (Maclaren). The studies of Anderson and Hayami (1986), Hillman(1982), Alston et al (1990), and Schmitz and Chambers (1987) are indicative of this approach.

Anderson and Hayami (1986) by examining variations in the nominal protection of agriculture in fifteen different industrial and industrializing countries over the period 1955-80, concluded that the level of protection tended to rise as comparative advantage shifted away from agriculture.

Hillman (1982)studied how a government which pursues its own self-interest motives to maximize political support advocated a declining industry. He found that political favor was not a function of profit and price but was a function of 1) additional profit brought about by the tariff and 2) consumer utility in the presence of the tariff relative to consumer utility in the absence of the tariff. Hillman concluded that government tariff support would be declining with world price.

Alston et al (1990) investigated the reasons for agricultural policy intervention and choice of policy instruments using pooled data for thirteen commodities across fifteen countries (both developed and developing) over a five-year period. The

theoretical underpinning of the model was Becker's model of political self-interest approach. Alston et al (1990) found that the level of government support depended significantly upon the choice of policy instruments as well as the characteristics of a country. In the equations explaining the choice of instrument, the most important explanatory variables were the level of support, the proportion of production imported or exported, the size of the country (population), GNP per capita, the elasticities of supply and demand, and the level of the development. The authors concluded that their model was consistent with the political self-interest model of political economy in explaining agricultural protectionism. However, their econometric results appeared to be weak and ambiguous, despite their claim to the contrary.

Schmitz and Chambers (1987) examined the welfare implications for an open economy of specific U.S. agricultural policies such as the deficiency payment program. Using partial equilibrium analysis they concluded that economic surplus was transferred from other sectors of the U.S. economy in order to subsidize foreign as well as domestic consumers. When the difference between the target price and market price increased and the supply elasticities became larger, the surplus transfers and social losses increased.

From reviewing the political economy models related to farm programs, some points can be addressed in analyzing domestic wheat programs as well as wheat trade policies. It was recognized that the farm program is the resolution of the conflict arising between various groups attempting to influence policy makers to adopt particular policies. The PPF approach, the game theoretic framework, and other studies of endogenizing political process were developed as the approaches for solving the bargaining game. These approaches reviewed reflected various behavioral assumptions

of economic agents and countries and presented techniques concerning the model validation.

However, there are some limitations in understanding and predicting farm policy behavior: 1) most studies neglect the formal structure of the political economy model concerning farm policy issues, 2) the political factors producing the political power were often not included in their model or framework, 3) even in the case where their frameworks included political factors, the hypotheses generated from the theory did not link to empirical verification, 4) the interrelationship between political factors and group effectiveness in the farm policy formulation was not considered.

Therefore, the review of literature suggests the following elements in developing the conceptual structure of the political economy models: 1) the addition of political factors generating the political influence of interest groups to the political economy model, 2) the consideration of interest group effectiveness in making farm policy decisions, and 3) the empirical verification on various hypotheses generated from the theory.

CHAPTER 3. THE MODEL FOR DOMESTIC WHEAT PROGRAMS

3.1. Issues for the Model Specification

About every five years Congress drafts new farm legislation which dictates the provisions of commodity programs for major food and feed grains for the subsequent five years. The legislation not only reflects the changes in market conditions and policy incentives in the process of farm policy formulation but also leads to fundamental shifts in the structure of agricultural policy and provides a base of evolving new farm policies. Since the Agricultural Adjustment Act (AAA) of 1933, the main purpose of agricultural policy has shifted from providing public goods, such as the information disseminated by the extension system, to directly affecting directly agricultural markets through various legislative Farm Acts. The Farm Acts, which include everything from AAA and even before to the 1990 Farm Act following the 1985 Act commodity programs, are used as a means of transferring income to the producer.

The principal policy instruments in the current domestic wheat programs are target price / deficiency payment, loan rate, acreage reduction program, and stockholding policy, including both Commodity Credit Corporation (CCC) and farm reserve policy. This set of farm policy instruments was established in essentially its present form in the Agricultural and Consumer Protection Act of 1973. While the target price guarantees producer prices, market prices for wheat are supported by means of non-recourse loans from the CCC. Since the CCC makes loans to producers using the

producers' stored commodities as collateral, the loan rate program provides a domestic floor price when a sufficient proportion of producers participate in the wheat program and market prices fall toward the loan rate. The regular deficiency payment rate is equal to the difference between a legislated target price and the higher of the loan rate or the national weighted average market price received by farmers for the first five months of the marketing years. Thus, the target price/deficiency payments guarantee producer incomes. Farmers who participate in the voluntary wheat program must participate in an acreage reduction program (ARP) to receive program benefits. The diverted land has to be put in an approved conservation use. The ARP requires diversion from a crop-specific acreage base (Harwood and Bailey).

The process of formulating and evolving wheat programs reflects the underlying economic and political structure concerning wheat programs issues. To understand the process of wheat programs formulation and to determine the values of endogenous economic variables as well as those of the policy instruments, a system of economic and political relations-- a political economy -- should be recognized. Since interest groups attempt to influence policy makers to adopt policies that will maximize their objectives, the essence of the political problem is the resolution of the conflict arising between various interest groups[4]. Thus, the political economic equilibrium is the outcome of the corresponding bargaining problem whose solution is acceptable to the interest groups (Rausser and Freebain; Zusman and Amiad; Gallagher; Beghin).

The bargaining process and the resulting compromises between different political groups and the range of preferences of these groups result in construction of several

[4]Interest groups are defined as the organizations whose members act together to influence public policy in order to promote their common interests.(Veeman, p 366)

criterion functions such as the Political Preference Function (PPF) and Social Welfare Function (SWF) or result in the Game Theoretical Framework (Harsanyi; Zusman; Zusman and Amiad; Beghin and Karp; Beghin[5]).

Both approaches have pros and cons when applying them to the political economy of public policies. One theoretical device in constructing criterion functions is to develop a Social Welfare Function (SWF). A SWF can be used to find the entire Pareto frontier as the solution to a parametric optimization. But a SWF is so general it can be used to summarize the properties of many kinds of moral judgement. On the other hand, it does not have much use in deciding what kinds of ethical judgement might be reasonable ones. There is no way to prescribe the proper SWF.

The PPF approach recognizes the role of pressure groups in the political process and in the corresponding formulation of the policy preference function in terms of the group's objectives. But because it does not explain how the PPF is formed and why the PPF occurs, the PPF approach does not provide the formal structure of the political economy (Zusman and Amiad).

Although the game theoretical framework easily confirms the Beghin's results of the comparative static analysis by estimating econometrically policy behavioral equations, some weaknesses appear. These weaknesses include 1) barely identifying the distributional effects and transfer efficiency resulting from farm policies, 2) ignoring the

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[5]Beghin addressed three approaches such as the Revealed Preference Function approach, the Cooperative Game Theory approach, and the Game Theoretical approach in understanding the bargaining game. The game-theoretic approach emphasized how the PPF approach and the cooperative game theory approach complement each other. However, the Cooperative Game Theory approach and the Game Theoretical approach can be simply grouped as the Game Theoretical Framework.

substantial political factors which produce political pressure in the model, and 3) not being easier than the PPF approach in estimating policy behavioral equations.

Adding the political influence functions of interest groups to the PPF model permits the PPF to incorporate the formal structure of the political economy of public policies. Presumably, the policy-maker maximizes the PPF in which different groups in society have different weights in the function. The PPF approach accepts the actual choices of governments as revealed by the SWF. The first order conditions generate weights for the interest groups which, in empirical works, can be assumed or estimated to reveal the policy-maker's implicit weights (Oehmke and Yao; Sarris and Freebairn; Rausser and Foster; Zusman and Amiad; Gallagher). Thus, the valuable work generated in theoretical welfare economics can be carried over to the political preference function through replacing unmeasurable and interpersonally incommensurable utility by simple preference relations (Gardner). Consequently, the PPF approach treats the resulting set of preferences parameterically and provides decision-makers with rational policy outcomes based on the representation of policy preferences as revealed policy preferences. The revealed preference of the government to the public issues can be employed to determine weights associated with various objectives. A set of weights in the PPF model reflects the political power and strength of various interest groups (Rausser and Just; Gardner; Sarris and Freebairn).

Given the PPF, the choices of public policies are accomplished by solving the constrained maximization problem. The idea came from the fact that the political process can be explained by rational maximizing behavior. In other words, modeling government behavior as the behavior of an economic agent in political activities is similar to modeling consumer behavior.

Generally, the investment in political influence takes the form of resources (time and money) expended in political campaigns, political advertising, cultivation of bureaucrats and politicians, and employment of political party workers. Such important subjective and nonobservable elements in modeling the political activities suggest the imposition of some assumptions such as quasi-concavity and separability. Although there seems to be no evidence to date that political preferences pertaining to agricultural policies are less stable than market-revealed consumer preferences (Gardner), it is useful to assume that there exist regularity conditions, which implies that there are convex political indifference curves and quasi-concave constraints in the PPF model.[6]

In the PPF framework, one concern is how interest groups generate political pressure upon policy decision makers. In exerting political pressure on the policy makers, individual voters need to form a coalition with others who share their interests. This means that the resolution to the policy issues is affected by the collective actions of the interest groups. There have thus been a lot of studies about how interest groups generate political effectiveness and how the conflict between interest groups is resolved in the policy preference function framework[7].

It has been widely recognized that spending resources on political activities affects a group's political influence. Political expenditure is a key factor in generating

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[6]The concavity of the PPF may not guarantee interior solutions.

[7]Studies in economics are more interested in economic theories of effectiveness of pressure groups in affecting the legislation rather than the formation and behavior of interest groups. See the proliferation theory(Truman),the homeostatic theory(Truman), the exchange theory of interest groups(Salisbury), and the by-product and special interest theory(Olson) for the relevant theories about the origin of group formation.

pressure on interest groups (Becker). In other words, the individual or group who has the gold decides the rules (" political golden rule ") (Gardner).

But the gold is not the only determinant of a group's effectiveness. As the membership of an interest group becomes larger, the activity level of the group is higher and the cost per contributor tends to increase because of the free-rider problem that accompanies size. Other organization costs also tend to increase as the group size becomes larger and it is likely that benefits from a particular policy are spread more sparingly across the members (Olson; Pincus; Stigler; Gardner).

The degree of geographical dispersion is also a factor in obtaining political support through the voting strength of an industry. There are two different points of view on the issues of the relationship between political effectiveness and the degree of geographical dispersion. Caves (1976) argued that a geographically dispersed industry can obtain the support of a larger number of elected representatives than a regionally centralized one, while Pincus (1976) stressed that geographically concentrated groups would react more intensively in attempting to influence the legislature.

The size of the group and its geographical dispersion tend to affect the per capita benefits and increase per capita costs associated with group membership. These factors explain why consumer interests have been unsuccessful in forming a coalition to oppose the producer's coalition (Vousden). Beyond the political expenditure and the size of the group, the degree of geographical dispersion, the level of firm concentration (Caves), the ease with which potential gains can be achieved (Stigler), the homogeneity of the goods (Pincus), and the indicator of efficiency (Gardner) can be listed as factors affecting the potential effectiveness of interest groups.

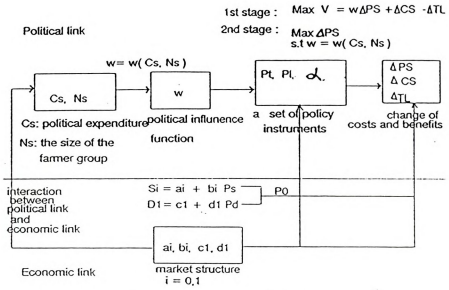
Consequently, group effectiveness depends on many factors such as size, costs of the organization, degree of geographical dispersion, homogeneity of goods, market structure, etc. Magee et al (1990) address the mechanisms by which the costs are shared by the members of the group and states that these are important determinants in producing the political pressure by the interest group. This implies that expenditures on political activities and the member size of interest groups can be the essential determinants in generating political pressure.

Recognizing the importance of the PPF framework and its connection with the political influence of interest groups, Zusman and Amiad suggested four essential components in developing the conceptual structure of the political-economy model. They are 1) the economic structural equation, 2) the set of feasible policy instruments, 3) the policy-makers' and interest groups' objective functions, and 4) the interest groups' influence functions.

The flow chart illustrated in Figure 3-1 shows the linkage between the main components being composites of political economy. In this diagram the focus is on the political influence of the producer group, w , by normalizing the weights of the consumer and taxpayer group.

There are two links in political economy. One is the political link as it refers to the political process through which economic interests are translated into actual farm policies, while the other is the economic link as it refers to the market structure through which the real income of each interest group is affected (Mayer). There exist interactions between the factors affecting political pressure and market conditions. The

Figure 3-1. The linkage between components in political economy



* Total effect = the effect of economic link + the effect of political link + interaction between two effects

$$\frac{dZ_m}{dX_i} = \frac{\partial Z_m}{\partial X_i} + \frac{\partial Z_m}{\partial Y_j} * \frac{\partial Y_j}{\partial X_i}$$

Where, X_i = vector of market variables
i: a, b, c, and d.
Y_j = vector of political variables
j: C_t, N_t
Z_m = vector of policy instruments
m: P_t, P_l, α

changes in market conditions, such as the changes in demand or supply, not only directly affect policy instruments and welfare changes of interest groups but also indirectly affect the expenditure on political activities and the member size of the producer group which, in turn, lead to the execution of power of interest groups and the choice of policy instruments. The kinds and the levels of policy instruments affect the distributions of costs and benefits of each interest group such as producers, consumers, and taxpayers. Therefore, the total effect of the changes in the market conditions on the farm programs are derived from the effect of the political link, the effect of the economic link, and the interaction between the two links. Mathematically, it is expressed as follows :

$$\frac{dZm}{dX_i} = \frac{\partial Z_m}{\partial X_i} + \frac{\partial Z_m}{\partial Y_j} * \frac{\partial Y_j}{\partial X_i} \tag{3.1}$$

where Z_m is the set of policy instruments in domestic wheat programs, X_i is the set of parameters representing the condition of the economic market, and Y_j is the set of political variables producing the political influence of the producer group.

The first term on the right side of the above equation $\frac{\partial Z_m}{\partial X_i}$ implies the effect of the economic link which is a direct effect of the changes in economic conditions on the policy instruments. The second term on the right side shows the indirect effects which take into account both the effects of the political link and the interaction between the two links. Thus, the total effects of the changes in the market variables on the policy instruments in the wheat programs depend on the direct effects, indirect effects, and interactions between the two effects. If the direct effects outweigh the indirect effects, then the signs of $\frac{\partial Z_m}{\partial X_i}$ are dominated by the effects of the economic link. In contrast, if the indirect effects outweigh the direct effect, then the signs of $\frac{\partial Z_m}{\partial X_i}$ are dominated by the effects of the political link and the interaction between two links. Based on the

discussion of the theoretical issues, the assumptions discussed below are needed for the model specification in political economy.

3.2. Assumptions

1) The economic structure : Assume for simplicity that supply and demand are linear functions of domestic price. Let D_1 represent the total demand curve, which is the horizontal summation of the commercial exports and domestic demand(D_0) for wheat. The supply curve S_0 is assumed to represent the no-program supply, while S_1 indicates the adjusted supply curve due to provision of the acreage reduction program. Thus, the supply curve of U.S. wheat shifts from S_0 to S_1 as seen in Figure 3-2. The adjusted supply curve establishes S_1 at a smaller output than the no-program supply curve S_0.

The supply functions under the absence and provision of wheat programs are defined as follows:

$$S_0 = a_0 + b_0 P_s \text{(without farm program)}$$

$$S_1 = a_1 + b_1 P_s \text{(with farm program)}$$

The demand functions are also defined as

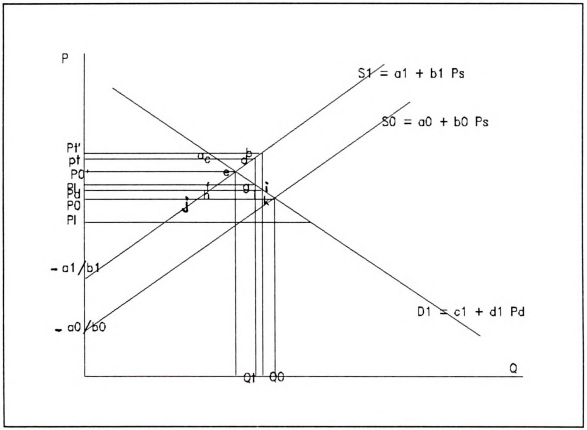
$$D_0 = c_0 + d_0 P_d \text{ (domestic demand),}$$

$$D_1 = c_1 + d_1 P_d \text{(total demand)}$$

It is assumed that $c_1 > a_0 > a_1 > 0$, $b_1 > b_0 > 0$, $d_1 < 0$ as Figure 3.2 shows.

2) The set of feasible policy instruments: Assume that the following three policy instruments are available for domestic farm programs. Target price (P_t) / Deficiency payment, Loan rate (P_l), and Acreage reduction program (α). Because these policy

Figure 3-2. The Implementation of Target Price / Deficiency Payment and Loan Rate and Acreage Reduction Programs.



instruments can be listed as main policy instruments[8], the vector of policy instruments is denoted by $Z_m = (P_t, P_l, \alpha)$.

It is assumed that the guaranteed target price is higher than the loan rate which is the floor price. Farmers respond to the target price by producing Q_t and the loan rate is higher than the free market equilibrium price which is the price under the absence of government intervention in the wheat market. That is, $P_t > P_l > P_0$. The consumer surplus depends on whether the loan rate is set above or below the free market price, P_0. If $P_l > P_0$, as drawn in Figure 3-2, there is a loss in consumer surplus which is the sum of domestic consumer surplus and foreign consumer surplus. When P_0 is greater than P_l, there is a gain in consumer surplus. The acreage reduction program (ARP) shifts the total supply curve to the left by α. Thus, the amount of production moves from Q_0 to Q_t. Thus, $Q_t = (1 - \alpha) Q_0$ where α is the proportion of acreage reduction in total supply and $0 < \alpha < 1$.

Therefore, Figure 3-2 illustrates the general economic consequences of domestic wheat programs in the case where Target price / Deficiency payment , Loan rate , and Acreage Reduction Program are implemented.

3) The policy maker's and interest group's objective functions: The government maximizes the weighted sum of producer and consumer surplus and taxpayer loss. Thus, the domestic government objective function (or PPF) can be specified as $V = w * \Delta PS + \Delta CS - \Delta TL$, reflecting the fact that different policy instruments impose different weights and performances on the special interest groups. The weights of each interest group indicate the resolution of the conflicts between the various groups before

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[8]The stockholding activities of the government such as CCC and farm reserve policies can be included in main policy instruments of wheat programs. But, the stockholding policy was ignored for simplicity.

the policy maker sets the policy instrument. For simplicity, let the consumers' and taxpayers'(publics') welfare weight be normalized to 1 and the producers' welfare weight be represented by the parameter w.

Government is also interested in the change of producer surplus, consumer surplus, and taxpayer loss rather than simply producer surplus, consumer surplus, and taxpayer loss as performance measures, where the " change " is defined to be that increase or decrease resulting from government policies.

One advantage of using the surplus concept is that the government objective function becomes a quadratic function and is easily manipulated using mathematical expressions. However, the surplus calculating from the Marshallian demand curve ignores the income effects from the changes in policy instruments. Therefore, it is assumed that there are no income effects from policy changes. It is also assumed that regularity conditions are satisfied. Thus, V is twice differentiable and concave in(Z, w). To guarantee an interior maximum of the government objective function, it is required that the second order conditions are satisfied, i.e., $V_{zz} < 0$. This means that an increase in the level of policy instruments reduces the net marginal benefit of those policy instruments.

Since w is normalized, it is possible to focus on the political influence of the producer group. The objective function of the producer group is to maximize the changes in producer surplus subject to the political influence function of the producer's group.

4) The interest group's influence function[9]: As Magee et al (1990) pointed out,

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[9]Different words are used with the same meaning. For example, political influence function (Becker), government support function (Rausser and Foster), political pressure function (Gardner), and strength function (Zusman and Amiad) all have a

the expenditure on political activities and the size of the group are presumed to be the two main factors in determining political effectiveness. That is, it is assumed that the political influence of the producer group is a direct function of investment in political support (or political expenditure) for the interest group and the size of the group. Therefore, the political influence function of the producer group[10] can be defined as $w = w (C_s, N_s : Xi)$, where, C_s is the expenditure on the political activities of the producer group, N_s is the member size of the producer group, and Xi is a set of economic variables.

Assume that as the political expenditure increases, the political support (or political pressure) increases with diminishing marginal effectiveness. Thus,

$$\frac{\partial w}{\partial C_s} > 0, \quad \frac{\partial^2 w}{\partial C_s^2} < 0. \tag{3.2}$$

In addition, following Olson's point of view, the transfer income from redistributing wealth is a collective good to the producer. When membership increases, the incentives for each member to work for the welfare of the group lessens because of the free-rider problem. Thus, the relation between the size of membership and the political influence of the producer group is assumed as follows :

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similar meaning.

[10]The political influence can be as a public good within the group advocates or opponents.

$$\frac{\partial w}{\partial N_s} < 0, \quad \frac{\partial^2 w}{\partial N_s^2} > 0. \tag{3.3}$$

Finally, the model is specified by hypothesizing that the optimization is a two-stage process. The first stage is the maximization of the government objective function to determine optimal levels of farm policies : government decides the levels of farm policy instruments needed to achieve government objectives by differentiating V with respect to policy instruments. The second stage is to optimize the producer's behavior : the producer's group maximizes ΔPS to decide optimal C_s and N_s. Thus, the specification of the model is summarized as follows :

a). The first stage : government's behavior

$$\underset{P_t,P_l}{\text{Max}} \quad V = w^*\Delta PS + \Delta CS - \Delta TL$$

s.t

$$\Delta PS = F(Z_m : X_i)$$

$$\Delta CS = F(Z_m : X_i)$$

$$\Delta TL = F(Z_m, X_i)$$

b). The second stage : the producer's behavior

$$\underset{Cs,Ns}{\text{Max}} \quad \Delta PS^{11}$$

s.t $w = w (C_s, N_s : X_i)$

[11]If the costs of lobbying and changing membership are considered, the producer's behavior would be Max $\Delta PS - C_s - C(N_s)$. But, it is assumed for simplicity that there are no costs of lobbying and changing membership.

3.3. The Changes in Gains and Losses from the Domestic Wheat Programs.

The net social costs resulting from government intervention can be analyzed by comparing the gains and losses with the programs to a no-program situation. The overall distributional consequences, total deadweight loss (TDWL), are measured as the gains in producer surplus (PS) plus losses in consumer surplus (CS) minus losses to the taxpayer (TL).

The changes in total producer surplus are the welfare gain to producers from having the option to sell much of the commodity at the target price. Thus, the gain in producer surplus is equal to the difference between area P_0P_tcd and area $-\frac{a_0}{b_0}-\frac{a_1}{b_1}$jk in Figure 3-2. Thus, the gain in PS is

$$\Delta PS = \int_{-\frac{a_1}{b_1}}^{P_t} S_1(P)dP - \int_{-\frac{a_0}{b_0}}^{P_0} S_0(P)dP \tag{3.4}$$

Substituting $a_0 + b_0 P$ and $a_1 + b_1 P$ for $S_0(P)$ and $S_1(P)$,

$$\Delta PS = \int_{-\frac{a_1}{b_1}}^{P_t} (a_1+b_1P)dP - \int_{-\frac{a_0}{b_0}}^{P_0} (a_0+b_0P)dP \tag{3.5}$$

Solving Eq. (3.5), the changes in PS are

$$\Delta PS = a_1P_t+\frac{b_1}{2}P_t^2-a_0P_0-\frac{b_0}{2}P_0^2-\frac{a_0^2}{2b_0}+\frac{a_1^2}{2b_1} \tag{3.6}$$

The participation rate, how many farmers are involved in the wheat program, is important in calculating distributional consequences as well as overall benefits resulting

from the wheat program. Thus, if the participation rate is considered, the changes in producer surplus are $\Delta PS = \beta * \Delta PS$ where β is the participation rate in the wheat program.

The change in total consumer surplus is the welfare loss to buyers from having to purchase less of the commodity at the loan rate with the program in effect(P_l) compared to the free market price (P_0) in Figure 3-2. Therefore, the change in consumer surplus is the area behind the demand curve from P_0 to P_l (area P_0P_lgk in Figure 3-2). The gain in consumer surplus is measured as[12]

$$\Delta CS = -\int_{P_0}^{P_l} D_1(P)dP \tag{3.7}$$

$$\Delta CS = -c_1(P_l - P_0) - \frac{d_1}{2}(P_l^2 - P_0^2) \tag{3.8}$$

The deficiency payment is equal to the difference between target price and the farm price if it is above the loan rate or the difference between the target price and the loan rate if the farm price is below the loan rate, multiplied by the proportion of the farm base that is allowable for planting and the program yield assigned to the farm[13]. Thus, the taxpayers' losses are equal to area P_lP_tdg ($P_l > P_0$) or $P_t'P_dbi$ ($P_l < P_0$) in Figure 3-2. Therefore, the changes in taxpayer losses are measured as

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[12]If $P_0 > P_l$, $\Delta CS = -\int_{P_o}^{P_d} D_1(P)\,dP = -c_1(P_d - P_0) - \frac{d_1}{2}(P_d^2 - P_0^2)$

[13]All that a complying farm producers is eligible for the loan, but only a specific amount is eligible for the deficiency payment. Thus, Figure 3-2 may not technically a correct figure, but it is a simple representation to deal with the deficiency payment.

$$\Delta TL = (P_t - P_l)Q_t = (P_t - P_l)(a_1 + b_1 P_t) = b_1 P_t^2 + (a_1 - b_1 P_l)P_t - a_1 P_l \quad (3.9)$$

or,

$$\Delta TL = (P_t - P_d)Q_t = (P_t - P_d)(a_1 + b_1 P_d) \quad (3.10)$$

If the participation rate in the wheat program is considered, the changes in taxpayer losses are $\Delta TL = (P_t - P_l) \cdot \beta \cdot \Delta TL$.

3.4. Derivation of Optimal Policies.

1) The optimal values of farm policy instruments.

To determine the optimal choice of the policy control variables, P_t and P_l, taking the weight as given, the expected value of the PPF is maximized with respect to two control variables. Substituting the changes in producer and consumer surplus and taxpayer loss derived for the government objective function, the government objective function is

$$V = w[a_1 P_t + \frac{b_1}{2} P_t^2 - a_0 P_0 - \frac{b_0}{2} P_0^2 - \frac{a_0^2}{2b_0} + \frac{a_1^2}{2b_1}] - c_1(P_l - P_0) - \frac{d_1}{2}(P_l^2 - P_0^2) - b_1 P_t - (a_1 - b_1 P_l)P_t + a_1 P_l$$

Thus, the optimal levels of farm policies are derived by maximizing the PPF(or V) with respect to two control variables.

The first order conditions (FOC) for the optimization of P_t and P_l are[14]

$$P_t: (a_1 + b_1 P_t)\, w - 2 b_1 P_t - (a_1 - b_1 P_l) = 0 \quad (3.11)$$

$$P_l: a_1 - c_1 + b_1 P_t - d_1 P_l = 0 \quad (3.12)$$

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[14]The first order conditions may be affected by inclusion of the participation rate, β.

Solving the first order conditions equations Eq.11) and 12), the optimal values of the government control parameters are

$$P_t^* = \frac{a_1 d_1 (1-w) + b_1 (c_1 - a_1)}{b_1 (b_1 + d_1 (w-2))} \tag{3.13}$$

$$P_1^* = \frac{c_1 (2-w) - a_1}{b_1 + d_1 (w-2)} \tag{3.14}$$

The optimal wheat policies derived indicate that the optimal levels and the signs of P_t and P_1 depend on the parameters representing the economic condition as well as the distribution of political influence function of the producer group, w, which is assumed to be a direct function of investment in political influence and the size of the producer group.

The second order condition (SOC) is

$$b_1 (w - 2) < 0 \tag{3.15}$$

Because $b_1 > 0$, $w < 2$ (3.16)

Assume that the political influence of the producer group is at least greater than zero($w > 0$). Then the second-order condition becomes

$$0 < w < 2 \tag{3.17}$$

One of the main concerns in the study is to investigate effects of the political parameters in the producer's influence function on the changes in policy instruments as well as the changes in gains and losses resulting from domestic wheat programs. Thus, the objective function of the producer set up at the second stage is maximized with respect to the political factors, Cs and Ns, to derive the results of this comparative static analysis.

Unless detailed functional forms for Cs and Ns are specified, explicit reduced-form solution for Cs and Ns cannot be obtained from the first order conditions of the producer's maximization problem. Since Cs is an unobservable variable, a proxy variable for Cs is needed for deriving the specific optimal values.[15] However, for the general function w = w (Cs, Ns : Xi) given in the model, the comparative static analysis can be accomplished by assuming differentiablity specifying the signs of the derivatives of w.

Using the simple substitution method rather than using the Lagrangian method, the first-order conditions for the optimization of the producer in the second stage are

$$F_c = \frac{d\Delta PS}{dC_s} = \frac{\partial \Delta PS}{\partial C_s} + \frac{\partial \Delta PS}{\partial w} \cdot \frac{\partial w}{\partial C_s} = \frac{\partial \Delta PS}{\partial w} \cdot \frac{\partial w}{\partial C_s} = 0 \quad (\because \frac{\partial \Delta PS}{\partial C_s} = 0) \tag{3.18}$$

$$F_n = \frac{d\Delta PS}{dN_s} = \frac{\partial \Delta PS}{\partial N_s} + \frac{\partial \Delta PS}{\partial w} \cdot \frac{\partial w}{\partial N_s} = \frac{\partial \Delta PS}{\partial w} \cdot \frac{\partial w}{\partial N_s} = 0 \quad (\because \frac{\partial \Delta PS}{\partial N_s} = 0) \tag{3.19}$$

The second-order conditions are

$$F_{cc} = \frac{1}{\partial C_s} \cdot (\frac{\partial \Delta PS}{\partial w}) \cdot \frac{\partial w}{\partial C_s} + \frac{\partial \Delta PS}{\partial w} \cdot \frac{\partial^2 w}{\partial C_s^2} \tag{3.20}$$

$$F_{nn} = \frac{1}{\partial N_s} \cdot (\frac{\partial \Delta PS}{\partial w}) \cdot \frac{\partial w}{\partial N_s} + \frac{\partial \Delta PS}{\partial w} \cdot \frac{\partial^2 w}{\partial N_s^2} \tag{3.21}$$

To satisfy the second-order conditions, Fcc < 0 and Fnn < 0 should be met.

Proposition 3-1. Under current wheat programs in which the target price and the loan rate and the acreage reduction program are simultaneously implemented, the optimal levels of target price and loan rate are positive if the government puts more

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[15]Rausser and Lattimore (1982) suggested various ways of specifying unobservable variables such as investment in political influence.

weight on the producer group than the consumer group or the taxpayer group($1<w<2$).

Proof. From Eq.(3.13) and (3.14): if $1 < w < 2$, then $P_t > 0$, $P_l > 0$ and if $0 < w < 1$, then P_t and P_l are indeterminate.

2) Estimation of w

If Eq. (3.11) is rearranged, then

$$[b_1^2+b_1d_1(w-2)]P_t = a_1d_1(1-w)+b_1(c_1-a_1) \tag{3.22}$$

Solving Eq(3.22) for w, then w is

$$w = \frac{-b_1^2P_t+2b_1d_1P_t+a_1d_1+b_1(c_1-a_1)}{b_1d_1P_t+a_1d_1} \tag{3.23}$$

The distribution of political influence of the producer group is not observable but the target price is observable. Consequently, the empirical observer can infer through Eq. (3.23) the value of w from observation of the target price, and the values of parameters of supply and demand equations(a_1, b_1, c_1, and d_1). Thus, the distribution of political influence of the producer group varies and can be estimated from Eq. (3.23).

Different values of the weight w, called w_2, can be estimated from another first-order condition, Eq. (3.12).

Thus, w_2 is

$$w_2=\frac{(2d_1-b_1)P_l + 2c_1-a_1}{c_1+d_1P_l} \tag{3.24}$$

Again, all right-hand-side variables are observable, so that w_2 can be inferred from available data. Two different weights will be more specifically compared and discussed in the empirical analysis in Chapter 4.

3) Maximizing social surplus

Setting w = 1 in the government objective function corresponds to the situation of maximizing social surplus. Substituting w = 1 for Eq. (3.13), then

$$P_t = \frac{c_1 - a_1}{b_1 - d_1} = P_1 = P_0' \tag{3.25}$$

where P_0' is the market price under the provision of wheat programs. Thus, under w=1, the optimal level of the target price should be equal to the level of the loan rate and the market price; that is, a no-intervention policy is optimal. This is the traditional welfare economics result.

4) The relationship between farm policy instruments (Z_m) and the distribution of political influence (w) of the producer group.

Proposition 3-2. Given the economic parameters constant, P_t is an increasing and convex function of w, while P_l is a decreasing and concave function of w.

Proof. Taking the first derivatives of optimal wheat programs with respect to w,

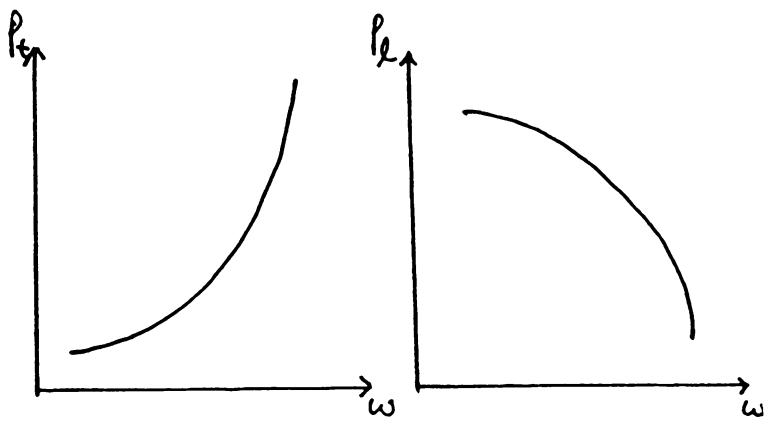
$$\frac{\partial P_t}{\partial w} = \frac{d_1(a_1d_1 - b_1c_1)}{b_1(b_1 + d_1(w-2))^2} = > 0 \ , \ \frac{\partial^2 P_t}{\partial w^2} = \frac{-2d_1^2(a_1d_1 - b_1c_1)}{b_1(b_1 + d_1(w-2))^3} > 0 \tag{3.26}$$

$$\frac{\partial P_l}{\partial w} = \frac{a_1d_1 - b_1c_1}{(b_1 + d_1(w-2))^2} = < 0 \ , \ \frac{\partial^2 P_l}{\partial w^2} = \frac{-2d_1(a_1d_1 - b_1c_1)}{(b_1 + d_1(w-2))^3} < 0 \tag{3.27}$$

This proposition implies that as the exertion of the political pressure in the producer group increases, a) the level of target price increases at an increasing rate, and b) the level of loan rate decreases at a decreasing rate.

The relationship between P_t, P_l, and w are diagrammed in Figure 3-3.

Figure 3-3. The relationship between P_t, P_l, and w



5) The relationship between the political influence of the producer group, w, and gains and losses resulting from wheat programs

Proposition 3-3. ΔPS, ΔCS and ΔTL are increasing convex functions of w.

Proof. Differentiating Eq. (3.6), Eq. (3.8), and Eq. (3.9) with respect to w, then

$$\frac{\partial \Delta PS}{\partial w} = \frac{d_1(a_1d_1 - b_1c_1)^2}{b_1(b_1 + d_1(w-2))^3} => 0, \frac{\partial^2 \Delta PS}{\partial w^2} = \frac{3d_1^2(a_1d_1 - b_1c_1)^2}{b_1(b_1 + d_1(w-2))^4} > 0 \tag{3.28}$$

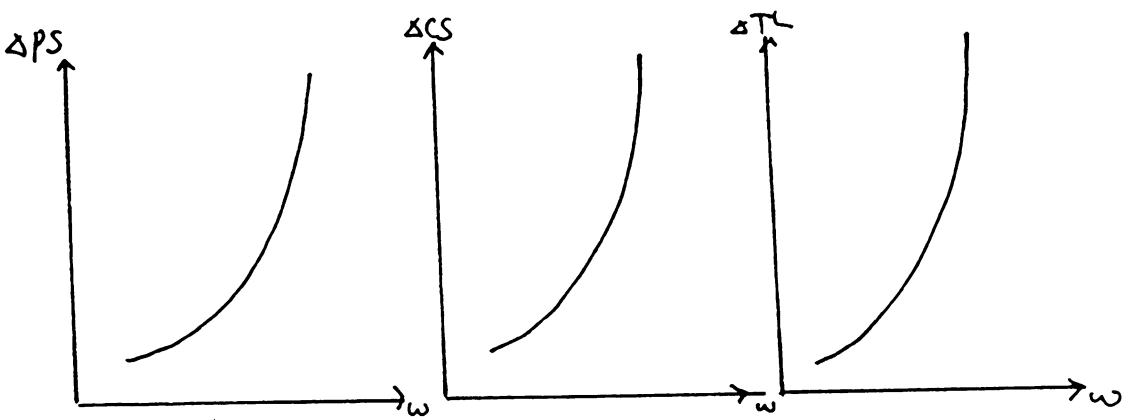
$$\frac{\partial \Delta CS}{\partial w} = \frac{(b_1c_1 - a_1d_1)^2}{(b_1 + d_1(w-2))^3} => 0, \frac{\partial^2 \Delta CS}{\partial w^2} = -\frac{3d_1(b_1c_1 - a_1d_1)^2}{(b_1 + d_1(w-2))^4} > 0 \tag{3.29}$$

$$\frac{\partial \Delta TL}{\partial w} = \frac{(b_1 - d_1w)(b_1c_1 - a_1d_1)^2}{b_1(b_1 + d_1(w-2))^3} => 0, \frac{\partial^2 \Delta TL}{\partial w^2} = \frac{2d_1(-2b_1 + dl + d_1w)(a_1d_1 - b_1c_1)^2}{b_1(b_1 + d_1(w-2))^4} > 0 \tag{3.30}$$

This proposition implies that as the exertion of political influence of the producer group increases, a) the marginal gain to the producer from a given weight reduction is

larger at higher w, and b) the marginal loss to the consumer or the taxpayer from a given weight(w) reduction is smaller at higher w. The relation between ΔPS, ΔCS, and ΔTL is diagrammed in Figure 3-4.

Figure 3-4. The relationship between ΔPS, ΔCS, and ΔTL and w



The fact that P_t, ΔPS, ΔCS, and ΔTL are increasing convex functions while P_l is a decreasing concave functions explains why it is so difficult to achieve substantial reform in inefficient agricultural policies. As the welfare weight w increases, the level of target price and the welfare level of the producer group increase. Thus, the producer group has a strong incentive to produce political pressure by spending time and money on political activities. But, at the same time, the welfare level of the consumer and taxpayer group decrease as the political influence of the producer group increases. Thus, the consumer and taxpayer group also have incentives to form a consumer-taxpayer coalition because they are being made worse off as the political influence of the producers

increases. However, the consumer and taxpayer are not as efficient as the producer in producing political influence because of the free-rider problem. Consequently, although the higher price support make the wheat program more inefficient, the producer group has a higher P_t and thus welfare level of the producer group increases as the political influence of the producer group increases. But the target price cannot be increased infinitely because of the public's counter group activities.

3.5. Comparative Static Analysis

The effects of changes in various market parameters[16] (Xi) on the optimal values of policy instruments (Zm) can be represented by total differentiation of Zm with respect to Xi. Taking the total differential of Zm with respect to Xi, then

$$\frac{dZ_m}{dX_i} = \frac{\partial Z_m}{\partial X_i} + \left(\frac{\partial Z_m}{\partial w}\right)\cdot\left(\frac{\partial w}{\partial X_i}\right) \tag{3.31}$$

$$\text{Since } \frac{\partial w}{\partial X_i} = \left(\frac{\partial w}{\partial C_s}\right)\cdot\left(\frac{\partial C_s}{\partial X_i}\right) + \left(\frac{\partial w}{\partial N_s}\right)\cdot\left(\frac{\partial N_s}{\partial X_i}\right), \tag{3.35}$$

Eq. (3.32) becomes

$$\frac{dZ_m}{dX_i} = \frac{\partial Z_m}{\partial X_i} + \frac{\partial Z_m}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial X_i} + \frac{\partial Z_m}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial X_i} \tag{3.33}$$

The two terms on the right side of Eq.(3.32) can be identified as the direct and indirect effects, respectively. The market parameters (Xi) can affect optimal values of policy instruments through two channels, 1) directly via $\frac{\partial Z_m}{\partial X_i}$ and 2) indirectly via

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[16]In this comparative static analysis, Xi can include non-market parameters, such as those listed in Table 4-1.

$$(\frac{\partial Z_m}{\partial w})\cdot(\frac{\partial w}{\partial C_s})\cdot(\frac{\partial C_s}{\partial X_i}) + (\frac{\partial Z_m}{\partial w})\cdot(\frac{\partial w}{\partial N_s})\cdot(\frac{\partial N_s}{\partial X_i}) \tag{3.34}$$

The indirect effect is composed of the effect of the political link and the effect of interactions between the political and economic links. The changes in market parameters(dXi) is transmitted to factors of political influence function(Cs, Ns). Through the resulting change in w(dw), it is conveyed to the set of policy instruments (Zm). That is, the set of policy instruments is a response to political influence generated by organized interest groups, providing incentives for collective action within groups, and the changes in the environment of the economic market. The interactions between the economic and political market is expressed as $\frac{\partial Y_j}{\partial X_i}$.

Using the implicit function theorem, the signs of $\frac{\partial C_s}{\partial X_i}$ and $\frac{\partial N_s}{\partial X_i}$ are

$$\frac{\partial C_s}{\partial X_i} = -\frac{F_{cx}}{F_{cc}} = (-)\cdot\frac{F_{cx}}{(-)} \tag{3.35}$$

$$\frac{\partial N_s}{\partial X_i} = -\frac{F_{cx}}{F_{nn}} = (-)\cdot\frac{F_{nx}}{(-)} \tag{3.36}$$

Since the sign of F_{cxi} decides the signs of $\frac{\partial C_s}{\partial X_i}$ and $\frac{\partial N_s}{\partial X_i}$, the sign of F_{cxi} with $\frac{\partial Z_m}{\partial X_i}$ and $\frac{\partial Z_m}{\partial w}$ helps evaluate the effects of market variables on the optimal values of policy control variables. For example, the effect of supply shifts on target price depends on the direct effect and indirect effect. Thus,

$$\frac{dP_t}{da} = \frac{\partial P_t}{\partial a} + \frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial a} + \frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial a} \tag{3.37}$$

The first and second term of Eq(3.37) are the direct and indirect effects, respectively.

$$\frac{\partial P_t}{\partial a_1} = \frac{-b_1+d_1(1-w)}{b_1(b_1+d_1(w-2))}. \quad \textit{Thus, if } 0<w<2, \quad \frac{\partial P_t}{\partial a_1}<0. \tag{3.38}$$

Thus, Eq. (3.38) shows that the sign of $\frac{\partial P_t}{\partial a_1}$ depends on w and b_1 and d_1.

From Eq. (3.38) and assumptions, Eq. (3.2) and Eq. (3.3) in Chapter 3,

$$\frac{\partial P_t}{\partial w}>0, \quad \frac{\partial w}{\partial C_s}>0, \quad \frac{\partial w}{\partial N_s}<0. \tag{3.39}$$

To examine the sign of $\frac{\partial C_s}{\partial a_1}$, $\frac{\partial N_s}{\partial a_1}$, the following relationship is used from the second stage of the optimization process. Thus,

$$F_{ca1}=\frac{\partial}{\partial a_1}(\frac{\partial \Delta PS}{\partial w})(\frac{\partial w}{\partial C_s})=(\frac{\partial^2 \Delta PS}{\partial w \partial a_1})(\frac{\partial w}{\partial C_s}) \tag{3.40}$$

$$\frac{\partial^2 \Delta PS}{\partial a_1 \partial w}=\frac{-2d_1^2(a_1d_1-b_1c_1)}{b_1(b_1+d_1(w-2))^3} \tag{3.41}$$

$$F_{ca1}=(\frac{\partial^2 \Delta PS}{\partial w \partial a_1})(\frac{\partial w}{\partial C_s})=(+)\cdot(+)>0. \tag{3.42}$$

Therefore, using the implicit function theorem, the sign of $\frac{\partial C_s}{\partial a_1}$, $\frac{\partial N_s}{\partial a_1}$ is derived by the following steps.

$$\frac{\partial C_s}{\partial a_1}=-\frac{\partial F_{ca1}}{\partial F_{cs}}=(-)\cdot\frac{(+)}{(-)} > 0. \tag{3.43}$$

Similarly,

$$F_{na1}=\frac{\partial}{\partial a_1}(\frac{\partial \Delta PS}{\partial w})(\frac{\partial w}{\partial N_s})=(\frac{\partial^2 \Delta PS}{\partial w \partial a_1})(\frac{\partial w}{\partial N_s}) \tag{3.44}$$

$$F_{na1}=(\frac{\partial^2 \Delta PS}{\partial w \partial a_1})(\frac{\partial w}{\partial N_s})=(+)\cdot(-)<0. \tag{3.45}$$

$$\frac{\partial N_s}{\partial a_1}=-\frac{\partial F_{ca1}}{\partial F_{ns}}=(-)\cdot\frac{(-)}{(-)} < 0. \tag{3.46}$$

Thus, the sign of dP_t/da_1 can be identified from Eq. (3.39), Eq. (3.43), and Eq. (3.46).

$$\frac{dP_t}{da}=\frac{\partial P_t}{\partial a}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial a}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial a} \tag{3.47}$$

$$\frac{dP_t}{da_1} = (-) + (+)\cdot(+)\cdot(+) + (+)\cdot(-)\cdot(-) = ? \tag{3.48}$$

The sign of dP_t/da_1 appears to be ambiguous. However if the direct effect is greater than the indirect effect, then the total effect is negative. Similarly, if the indirect effect is greater then the direct effect, then the total effect is positive.

If the same method is applied to other market parameters and farm policy instruments, the comparative static analysis to wheat programs is completely accomplished. The results of comparative static analysis are summarized in Table 3-1. The comparative static analysis generated the following interesting results.

Proposition 3-4. When the political process is endogenized in the model, the results of comparative static analysis and the redistributional efficiency depend not only on the distribution of the political influence function, w, and the type of political instruments used but also on the relative magnitude of direct and indirect effects.

Proof. See Appendix A.

This proposition indicates that the behavior of policy instruments in the wheat program are affected by the process of farm policy formulation, kinds and levels of policy instruments, and the market structure.

In the case in which parameters representing economic conditions affect the target price policy, if factors affecting the intercept of the supply equation shift upward under $1 < w < 2$, then the level of the target price rises. But, in the case in which $0 < w < 1$, the level of target price either rises or declines as w increases because the direct and indirect effects are different. If the indirect effect is greater than the direct effect, then the level of the target price rises. But if the direct effect is greater, the level of the target price declines. Consequently, if the direct effects outweigh the indirect effects,

Table 3-1. The results of the comparative static analysis to the wheat programs (Pt and Pl).

		P_t			P_l		
		Direct(1)	Indirect(2)	Total(3)	(1)	(2)	(3)
a_i		-	+	?	-	-	-
b_i	1< w<2	-	-	-	-	+	?
	0< w<1	-	-	-	+	+	+
c_i		+	+	+	+	-	?
d_i	1< w<2	-	-	-	+	+	+
	0< w<1	+	-	?	-	+	?

* (1): indicates the direct effect .
* (2): indicates the indirect effect .
* (3): indicates the total effect which is the sum of the direct effect and the indirect effect.

then the results of the comparative static analysis are dominated by the direct effects of market variables. In contrast, when the indirect effects outweigh the direct effects, the opposite results appear. The first and third row in Table 3-1 show these results.

The impacts of the supply elasticity (or slope of the supply curve) on the policy variables are different in each policy instrument. Given $1 < w < 2$, as the supply elasticity becomes inelastic, the level of the target price becomes higher, but the level of the loan rate program is indeterminate. Similarly, as the demand elasticity becomes inelastic, the level of the target price becomes higher and the level of the loan rate becomes smaller. The second row in Table 3-1 and Table 3-2 shows these results. Consequently, the effects of exogenous demand and supply shifts on the policy variables are not influenced by the distribution of the political influence function but are influenced by the relative magnitude of the direct effect and the indirect effects and the type of policy instruments used in wheat programs.

Gardner (1983) argued that there exists an a priori expectation that if supply and demand are inelastic, then redistribution efficiency will be increased under the specific commodity program such as a production control program. Bullock (1990) argued that this Efficient Redistribution Hypothesis (ERH) presented by Gardner can be wrong because the type of policy instrument affects the results of comparative static analysis. As Bullock pointed out, this a prior; expectation could be wrong because the optimal level of farm policy instruments, which in turn affect the redistribution efficiency, depends on the distribution of the political influence function, w, and the relative

magnitude of direct and indirect effects as well as the type of political instruments used[17].

Table 3-2. The results of the comparative static analysis under 1 < w < 2 (total effects).

Market Variables	P_t	P_l
a_1	?	-
b_1	-	?
c_1	+	?
d_1	-	+

[17]Bullock(1990) dealt with only one element, the type of policy instrument, as a factor affecting the results of comparative static analysis.

CHAPTER 4. EMPIRICAL ANALYSIS

The empirical analysis covers four main issues. First, the history of U.S. farm programs is briefly reviewed with a focus on the wheat programs. Second, based on current data from U.S. wheat programs, the political influence of the producer group is estimated. The domestic wheat programs included in the analysis are the target price/deficiency payment and loan rate. The study focuses on the relationship between the political influence of the producer group and the policy instruments. Third, in order to test the hypothesis generated from the comparative static analysis, policy behavioral equations are econometrically estimated. Finally, the relationship between the political influence weights and the changes in PS, CS, and TL is examined. In addition, the relationship between w and the efficiency of redistribution is examined; the redistribution efficiency is evaluated in terms of deadweight loss resulting from the wheat programs and the Surplus Transformation Curve (STC) developed by Gardner.

Data for the empirical analysis were obtained from several sources. Substantial portions of the data were collected from the AGMOD model, an econometric model of U.S. agriculture developed at Michigan State University (Ferris). The model is commodity specific and includes feed grains, soybeans, wheat and major livestock enterprises. Based on annual data from 1960-90, the data used in the AGMOD model were mainly collected from the Economic Research Service (ERS), a branch of the United States Department of Agriculture (USDA). The sample used in this study to estimate the current U.S. domestic wheat program model, however, covered the period

1974-1991. This period was chosen because the target price policy enacted in 1973 Act was in effect after 1974. The data for the number of farms participating in the wheat programs were obtained from the Commodity Fact Sheet of the Agricultural Stabilization and Conservation Service (ASCS) which is a branch of the United States Department of Agriculture (USDA, 1991). The data for the total number of wheat farms were obtained from the Census of Agriculture (1987). Because the census covered only a few years, the data for the total number of wheat farms are linearly interpolated to obtain values for non-census years. U.S. wheat prices (gulf) were used as proxies for world wheat prices. The data, their sources, and the definitions of the variables are given in Table 4-1 and Appendix C.

4.1. A Brief History of U.S. Farm Programs since 1973.

In order to interpret the results of estimating the political influence of the producer group using the actual data, it is essential to review briefly the history of U.S. farm programs. Since the sample for the empirical analysis covers the period of 1974-1991, the U.S. farm programs considered in this study are the 1) Agriculture and Consumer Protection Act of 1973, 2) Food and Agriculture Act of 1977, 3) Agriculture and Food Act of 1981, 4) Food Security Act of 1985, and 5) Food, Agriculture, Conservation and Trade Act of 1990.

Table 4-1. Data Description.

Variables	Symbol	Definition	Sources
Area Harvested	AHWHF	$/BU	ERS,USDA. Wheat Outlook
Area Set-Aside	ASAWHF		
Consumer Price Index	CPI	1982-84: 1.0	
Disposal Income Per Capita Deflated by CPI	DICD	$	
Difference for Gross Margin b/w Program and No Program	DPMWHF	$/acre	
Set-Aside Requirement	DRWH	%	
Expected Price Received by Farmers	EFPWHF	$/BU	
Expected Gross Margins in the Wheat Programs	EPWHDF	$/BU	
Price Received by Farmers	FPWHF	$/BU	
Interest Rate	IRLB	%	
Loan Rate	LRWH	$/BU	
Gross Margin on Wheat	NWHDF	$/acre	
Population of the U.S	POP	Million	
Production of Wheat	QWHF	Mil. BU	
Ratio b/w Harvested Area and TAWSAF	RHTWHF	%	
Total Area (Harvested + Set-Aside)	TAWSAF	Mil. acre	
Target Price	TPWH	$/BU	
Total Utilization	UWHF	Mil BU	
Yield on Wheat	YWH	BU/acre	
Cost of Energy	CSTERWH	$/acre	
Number of Wheat Farms	NUMWHF	1000	Census of Agriculture
Number of Participating Wheat Program	NUMPWP	1000	Commodity Fact Sheet, ASCS
Export Price	EXPWH	$/BU	

1) Agriculture and Consumer Protection Act of 1973.

The Agriculture and Consumer Protection Act of 1973 was legislated in an entirely different atmosphere from farm programs developed the 1930s; this atmosphere was one of excess demand and rising prices. The role of consumer power in affecting farm programs was substantial (Tweeten, 1989).

The 1973 Act made significant revisions in income programs. Strong exports, excess demand and rising prices of agricultural products allowed the farm programs to move toward more market-oriented farm programs. To separate price and income support, the parity formula was dropped and target prices were introduced to set a direct deficiency payment when market prices fell below the target price.

The goal of the target price system was to support income without affecting the market price. Since the market prices of wheat were coming down from the high levels of 1974 and 1975, the target prices were set directly by legislation in the 1973 Act and remained at the same level in 1974 and 1975. The lower market prices of wheat for 1975 and 1976 induced an adjustment in the target prices by applying a formula based on an index of prices paid by farmers and changes in yield. Maximum allowed payments to any one person were lowered to $ 20,000. The 1973 Act continued the set-aside concept and promoted flexibility by making crop-specific payments for program crops planted (Harwood and Bailey).

Because of large foreign demand from 1973 to 1977, the 1973 Act emphasized expansion of production to meet world demand. Therefore, the 1973 Act remained largely an implemented backstop rather than an operating program since market prices remained above target levels over most of the Act's life (Tweeten, 1989).

2) Food and Agriculture Act of 1977

The 1977 Act, covering four years, retained the basic structure of the 1973 Act but introduced several modifications. The 1977 Act adjusted target prices on the basis of changes in production costs per bushel, instead of using the aggregate price paid index. This Act reflected the unfavorable economic circumstances with no real increase in net export, small acquisition, and a continued increase in farm productivity. That is, for the final three years of the 1977 Act (1979 and subsequent years), unfavorable economic conditions forced all target prices to escalate according to changes in the variable costs of production. Thus, the compromise target price levels were substantially higher in absolute terms than those of the previous 1973 Act. Under the 1973 Act, deficiency payments were oftentimes considered out of line with current planting patterns. But the 1977 Act introduced the normal crop acreage concept-- acreage based on the farm shift from the historical period to the current or the preceding year's planted acreage. Thus, the target price remained important in affecting producer planting decisions and market prices, but direct payments were tied to normal crop acreage adjusted for set asides, not the actual plantings (Spitze, 1978).

The farmer-owned grain reserve was established in the 1977 Act which recognized the growing importance of exports to U.S. agriculture and the potential for greater demand and price instability.

Statutory minimum loan levels remained constant for wheat and feed grains through the life of the 1977 Act. Both domestic and foreign food aid programs such as the food stamps program, WIC, and P.L. 480 were encompassed. The cash purchase requirement for food stamps by eligible recipients had been eliminated.

3) Agricultural and Food Act of 1981.

With world-wide recession, falling exports, growing surpluses, and real net farm income declining in 1982 to the lowest level since the Great Depression, the focus of the debate was on price and income supports and methods for adjusting these levels annually. Decisions about the 1981 Act were especially influenced by an inflation of almost 13 percent in the two years of 1979-80.

The target price (cost of production) adjustment formula specified by the 1977 Act, applied during a period of rapid inflation, had not boosted target prices enough to satisfy agricultural interests. Thus, minimum target prices were established for the 1982 through 1985 crops. These minimum levels increased about 6 percent per year, reflecting anticipated inflation rates. After enactment of the 1981 Act, a decrease in annual inflation rates, which is a result of Federal Reserve monetary policy actions begun in Octerber 1979, and increases in deficiency payments soon brought about Adminstration efforts to reduce target prices below levels established in the 1981 Act. The 1981 Act set the minimum nonrecourse loan rate at levels which made the U.S. non-competitive in the world markets.

The 1981 Act also reestablished acreage bases for individual crops, reflecting recent crop plantings. Crop-specific acreage bases created inflexibility in farmers' planting decisions. In the mid-1980's, when participation rates in ARP were high, the acreage-base concept locked in production patterns in much the same way as had the acreage allotments under earlier programs. The attractive Payment-In-Kind(PIK) program which led to above 75 percent participation, converted wheat acreage into conserving uses. But falling exports and record yields prevented 1983's sharp acreage cut from a significant reduction in stocks (Spitze, 1983).

4) Food Security Act of 1985

The development of farm legislation in 1985 took place during serious financial stress for many farmers. High real interest rates and a major decline in land values left many farmers badly over leveraged, forcing some into bankcruptcy. Between 1982 and 1985, the United States suffered a significant loss of export markets and farm income, accompanied by growing surplus stocks and escalating government costs. Thus, the Food Security Act of 1985 was designed to increase U.S. competitiveness in world markets and to support farm income. To achieve these goals, the 1985 Act employed lower loan rates, generic certificates, and export promotion in the wheat program. It also provided for a transition from high and rigid price support to flexible and market-clearing price support and was designed gradually phase out the acreage reduction program.

Freezing target prices at 1985 levels for 1986-87 and allowing for slowly declining target prices(limited to 10 percent between 1987-1990) thereafter maintained farm income support. The subsequent large gap between loan rates and target prices resulted in large deficiency payments(Young, et al). The 1985 Act gave the Secretary of Agriculture greater flexibility in setting loan rates and allowed exporters greater latitude in getting competitive prices.

5) Food, Agriculture, Conservation and Trade Act of 1990

The 1990 Farm Act was comprised of 25 sections including the various commodity groupings, conservation, agricultural trade, research, food stamps, human resources, rural electrification, and global climate change. The 1990 Act attempted to reduce the budget exposure of farm programs, to combine acreage reduction with

conservation objectives and to keep U.S. crops competitive in world markets. The flexibility in substituting crops represents a major new feature. It froze target prices at the 1990 level for the duration of the Act. In the budget reconciliation process, the choice was to adopt the " triple base " option, which reduced the acreage on which deficiency payments are made, rather than reducing the target prices. Loan rates and the ARP operated similarly to the 1985 Act (USDA, 1991).

By reviewing a short history of U.S. farm programs, the following facts should be addressed as characteristic of recent U.S. Farm Acts. First, the current Farm Act demonstrates a continued evolution from several previous Farm Acts. Usually the continuity in the price and income intervention policies from past Farm Acts outweigh the dramatic changes in farm policies. The introduction of the target price and the establishment of the farmer-owned grain reserve in the 1973 Act and the 1977 Act indicates that the government does have a major degree of autonomy in setting initial policy rules to achieve resonable market balance. But the continuity of minor modifications from past public policies shows that the levels of farm programs were affected by the macro political and economic conditions once a framework of institutions had been developed (Paarlberg, 1989).

Second, as the Farm Acts developed, the Farm Acts were more inclusive and comprehensive. The 1990 Act included 25 distinct sections while the 1981 Act included 18 sections.

Third, the policy-making process deals not only with the different political philosophies but also with disparate economic orientations. Hence, the adoptions of various Farm Acts are the outcomes of a bargaining game among competing interest

groups including several farm organizations, the House, the Senate, and the Administration of the U.S. government.

Fourth, one of the major determinants of new farm legislation is the immediate economic situation at that time the legislation is being debated. Continued high inflation in the two years of 1979-80 greatly affected the enactment of the 1981 Act. The economic conditions during the 1984-85 period were crucial to the enactment of the 1985 Act. The macroeconomic conditions, such as high interest rates and declining land values, the significant loss of export markets and farm income, growing surplus stocks and escalating government costs during the 1984-1985, caused the 1985 Act to employ lower loan rates, generic certificates, and export promotion to increase U.S. competitiveness in the world.

Fifth, the Farm Acts greatly influence the level of welfare and income of several interest groups. Some groups were made better off and others worse off from the farm programs over the years.

Finally, the various Farm Acts show how a new set of policy instruments is developed. If farm policy instruments are left unadjusted as the economic environment changes, a policy disequilibrium develops: the past policies are no longer appropriate to the original policy objectives. The policy disequilibrium leads to a policy crisis when dissatisfaction with either program benefits or costs is widespread. Thus, a change in policy or a new package of policy instruments becomes inevitable(Rausser and Foster).

4.2. Estimation of the Political Influence of the Producer Group

In order to estimate the political influence of the producer group, supply and demand function parameters in the presence of wheat programs should be estimated. The estimation of a commodity supply function in the presence of government programs is difficult to estimate due to changing provisions in the programs as well as to a myriad of supply-affecting provisions (Babcock et al).

There are various approaches to estimating supply and demand functions. They can be estimated using econometric approaches or by noneconometric approaches such as Gardner's or Babcock's methods. The econometric approach can directly estimate supply and demand equations without using arbitrary assumptions. However, program complexities, such as year-to-year changes in program mechanisms and the level at which policy instruments are set, challenge various econometric approaches in estimating commodity supply functions under program constraints (Cramer et al).

On the other hand, noneconometric approaches can be used to estimate the parameters of supply and demand functions. Since linear supply and demand curves are assumed in this study's theoretical model, the parameters necessary to conduct empirical analysis are data on quantities and prices. Supply and demand price elasticities with a wheat program and without a wheat program for this study were collected from previous literature in which supply and demand elasticity were usually estimated by the econometric approaches.

Noneconometric approaches focus on the determination of supply prices. Gardner substituted estimates of supply and demand elasticities into a supply and demand function where no program for wheat existed. The elasticities' estimates were

obtained from estimates of a wheat market where wheat programs did exist. This procedure provided the equilibrium price and quantity under a no-program situation. Cramer et al (1990) applied the Gardner method to the rice program in the U.S. The supply price of rice was the weighted average of the price received by producers participating in the program and those not participating in the rice program. Babcock et al (1990) formulated a model to represent a wheat supply in the 1986 crop year. The parameters of the two supply functions were determined by postulating what supply would have been with and without the programs in 1986, and by selecting reasonable elasticities for each supply function. They used an elasticity of 0.5 for the supply without wheat program and 0.4 for the supply curve with wheat program.

Since the objective of this section is to estimate parameters of demand and supply curves for several years with and without wheat programs, the simple replacement method is used to substitute the values of prices, quantity, and elasticity data for the linear supply and demand equations. That is, the intercept and slope terms of the supply and demand curves are adjusted and expressed as linear functions of own-price and quantity by substituting each year's data for wheat prices, quantities, and supply and demand elasticities for the linear supply and demand curves. The acreage elasticity is assumed to be + 0.3 and the elasticity for total demand is assumed to be - 0.2 over the sample period. The supply price is the seasonal average price from a year ago (t-1) and is used as a proxy variable for the expected price of wheat[18]. The demand price is the season average price received by farmers. The quantity of supply is the total amount

[18]The acreage response literature suggests past prices received by farmers and futures prices as predicting prices that farmers could use (Lee and Helmberger).

of production produced from the harvested area. The quantity for total demand is total utilization including the domestic utilization and the amount of export.

The same procedure is used to derive parameters of demand and supply under the free market equilibrium without wheat programs. The quantity of supply is the amount of production which is produced from both harvested and set-aside areas. The total demand, prices, and elasticities data are the same as before.

The adjusted parameters for demand and supply with and without wheat programs are used as the basis for estimating the distributional effects of wheat programs. That is, estimating parameters under the economic market makes it possible to 1) derive free market equilibrium, P_0 and Q_0, 2) estimate quantitatively the political influence of the producer group, and 3) measure the changes in PS, CS, TL, TDWL, etc. The parameters of adjusted demand and supply curves(a_0, a_1, b_0, b_1, c_1, and d_1) are presented in Table 4-2.

Equation (3.26) in Chapter 3 indicates the relation of the political influence of the producer group to P_t and market parameters. Equation (3.16) indicates that the political influence of a producer group is influenced by the parameters of economic and political markets which change over time. Thus, by substituting the values of a_1, b_1, c_1, and d_1 into Equation (3.16), the political influence of the producer group can be estimated. This method of estimating weights, w, is the concept of an ex-post measurement reflecting the final results of the decision-making process.

The yearly political influence of the producer group estimated from Eq. (3.13) is reported in Table 4-2. Figure 4-1 shows the trend in the changes in the political influence of the producer group. Table 4-2 indicates that the values of the estimated weights are between 0 and 2. The values of w are less than 1 in 1974, 1975, 1989, and

Table 4-2. The Values of Parameters of Adjusted Demand and Supply During the Sample Period.
(Unit : a_0, a_1, c_1 = Mil. Bu. b_0, d_1 = Mil. Bu/($/Bu))

Year	a_0	a_1	b_0	b_1	c_1	d_1	Weight of Producers
1974	1428.3	1247.4	90.401	135.34	2029.2	-85.620	0.65912
1975	1701.4	1488.9	104.00	156.01	2280.0	-92.910	0.73930
1976	1718.6	1504.3	121.03	181.61	2044.8	-96.000	1.0938
1977	1638.2	1432.2	150.01	224.84	2380.8	-145.35	1.0927
1978	1419.3	1243.2	152.28	228.67	2437.2	-174.33	1.0102
1979	1710.0	1493.8	143.94	215.56	2589.6	-145.32	1.0874
1980	1905.5	1666.7	126.02	188.97	2755.2	-121.48	1.0254
1981	2224.6	1949.5	142.24	213.68	3141.6	-133.91	1.0764
1982	2212.4	1935.5	151.53	227.26	2900.4	-132.44	1.2955
1983	1935.3	1694.0	136.29	204.51	3048.0	-143.10	1.0781
1984	2076.6	1816.5	147.90	221.79	3093.7	-146.90	1.1829
1985	1941.0	1696.8	143.14	214.51	2353.2	-115.69	1.5555
1986	1670.5	1463.7	135.59	203.67	2636.4	-142.66	1.2086
1987	1687.2	1475.6	174.29	261.32	3220.8	-221.82	1.1668
1988	1451.3	1268.4	141.18	211.52	2872.8	-186.30	1.0411
1989	1626.9	1425.9	109.33	164.27	2670.0	-119.62	0.94759
1990	2189.2	1915.2	147.13	220.65	2944.8	-131.94	1.2276
1991	1583.0	1386.7	151.63	227.70	3171.4	-202.52	0.96876
Mean	1784.3	1561.4	137.1	205.66	2698.3	-140.99	1.0809

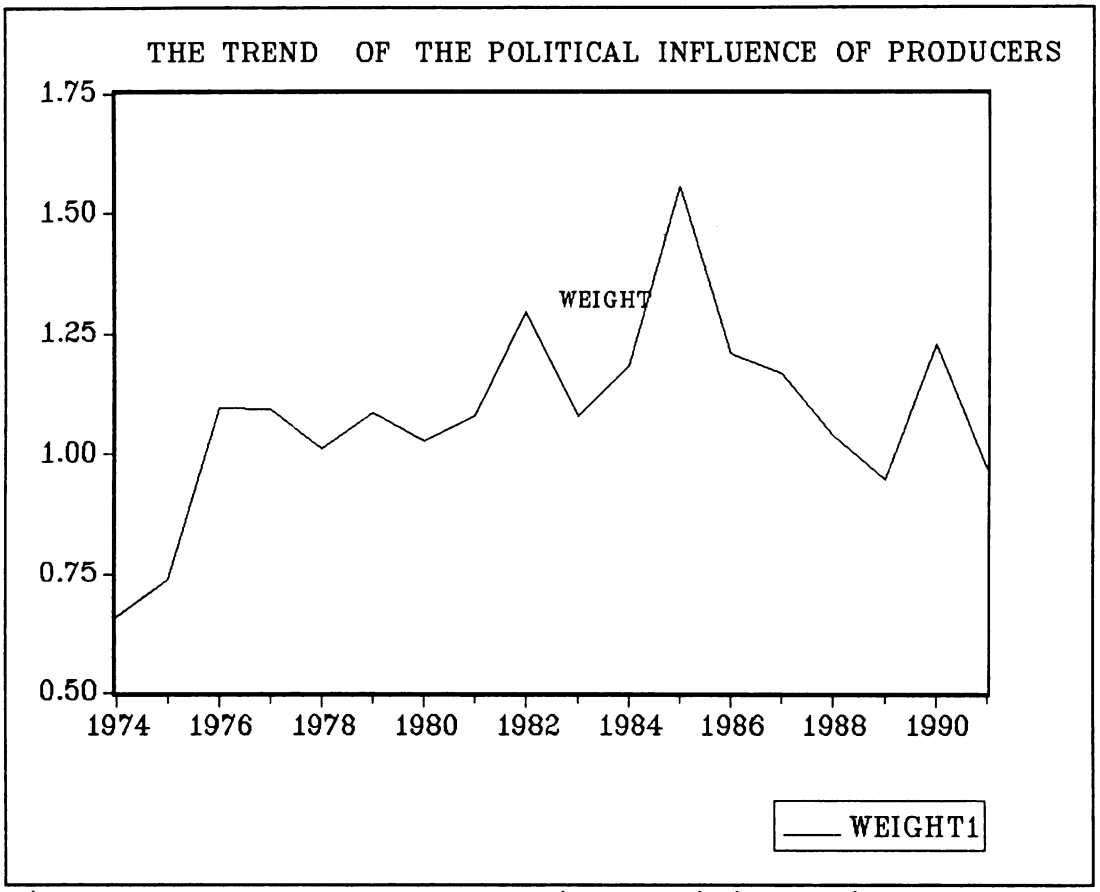

Figure 4.1. The changes in political influence of producers.

1991. The mean value of the political influence of the producer group was 1.08, which implies that the welfare of producers was weighted about 8 percent more than that of the public (consumers and taxpayers) during the period covered in this study.

The values of the political weights estimated over the sample period are interpreted in terms of the changing wheat policies and wheat market circumstances. Since the political weights of the producer group are estimated from the changes in producer surplus in the PPF model, the estimated political weights will be interpreted by the changes in the level of the target price and economic conditions. Decision-making about policy instruments in the wheat program is greatly affected by the political

influence of producers which is a reflection to changes in the economic conditions. But since the estimated values of the political influence were inferred from the first order condition in the optimal wheat policies, the estimated values of political influence can reflect changes in the economic conditions and changes in wheat policy instruments.

The value of the weights for 1974 and 1975 are 0.659 and 0.739, respectively, which reflect the rise of consumer political power resulting from excess demand and rising prices of wheat in 1974-75. The weight of 1.09 for 1976-77 indicates that the producer group increased political pressure in order to recover the economic loss from the inflationary trend and lower market prices of wheat for two years. The mean value of 0.83 during the 1973 Act reflects good market conditions for wheat. There is little incentive for producers to generate political influence accompanied with transferring farm income. Consequently, the weight of 0.83 presents the relative rise of consumer's power over the period of excess demand and rising prices.

The lower weight for 1978 indicates that the target price decision procedure was the same as for the 1973 Act. No increase in exports, but favorable farm productivity, for 1979 led to the different target price formulas based on the costs of production. Thus, the weight of 1.09 for 1979 shows a little higher political influence in taking the different target price formulas. There were no ARPs because of increasing exports for 1980-81. The mean value of 1.05 during the 1977 Act reflects the transition from the excess demand to the excess supply in the wheat market.

The high political weight of 1.30 for 1982 indicates that the high target price was based on the forecast of high inflation of almost 13 percent in the years 1979-1980 preceding the adoption of the 1981 Act. However, it turned out that the target price was too high due to a decrease in annual inflation rates. As a result, the lower political

weight of 1.08 shows that the target price was adjusted to reduce target prices below the level established in the 1981 Act. The high political influence of 1.56 for 1985 reflects not only a deteriorated wheat market condition due to falling export and lower market prices of wheat and the declining real net farm income, but also serious financial stress for wheat producers due to high interest rates and declining land values during 1982-84.

The weight of 1.26 for 1986 reflects freezing target prices at 1985 levels for 1986-87. The political weights appear to slowly decline between 1986 and 1989. These declining political weights indicate that U.S. competitiveness increased in the world as the loan rates became lower; thus wheat exports were promoted with slowly declining target prices. Thus, the mean value of the 1985 Act declined from 1.24 of the 1981 Act to 1.12.

The estimated values of political influence of the producer group confirm that the economic conditions are major determinants in changing the levels of farm policy instruments.

The mean values of w during the period covered by the Farm Acts are presented in Table 4-3.

Table 4-3. The Mean Values of Weights During the Period Covered by the Farm Acts.

	1973 Farm Act	1977 Farm Act	1981 Farm Act	1985 Farm Act
Mean value of weights	0.83	1.06	1.24	1.12

The political influences of the producer group are 1.09, 1.07, 1.55, and 1.23 for the beginning years of 1977, 1981, 1985, and 1990 during which new Farm Acts were enacted[20]. The political weights were generally higher (except for 1981) than the subsequent years of each Farm Act. This indicates that when a Farm Act is enacted, the producer group attempts to produce stronger political influence in order to recover the economic loss from the changes in economic conditions. That is, the imbalance in economic conditions such as the excess demand or excess supply resulting from the changes in export, productivity, and weather, affects the levels of the policy instruments to get out of economic losses caused by changing economic conditions. The significant loss from the changing economic situation makes a group which is a worse off form coalitions to influence the process of farm policy formulation, accompanied with transferring income from a group better off to a group worse off.

As a result, the trend of the changing political weights shows how the policy disequilibrium developed. Shocks to the economic environment led to changes in the

[20]Since the target price policy was in effect after 1974, the political influences of the producer group for 1973 cannot be estimated.

levels of policy instruments in order to solve the policy crisis resulting from changes in the welfare distribution among interest groups.

The political influence of the producer group may be underestimated because the stockholding policies such as the CCC, farm reserve policy, or the Export Enhancement Program (EEP) are ignored. The estimated welfare weights of the producer groups are used to estimate the relationship between the political influence of the producer and the policy instruments of the wheat program as well as the relationship between w and efficiency in redistribution.

4.3. Evaluation of the Alternative Political Influence of the Producer Group

Because the weights (w) of consumers and taxpayers are normalized to be 1, w reflects the relative strength of producers and the public (consumer and taxpayer). Thus, two different political influences from the two first order conditions, Eq. (3.11) and Eq. (3.12), can be derived. The weight estimated from Eq. (3.11), which is defined as w_1, is a function of the target price. The weight shows the relationship between w and the target prices under changing target prices, holding all others unchanged at some level. That is, w_1 reveals the political influence from the wheat program that implements a target price policy while maintaining status quo intervention. Similarly, another weight from Eq. (3.12), which is defined as w_2, is a function of the loan rate. This weight shows the relationship between w and the loan rates under changing the loan rates, holding all others unchanged at some level. The political influence of the wheat program which implements a loan rate policy while maintaining status quo intervention is revealed by w_2. Since the weight, w_1, depends on P_t which, in turn, affects the changes in PS, the

political influence of the producer group is identified by estimating w_1. Eq. (3.23) and Eq. (3.24) in Chapter 3 present two different political influences. These weights are presented in Table 4-5. The movements of each weight over time are shown in Figure 4-2. Figure 4-2 shows that two weights moved in opposite direction to each other. For example, the highest value of w_1 is the lowest value of w_2 in 1985.

Table 4-4. Comparison of Two Different Political Influences

Year	Weight1	Weight2
1974	0.65912	1.2506
1975	0.73930	1.2091
1976	1.0938	0.95401
1977	1.0927	1.0563
1978	1.0102	1.1218
1979	1.0874	1.0870
1980	1.0254	1.0657
1981	1.0764	1.0294
1982	1.2955	0.87161
1983	1.0781	1.0337
1984	1.1829	1.0232
1985	1.5555	0.78022
1986	1.2086	1.1644
1987	1.1668	1.2371
1988	1.0411	1.2947
1989	0.94759	1.2720
1990	1.2276	1.1273
1991	0.96876	1.3289

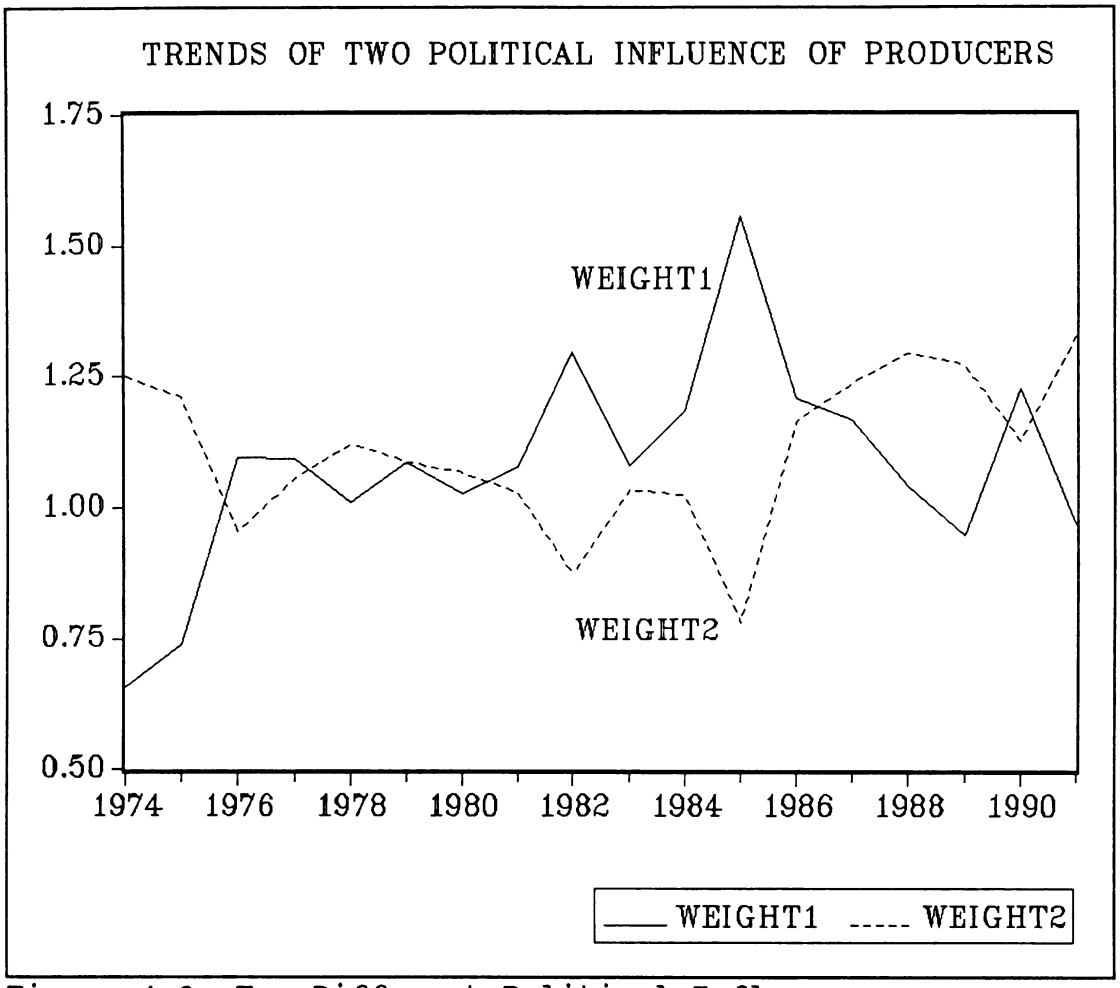

Figure 4-2. Two Different Political Influences

4.4. The Relationship Between Policy Instruments and Political Influence of the Producer Group Using Actual Data

The estimated political influence of the producer group and the level of policy instruments in wheat programs are presented in Table 4-5. Figure 4-3 shows the relationship between the political influence of the producer group and the level of policy instruments in the wheat programs. Figures 4-4 and 4-5 show the relationship between the political influence of the producer group and each policy instrument in the wheat programs. The figures show that the level of target price and loan rate increases as the political influence of the producer group increases. Consequently, the behavior of policy instruments in the wheat program is not consistent with the hypothesis generated from the theoretical model. The inconsistencies indicate that the model is inappropriate. These problems may arise because the PPF framework is an unsatisfactory model of government behavior, or that the particular function chosen is the wrong one.

Table 4-5. The Estimated Political Influence of the Producer Group and the Levels of Policy Instruments in Wheat Programs

Year	Target Price	Loan Rate	Weight
1974	2.0500	1.3700	0.65912
1975	2.0500	1.3700	0.73930
1976	2.2900	2.2500	1.0938
1977	2.9000	2.2500	1.0927
1978	3.0000	2.3500	1.0102
1979	3.4000	2.5000	1.0874
1980	3.6300	3.0000	1.0254
1981	3.8100	3.2000	1.0764
1982	4.0500	3.5500	1.2955
1983	4.3000	3.6500	1.0781
1984	4.3800	3.3000	1.1829
1985	4.3800	3.3000	1.5555
1986	4.3800	2.2900	1.2086
1987	4.3800	2.2800	1.1668
1988	4.2300	2.2100	1.0411
1989	4.1000	2.0600	0.94759
1990	4.0000	1.9500	1.2276
1991	4.0000	2.0400	0.96876

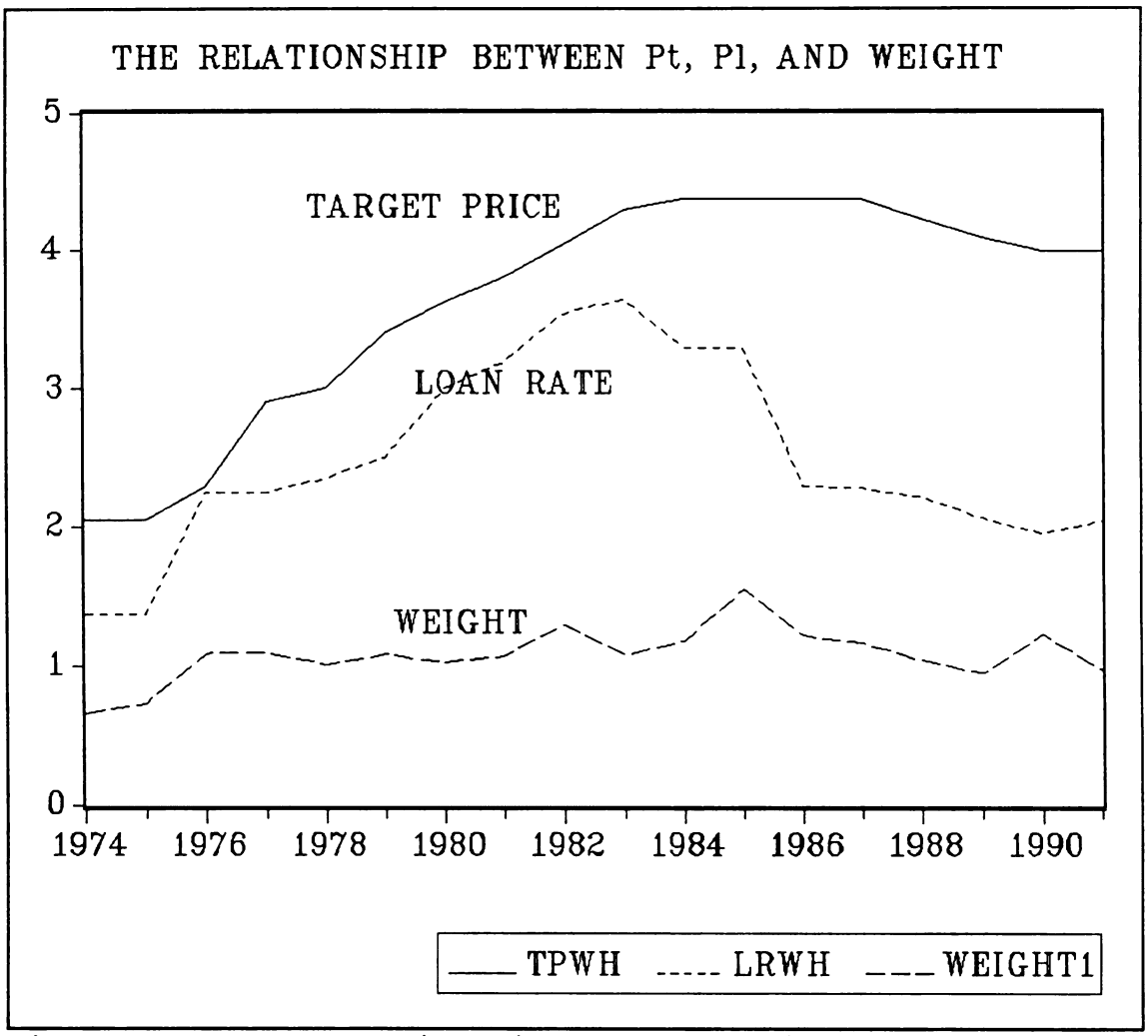

Figure 4-3. The Relationship between Policy Instruments and Political Influence of Producers.

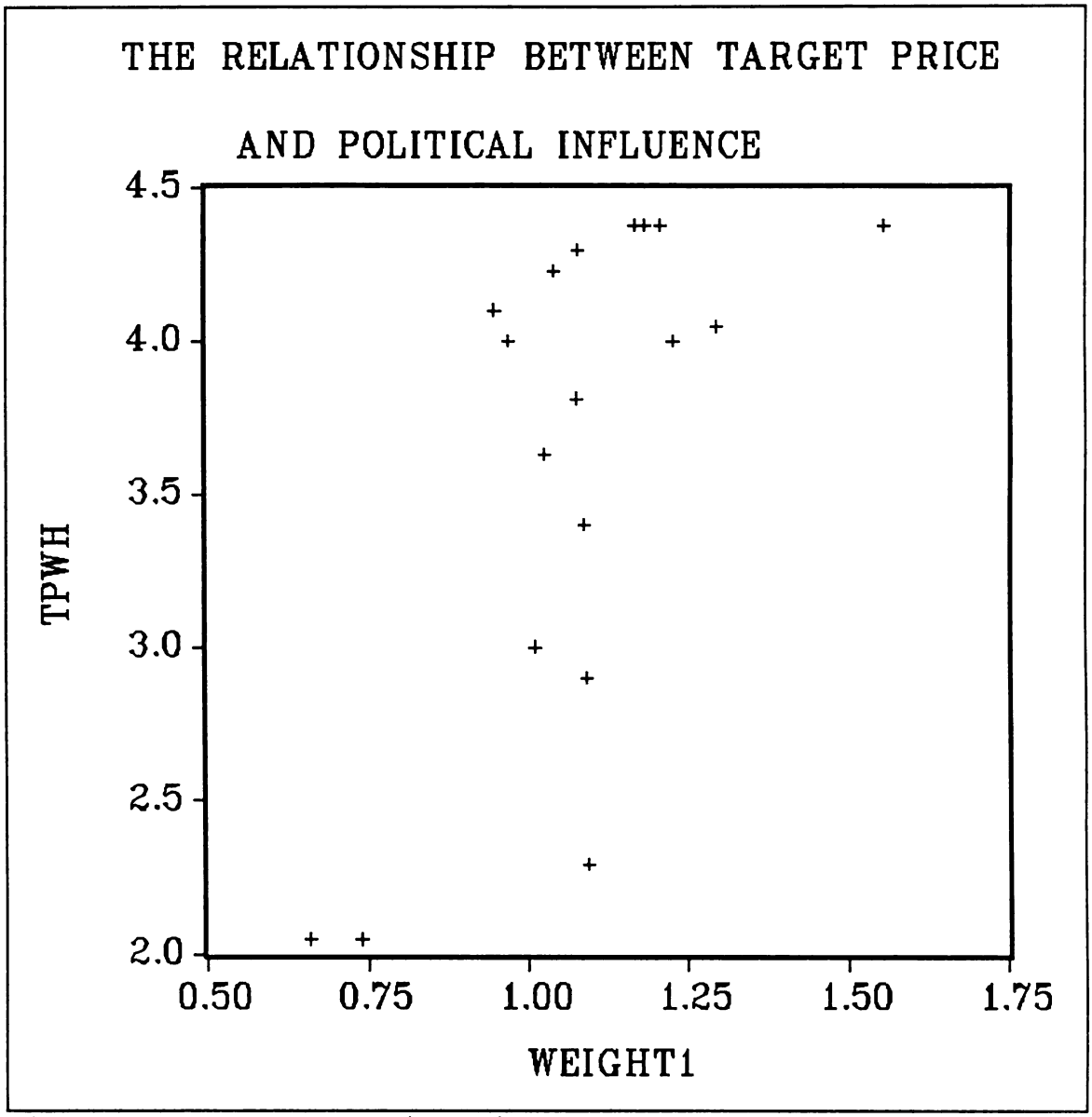

Figure 4-4. The Relationship between the Target Prices and the Political Influence of Producers

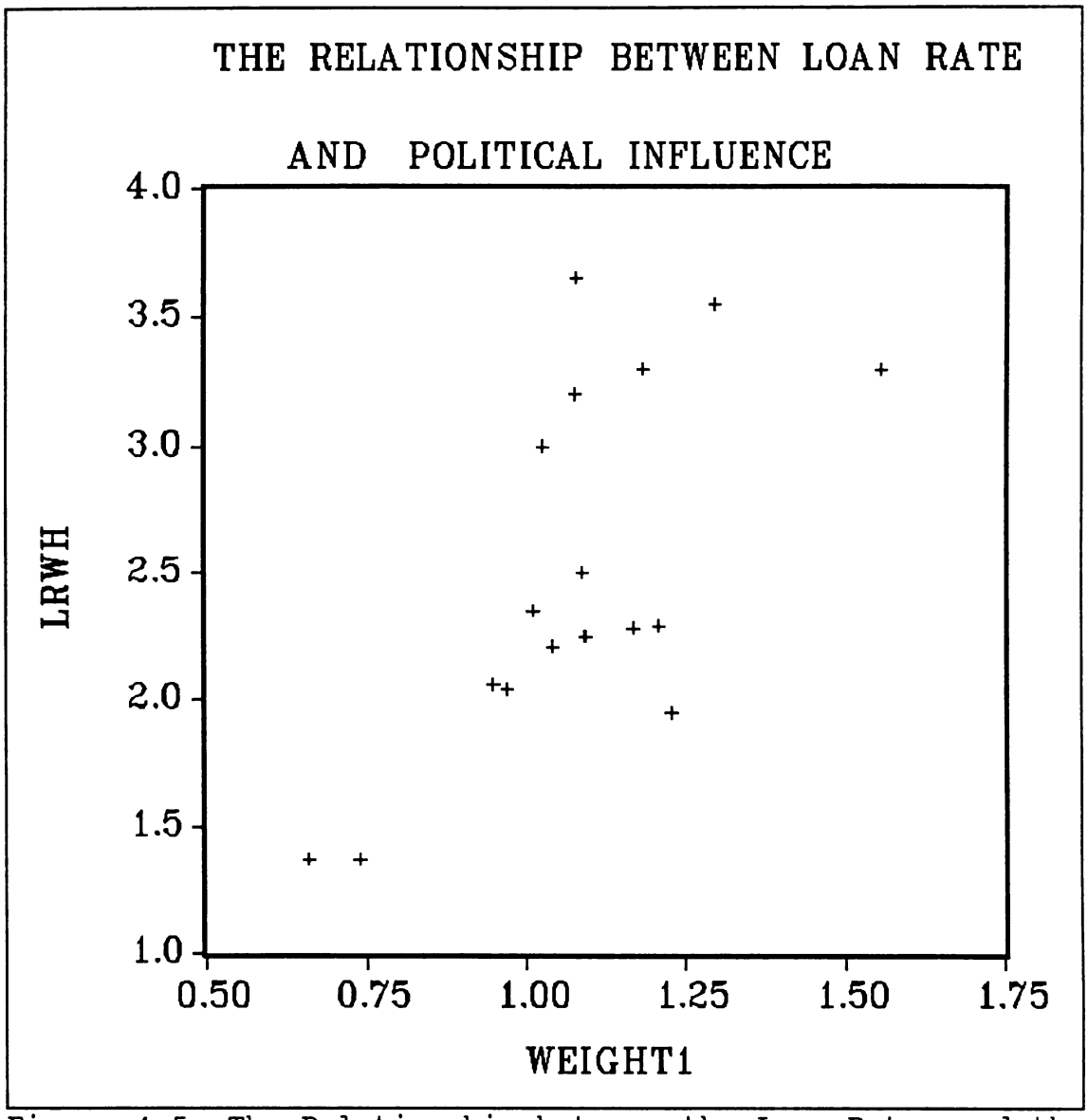

Figure 4-5. The Relationship between the Loan Rates and the Political Influence of Producers.

4.5. Estimation of Policy Behavioral Equations

This section explores several issues related to the estimation of policy behavioral equations(PBE) including: 1) the determinants which affect the level of various policy instruments (P_t, P_l) in domestic wheat programs, and 2) the effects of political and economic variables on the PBEs. The adequate specification of PBEs allows not only for the evaluation of a priori expectations by estimating actual response of policy variables with respect to changes in exogenous variables but also the prediction of policy behavior for domestic wheat programs including short-run and long-run forecasts.

The PBEs are specified as follows :

$$Z_m = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \epsilon \quad (4.1)$$

where $\epsilon \sim i.i.d.(0, \sigma^2)$, Z_m is the set of policy instruments in domestic wheat programs; X_1 is the political expenditure of the producer group; X_2 is the size of the producer group; X_3 is the set of variables which shifts total demand for wheat (for example, income and population); X_4 is the set of variables which shifts the supply of wheat (for example, interest rate and energy costs); X_5 represents dummy variables which indicate the shifts in the structure of the wheat programs, and X_6 represents other policy incentive variables related to the set of policy instruments. Thus, X_1, X_2, and X_6 represent political and policy variables, while X_3 and X_4 represent economic variables.

Each explanatory variable plays a specific role. That is, the number of farms participating in wheat programs (NUMPWP) and the difference of the gross margin on wheat over variable costs between participants and nonparticipants in the wheat program

(DPMWHF) are proxy variables[21] for the size and for the expenditure on the political influence of the producer group. Disposable income per capita deflated by CPI (DICD) and the civilian population of the U.S.(POP) are variables representing demand shifts. Interest rates charged new borrowers at the Federal Land Banks (IRLB) and the cost of energy related inputs such as fertilizer, chemicals, and fuel (CSTERWH) are variables representing supply shifter variables. D7780, D8184, and D8591 are dummy variables which represent the shifts in the structure of the commodity during each Farm Act, and DUMALP is a dummy variable which indicates implementation of the supply control policy.

Regression analysis was performed using a set of policy instruments in wheat programs as dependent variables and a set of political and economic market variables as regressors (independent variables). To avoid degree of freedom problems caused by a large number of exogenous variables and a limited number of observations, the Ordinary Least Square (OLS) estimation technique was preferred over the Simultaneous Equation Estimation techniques such as 2SLS and 3SLS. Any potential gain that could be achieved by a simultaneous equation is offset by potential loss if there is misspecification in the model. The presence of serial correlation in the error structure found in estimating the PBE for the loan rate policy is corrected using a first order autoregressive error specification (AR(1) procedure).

The time periods for the regression analysis covered the year 1974-91 for the target price policy and 1960-91 for the loan rate and ARP. The time period for the loan rate and ARP was extended to increase the number of observations.

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[21]Value of production can be an alternative proxy variables. But since the estimated result was statistically insignificant, the DPMWHF was used.

Table 4-6. The Estimated Results of Policy Behavioral Equations for P_t and P_l

	Target Price (P_t)	Loan Rate (P_l)	
Intercept	-7.81(- 6.08)[a]	6.73(5.20)	5.70(6.75)
NUMPWP	-0.00(- 0.11)	0.00(0.64)	
DPMWHF	0.01(2.61)	-0.00(- 0.52)	
POP	0.03(5.79)	-0.04(-4.67)	-0.03(-0.52)
DICD			
IRLB	0.36(8.40)	0.13(2.23)	
CSTERWH		0.02(1.90)	
DRWH			
TPWH		0.53(3.22)	0.42(5.04)
D7780	0.52(4.92)	0.33(2.40)	0.41 (4.53)
D8184		0.47 (2.40)	0.65(4.21)
DUMALP			
R^2	0.97	0.95	0.95
R^2	0.96	0.93	0.94
D.W	2.28	2.69	2.23
F-statistic	85.56	45.47	64.85
ρ			-0.39(-1.89)

a. t-values in parenthesis.

NUMPWP: the number of farms participating wheat programs.
DPMWHF: the difference between the real gross margin (over direct costs) of participants and non-participants.
DICD: disposable income per capita
POP: civilian population of the U.S.
IRLB: interest rates
CSTERWH: the energy costs(fertilizer, chemicals, petroleum) per acre on wheat.
D7780, D8184, D8591: dummy variables for the shifts of the farm program structure
DUMALP: a dummy variable indicating implementation of the supply control policy for 1974-1977 and 1980-81.
DRWH: set-aside requirement for wheat as a percent of the acreage base
TPWH: the level of the target price
D.W.: the Durbin-Watson statistic

The estimation results of the PBEs for the target price, loan rate, and acreage reduction program appear in Table 4-6. The detailed outputs of running OLS are presented in Appendix D.

In estimating the PBEs for the sample period, it is assumed that wheat policy instruments are affected by the immediate economic situation at that time the legislation is being debated as well as the likely economic conditions expected during the period in which each Farm Act is implemented.

Under an assumption of perfect forsight, economic conditions expected at the time the legislation is debated are exactly the actual economic conditions realized during the implementation of the Act. Consequently, contemporaneous economic variables are used as regressors in estimation of PBEs.

OLS estimates of PBEs for the sample period yielded a number of results. Most of the coefficients had the expected signs; signs on the coefficients, in general, corresponded with a priori reasoning and were statistically significant. Because the R^2 in all the PBEs were above 0.9, the explanatory power of all the PBEs were satisfactory.

However, the policy variable NUMPWP was not significant for the target price. The signs on NUMPWP and DPMWHF were as expected for their effect on the target price. This indicates that the level of the target price increases as expenditures on political activities increase and the number of farms participating in wheat programs decreases because of the reduction of the free-rider problem. Thus, wheat producer groups prefer to increase target prices by forming effective coalitions.

According to the results of comparative static analysis from the theoretical model, the signs on the supply shifters are ambiguous because they depend on the magnitude of the direct and indirect effect. The sign of IRLB as a supply shifter appeared to be

positive in the empirical analysis. If only the direct effects (economic link) are considered in the model, the sign of IRLB is negative. Without developing the political economy model which considers the direct (economic link) and indirect effect (political link and interaction between two links), the interpretation of the positive sign on IRLB might be difficult. The positive sign on IRLB indicates that the indirect effects dominate the direct effects. That is, the positive sign on IRLB appears to reflect the total effect which depends on the economic link and political link and on the interaction between the two links. The dummy variable, D7780, which represents the structural changes in wheat programs during the 1977 Act, explains the behavior of the target price well.

In the estimation of PBE for PI, the political variables, NUMPWP and DPMWHF, were not significant; this means that the political variables of producers did not seem to have significant effects in determining the level of the loan rate. Thus, an alternative PBE for the loan rate in which the political variables are deleted was introduced. The results of estimation of an alternative PBE reported better performance in explaining the behavior of the loan rate. The IRLB and CSTERWH as supply shifters did not have the expected signs. This result may be explained due to the noninclusion of the stockholding policy as one of the supply control policies. The dummy variables, D7780 and D8184 which represent the structural changes in wheat programs during the 1977 and 1981 Farm Acts, and the level of the target price explained the behavior of the loan rate policy well. This result indicates that the behavior of the target price and loan rate policy are greatly influenced by several Farm Acts which are the outcomes of the bargaining game among competing interest groups and which reflect the macro economic and political circumstances.

The impact of the Payment-In-Kind (PIK) program on the behavior of policy instruments in the wheat program was investigated by sensitivity analysis. However, it turned out that the PIK program did not affect the behavior of each policy instrument in the wheat program. This result indicates that although the attractive PIK program led to high participation, falling exports and record yields prevent 1983's sharp acreage cut from a significant reduction in stocks.

In summary, the empirical results obtained from this study found :

1) Most coefficients of selected regressors had expected signs and were statistically significant. The explanatory power of all PBEs was satisfactory.

2) The behavior of the target price responded to the political influence produced by membership size and expenditure on political activities of the producer group. However, the policy behavior of the loan rate was not affected by the political influence of the producer group. Beyond such political factors, economic factors affecting shifts in demand and supply were also responsible for explaining the behavior of policy instruments in the wheat program.

3) The Farm Acts' dummy variables, which represent the structural changes in wheat programs, and other policy instruments, such as DRWH, helped explain the policy behavior of wheat programs. This result indicated that the behavior of the target price and loan rate policy were greatly influenced by several Farm Acts which were the outcomes of the bargaining game among competing interest groups and reflected the macro economic and political circumstances.

4) As the theoretical model predicted, the policy behavior of wheat programs was explained by the political process through which economic interests were translated into

actual farm policies and the market structure through which the real income of each interest group was affected.

4.6. The Distributional Effects Resulting from Domestic Wheat Programs

This section attempts 1) to examine the relationship between free market prices under no wheat programs, market prices (seasonal average prices) under wheat programs, and policy prices such as target prices and loan rates and 2) to analyze how wheat programs affect the welfare level of producers, consumers, and taxpayers.

Before addressing the social costs and redistribution efficiency resulting from wheat programs, it is helpful to examine the relationship between free market prices under no wheat programs, market prices (seasonal average prices) under wheat programs, and policy prices, target prices and loan rates in understanding the role of these prices with regard to social costs and redistribution efficiency.

The free market prices under no wheat programs, the market prices under wheat programs, and policy incentive prices are presented in Table 4-7. The movements of those prices are illustrated in Figure 4-8.

Table 4-7 and Figure 4-6 indicate the following facts :

1) Target prices were lower than the market prices(seasonal average price received by producers) in 1974-76 and 1979. The target prices have been higher since 1980. Target prices were higher than the loan rates for the entire sample period. Target prices were also higher than the free market price except for 1974 and 1975. Thus, there were positive producer surpluses for most years of the wheat programs.

2) Market prices (farm received prices) were higher than loan rates except for the years 1983 and 1985. Market prices were higher than the free market prices except for 1977. The fact that loan rates were greater than the free market price over the period 1982 - 85 explains why the losses in consumer surplus occurred and TDWL was large during the period. These empirical results justified the fact that the theoretical model, in which $P_t > P_1 > P_0$ was assumed, was well specified except for a few years in which the loan rates were lower than the free market price. Since lower loan rates and lower market prices caused consumer surplus to increase, consumers were better off with relatively lower deadweight loss since 1986.

The changes in producer surplus, consumer surplus, and taxpayer losses were calculated from Eq. (3.6), Eq. (3.8), and Eq. (3.9).[21] The distribution and magnitude of the gains and losses to producers, consumers, taxpayers, and the net social costs(TDWL)[22] in wheat programs are presented in Table 4-8. When the participation rate in the wheat program is considered, the changes in producer surplus, consumer surplus, and taxpayer losses are illustrated in Table 4-9. The movements of the changes in producer surplus, consumer surplus, and taxpayer losses are illustrated in Figure 4-7.

Calculated changes in PS were related to the reductions in CS. The changes in PS were directly opposite to the changes in CS as shown in Figure 4-7. From 1974 to 1991 the changes in PS, CS, and TL averaged 2641.1, - 1643.3, and 2688.9 million dollars respectively. Thus, the absolute deadweight loss for the wheat program averaged 1691.2 million dollars per year. The changes in TL steadily increased from 1974 to 1986, and

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[21]In calculating the changes in producer surplus, the portion in which the intercept of the supply curve is greater than 0 was considered because price cannot be negative.

The net social costs (TDWL) are measured by the change in PS plus the changes in CS minus the changes in TL (or government revenues).

Table 4-7. The Estimated Free Market Prices under No Wheat Programs, Market Prices under Wheat Programs, and Policy Incentive Prices

Year	Free Market Price	Market Price	Target Price	Loan Rate
1974	3.5232	4.0900	2.0500	1.3700
1975	3.1792	3.5500	2.0500	1.3700
1976	1.9493	2.7300	2.2900	2.2500
1977	2.5580	2.3300	2.9000	2.2500
1978	2.2291	2.9700	3.0000	2.3500
1979	2.3027	3.7800	3.4000	2.5000
1980	3.5035	3.9100	3.6300	3.0000
1981	3.4415	3.6500	3.8100	3.2000
1982	2.1782	3.5500	4.0500	3.5500
1983	1.1783	3.5100	4.3000	3.6500
1984	1.7925	3.3900	4.3800	3.3000
1985	0.41071	3.0800	4.3800	3.3000
1986	1.6067	2.4200	4.3800	2.2900
1987	1.8721	2.5700	4.3800	2.2800
1988	2.1858	3.7200	4.2300	2.2100
1989	3.3234	3.7200	4.1000	2.0600
1990	2.1827	2.6100	4.0000	1.9500
1991	2.9013	3.0500	4.0000	2.0400

the high taxpayer loss was not significantly changed over the period in which target prices held at the same levels. Loan rates became lower since 1986. Total deadweight loss has been substantial since 1982.

Consequently, wheat programs forced consumers and taxpayers to transfer income to producers during most of the sample period (before 1989). The deadweight losses arose from government intervention in the U.S. wheat market in order to protect

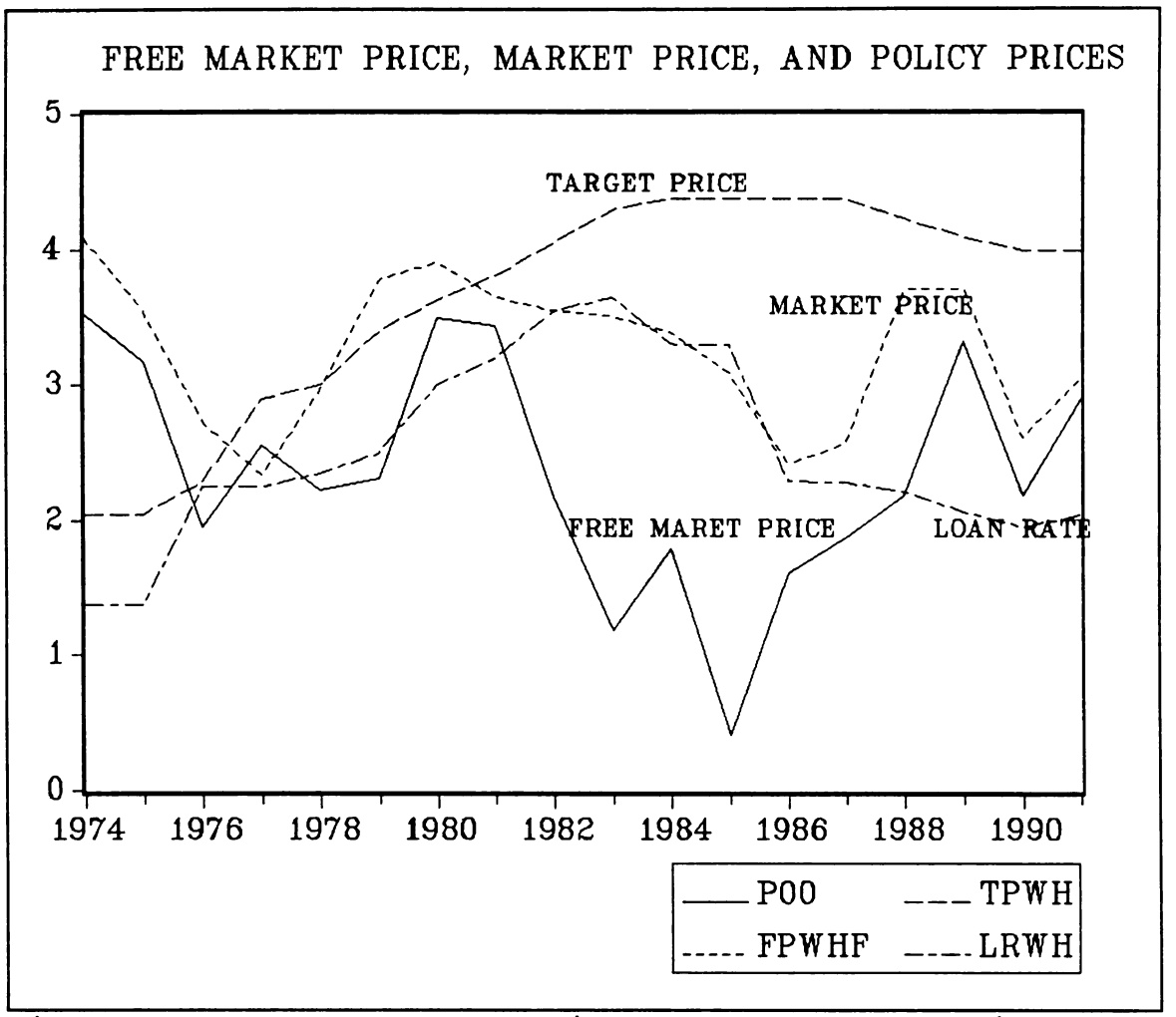


Figure 4-6. The Market Price, Free Market Price, and Policy Incentive Prices.

domestic producers at the expense of taxpayers and consumers. However, the lower loan rates and maintained target prices and implementation of ARP resulted in positive gains in consumer surplus since 1989. The recent wheat programs supported the producer group and improved the welfare of the consumer group at the expense of the taxpayer group. Recent high taxpayer losses resulting from the higher deficiency payment (the lower rates and maintained target prices) disclosed that the clear losers resulting from recent wheat programs were the taxpayers.

Table 4-8. The Gains and Losses to Producers, Consumers, and Taxpayers, and Net Social Costs.

Year	Producer Surplus	Consumer Surplus	Taxpayer Loss	Deadweight Loss	Weight
1974	-2751.8	-965.4	1036.9	-4754.1	0.65912
1975	-2554.4	-729.5	1229.9	-4513.8	0.73930
1976	341.02	-554.30	76.807	-290.08	1.0938
1977	417.55	461.9	1354.7	-475.36	1.0927
1978	1216.5	-246.33	1254.0	-283.82	1.0102
1979	2005.5	-442.01	2004.0	-440.49	1.0874
1980	-154.2	-936.9	1482.2	-2573.3	1.0254
1981	480.42	-556.1	1685.8	-1761.5	1.0764
1982	4524.0	-3458.3	1428.0	-362.21	1.2955
1983	6799.9	-6679.9	1672.7	-1552.7	1.0781
1984	6124.0	-4100.0	3011.0	-987.03	1.1829
1985	8680.4	-6178.9	2847.3	-345.78	1.5555
1986	5505.6	-1611.4	4923.6	-1029.3	1.2086
1987	5505.8	-1125.9	5502.4	-1122.4	1.1668
1988	3748.2	-59.725	4369.5	-680.97	1.0411
1989	1216.4	-891.9	4282.8	-3958.3	0.94759
1990	4296.9	-1123.1	5735.5	-2561.6	1.2276
1991	2137.4	-381.9	4503.1	-2747.6	0.96876

Table 4-9. The Gains and Losses to Producers, Consumers, and Taxpayers, and Net Social Costs (Consideration of the Participation Rate*).

Year	Producer Surplus*	Consumer Surplus	Taxpayer Loss	Deadweight Loss	Weight
1974	N.A	3918.2	N.A	N.A	0.65912
1975	N.A	3742.6	N.A	N.A	0.73930
1976	N.A	-554.30	N.A	N.A	1.0938
1977	N.A	625.74	N.A	N.A	1.0927
1978	868.6	-246.33	895.4	-273.13	1.0102
1979	1034.8	-442.01	1034.1	-441.32	1.0874
1980	-150.8	1188.4	1449.6	-2537.3	1.0254
1981	464.6	651.26	1630.2	-1721.7	1.0764
1982	2185.1	-3458.3	689.7	-1962.9	1.2955
1983	5290.3	-6679.9	1301.4	-2691.0	1.0781
1984	3662.2	-4100.0	1800.6	-2238.5	1.1829
1985	6458.2	-6178.9	2118.4	-1839.1	1.5555
1986	4696.3	-1611.4	4199.8	-1114.9	1.2086
1987	4817.6	-1125.9	4814.6	-1122.9	1.1668
1988	3215.9	-59.725	3749.0	-592.8	1.0411
1989	951.2	2966.4	3349.1	-3289.8	0.94759
1990	3562.1	621.88	4754.7	-2315.7	1.2276
1991	N.A	2300.7	N.A	-381.9	0.96876

*: The program participation rate is defined as acreage allotment of participating farms divided by the national acreage allotment. Data are collected from the Commodity Fact Sheet, ASCS.

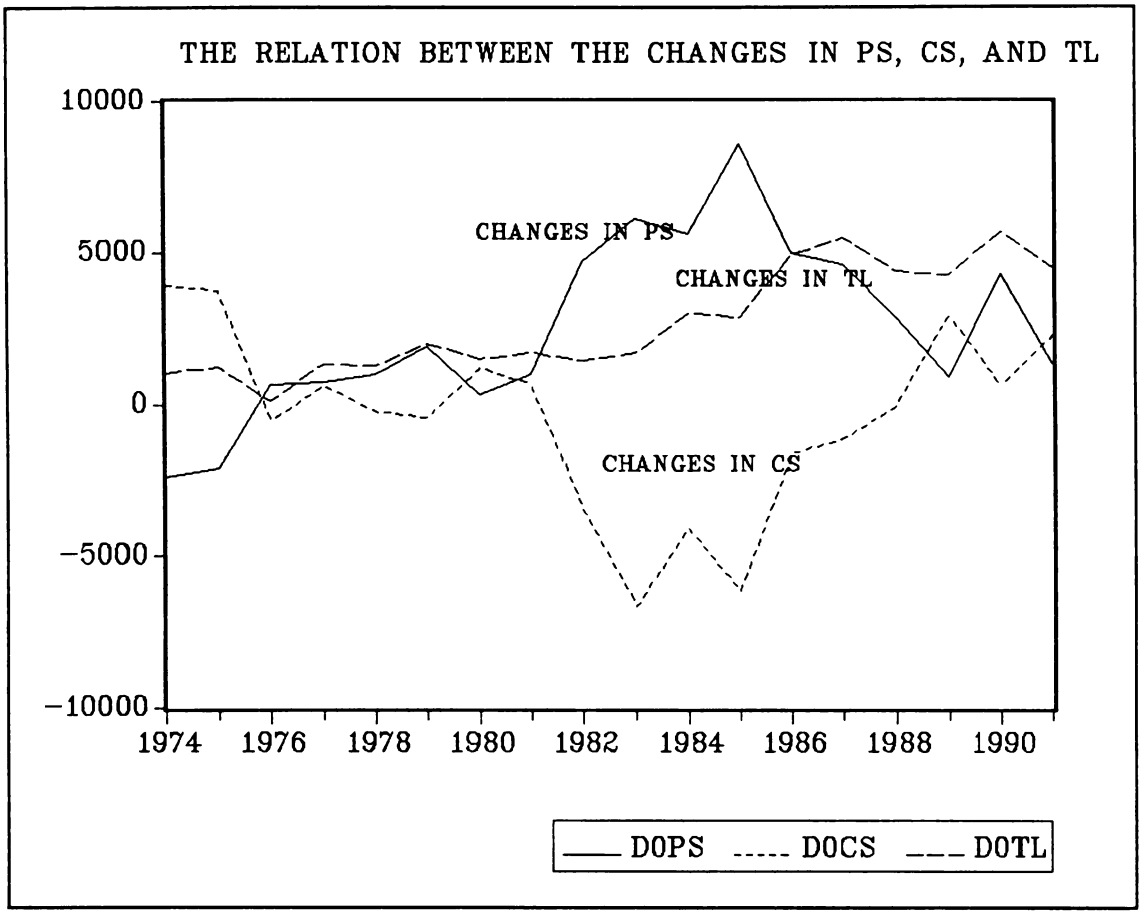


Figure 4-7. The Relationship between the Changes in PS, CS, and, TL.

4.7. Relationship Between the Political Influence of the Producer Group and Redistribution Efficiency of Wheat Programs

This section attempts 1) to investigate theoretically the relationship between the political influence of the producer group and redistribution efficiency of the wheat programs, 2) to examine empirically the relationship between the political influence of the producer group and the welfare levels of the interest groups, 3) to compare various redistributional efficiency measures developed from previous studies, and 4) to examine the relationship between the estimated political influence of the producer group and the transfer efficiency.

The choices of policy instruments in wheat programs result in trade-offs of the gains of producers and losses of consumers' surplus and taxpayers' losses. Gardner (1983) defined the combinations of PS and CS attainable by changing prices or quantities as Surplus Transformation Curves (STC). It is a concept similar to the utility possibility curves in the single-product framework. Gardner argued that the slope of STC is an indicator in measuring redistribution efficiency.

The trade-offs are the changes in PS and the changes in CT (which is the sum of consumer surplus and the taxpayer loss) resulting from the wheat programs. In order to derive the slope of STC, the changes in PS should be calculated. Eq.(3. 6), Eq. (3. 8) and Eq. (3. 9) show the changes in PS and CT. Thus, the changes in PS and CT are

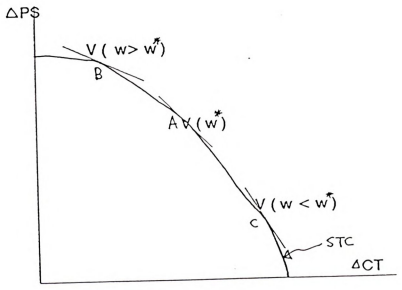
$$\Delta PS = a_1 P_t + \frac{b_1}{2} P_t^2 - a_0 P_0 - \frac{b_0}{2} P_0^2 - \frac{a_0^2}{2b_0} + \frac{a_1^2}{2b_1} \tag{3.6}$$

The surplus transformation curve is obtained by solving Eq. (3.6) for P_t and substituting in Eq. (4.3). Thus, the relationship between the changes in producer surplus and the

$$\Delta CT = -c_1(P_1 - P_0) - \frac{d_1}{2}(P_1^2 - P_0^2) - b_1 P_t^2 - (a_1 - b_1 P_1)P_t + a_1 P_1 \quad (4.3)$$

changes in consumer surplus can be shown. The curve of the STC is shown in Figure 4-9. The efficient redistribution tells how much PS will increase for each dollar that CT falls. This condition is expressed graphically by means of the line segment with slope STC passing through point A in Figure 4-9. Perfectly efficient redistribution is achieved at a point in which the slope of the STC is -1. As the slope increases, the optimal point moves from point A to point C; the changes in PS increase and the changes in CT decrease.

Figure 4-8. The Surplus Transformation Curve.



The STC developed by Gardner focused on investigating how the trade-offs between producer and consumers or taxpayers are changed if a single policy is changed

while holding other policy instruments constant. Since most farm programs simultaneously cover several policy instruments to achieve policy goals, the slope of STC under the multiple policy scheme should be derived. Although Bullock (1992) tried to derive the slope of STC under the multiple policy scheme, it is relatively difficult to derive the slope of the STC under the multiple policy scheme.

Since the PPF is defined as $V = w\Delta PS + \Delta CS - \Delta TL$, the slope of STC under the current wheat programs is $\frac{d\Delta PS}{d\Delta CT} = -\frac{1}{w}$, where CT is the sum of CS and TL. Thus, as the political influence of the producer group increases, the slope of the STC declines. This relationship at the optimal point implies that the political pressure of the producer group has an inverse relationship with redistributional efficiency. The political influence of the producer group has been regarded as the outcome of bargaining between conflicting interest groups as well as the political influence of the producer group. However, this inverse relationship between w and the slope of STC suggests that w can be a good measure of inferring redistributional efficiency. Once the linear PPF is defined and w is estimated, the transfer efficiency of the government's farm programs can be evaluated by simply looking at w instead of calculating the slope of the STC or deadweight losses.

A single policy scheme is the case where only one policy instrument (for example, the target price) is changed holding other policy instruments constant. Under a single policy scheme, if demand and supply functions are assumed to be linear, w is derived as Eq. (3. 26). Moreover, more general results can be obtained concerning the relationship between STC and w by relaxing the assumption of linear demand and supply.

The effect of a marginal change in P_t (target price) on the change in PS are $\frac{d\Delta PS}{dP_t} = S_1(P_t)$. Similarly, the effect of change in the target price P_t on the changes in CT is $\frac{d\Delta CT}{dP_t} = -[S_1(P_t) + P_T S_1'(P_t)]$. To get a unit free measure, the change in PS is normalized by dividing by P_tQ_t, where P_t is D(Q). The effect of a percentage change in P_t, $\frac{dP_t}{P_t}$ is obtained by dividing by D(Q):

$$\frac{d\Delta PS/P_tQ_t}{dP_t/P_t} = \frac{d\Delta PS}{dP_t} \cdot \frac{1}{Q_t} = \frac{S_1(P_t)}{Q_t} = 1 \tag{4.4}$$

$D(Q_t)$ is the target price on the demand function and $S(Q_t)$ is the target price of the supply function at Q_t. Using a unit free measure, when P_t is changed, the change in CT is

$$\frac{d\Delta CT/P_tQ_t}{dP_t/P_t} = -\frac{d\Delta CT}{dP_t} \cdot \frac{1}{Q_t} = -\frac{S_1(P_t)+P_tS_1'(P_t)}{S_1(P_t)} = -(1 + \epsilon_s) \tag{4.5}$$

Thus, when the target price is changed, the slope of STC is found by dividing Eq. (4.4) by Eq.(4.5) :

$$\frac{d\Delta PS}{d\Delta CT} = -\frac{1}{1+\epsilon_s} \tag{4.6}$$

Thus, the following relationship is established at the optimal point,

$$\frac{d\Delta PS}{d\Delta CT} = -\frac{1}{w} = -\frac{1}{1+\epsilon_s} \tag{4.7}$$

Thus, w can be expressed as a function of the supply elasticity at the optimal point,

$$w = 1 + \epsilon_s. \tag{4.8}$$

The optimum is achieved at the point in which w is equal to the $1 + \epsilon_s$. In general, since the elasticity of supply is greater than 0, w is greater than 1. If the elasticity gets close to 0, then w becomes 1 and the slope of the STC also becomes 1 from the above Eq. (4. 7).

As a result, under a single policy scheme,

$$\frac{d\Delta PS}{d\Delta CT} = -\frac{1}{1+\epsilon_s} \tag{4.9}$$

Under the multiple policy scheme, $\frac{\Delta PS}{\Delta CT} = -\frac{1}{w}$

Thus, if $w < 1 + \epsilon_s$, the slope of STC under a single policy scheme is less than that under the multiple policy scheme, then the redistribution efficiency under the multiple policy scheme is greater than that under a single policy scheme. In this empirical analysis, the average welfare weight is 1.08 over the years 1974-91. Since the supply elasticity is assumed as 0.3, $1 + \epsilon_s$ is 1.3.

Thus, $-\frac{1}{1.08} = -0.93 < -0.73 = -\frac{1}{1.3}$. This implies that the redistribution efficiency under current wheat programs is greater than those in which only the target price changes while the loan rate and ARP are held constant. If the U.S. wheat program is evaluated in terms of the redistribution efficiency, the current wheat programs (combination of P_t, P_l, α) are preferred to the wheat program in which the only target price is changed while holding the loan rate and ARP constant.

The estimates of the political influence of the producer group and the changes in PS, CS, TL are shown in Table 4-9 and Table 4-10. As the political influence of the producer group became stronger, the changes in PS rose and the changes in CT (the sum of CS and TL) declined. The political influence of the producer group positively affected the changes in PS and negatively affected the changes in CT.

The political influence of the producer group, total deadweight losses, the slope of the STC, and $\frac{TDWL}{\Delta PS}$ as efficiency measures of wheat programs are presented in Table 4-10. The DWLPS suggested by Cramer et al (1990) means each dollar of deadweight loss per dollar transferred to producers was associated with the commodity programs. The values of Table 4-10, Figure 4-9, and Figure 4-10 demonstrate that, by and large, the political influence of the producer group has an inverse relationship with the slope of the STC and a positive relationship with TDWL. This result indicates that w can be an indicator for measuring redistribution efficiency as the theoretical model predicted.

Table 4-10. The Political Influence of the Producer Group, Total Deadweight Losses, and the Slope of the STC as Efficiency Measures of Wheat Programs.

Year	Total Dead Weight Loss	Slope of STC	DWLPS	Weight
1974	-4754.1	1.37	-0.047	0.65912
1975	-4513.8	1.30	0.016	0.73930
1976	-290.08	-0.54	-0.851	1.0938
1977	-475.3	-0.47	-0.745	1.0927
1978	-283.82	-0.81	-0.233	1.0102
1979	-440.49	-0.82	-0.219	1.0874
1980	-2573.3	0.06	2.905	1.0254
1981	-1761.5	-0.21	-1.153	1.0764
1982	-362.21	-0.92	-0.080	1.2955
1983	-1552.72	-0.81	-0.228	1.0781
1984	-987.03	-0.86	-0.161	1.1829
1985	-345.78	-0.96	-0.039	1.5555
1986	-1029.37	-0.84	-0.187	1.2086
1987	-1122.47	-0.83	-0.204	1.1668
1988	-680.97	-0.84	-0.181	1.0411
1989	-39658.3	-0.23	-0.082	0.94759
1990	-2561.6	-0.63	-0.190	1.2276
1991	-2747.6	-0.43	-0.030	0.96876

* Slope of STC = (changes in producer surplus) / (changes in consumer surplus + changes in taxpayer loss)

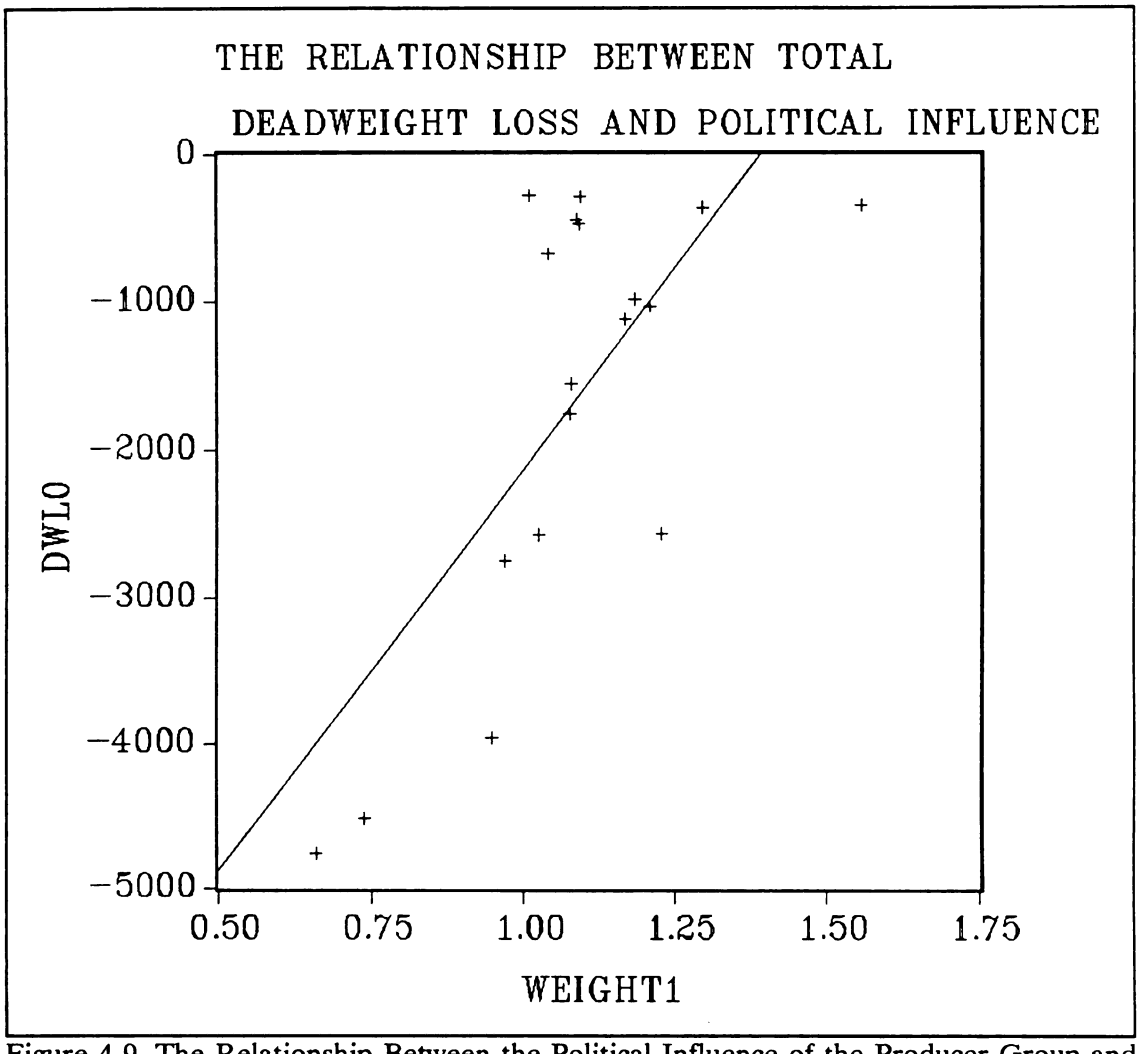


Figure 4-9. The Relationship Between the Political Influence of the Producer Group and Deadweight Loss

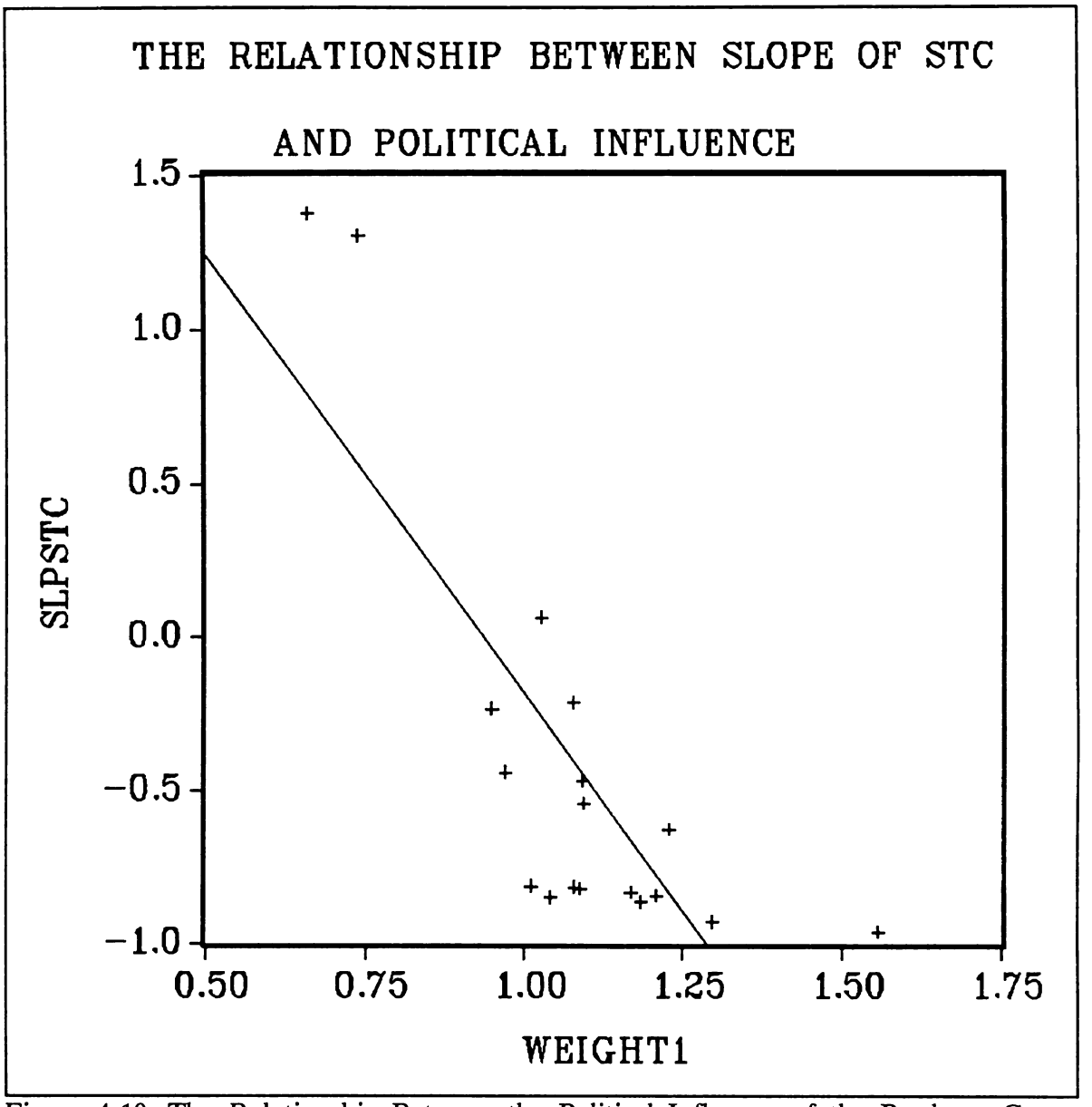


Figure 4-10. The Relationship Between the Political Influence of the Producer Group and Slope of STC

CHAPTER 5. SUMMARY AND CONCLUDING REMARKS

Under the rapidly changing domestic and international circumstances surrounding farm issues, a number of questions have been raised in the debate over farm policy reform. These questions include 1) how the government and its associated political processes affect economic activities, 2) what the distributional effects of these activities are, 3) why governments prefer farm policies that cause distortions in the market rather than the efficient farm policies, 4) why governments have difficulty making any substantial reform with respect to reducing distortional and expensive agricultural policies, and 5) why the advice of economists concerning agricultural policy instruments has been ignored so often in the agricultural policy process ?

These questions have produced a growing interest in understanding the process of farm program formation. Two approaches have been developed to analyze the political economy of farm policies and the process that generates protectionism. One approach is referred to as the "social contract" approach or " social concern " approach. This approach proposes that government intervention is based on a social consensus to prevent certain groups from suffering substantial income loss and to promote various national and international goals. However, the simple application of the social contract approach as an alternative to the public policy formulation presents some limitations.

The second approach emphasizes the economic self-interests of those participating in the political process. The representative paradigm of this approach is the public choice theory which is sometimes called " neoclassical political economy ".

This approach has increasingly emphasized the endogenous treatment of domestic and international policies as a response to the influence of special interest groups.

Since public choice theory does not admit to creation of positive rents, public choice theory cannot explain introduction of a new farm legislation such as the 1933 farm legislation. However, in general, public choice theory has an advantage in identifying factors determining government intervention once the original legislation has been developed. Reviewing primary models and frameworks in public choice theory leads one to understand which factors play important roles in government intervention. Self-interest coalitions, voting mechanisms (majority voting or probabilistic voting), dominant classes, regulatory power, rent-seeking activities, competition among interest groups, redistribution efficiency, and the efficiency of group effectiveness are all identified as factors affecting government intervention.

When the public choice approach is applied to farm policies and programs, political decisions concerning farm programs are a reflection of selfish economic interests of several groups in farm policy matters. The design and tactical implementation of government farm policies are explained by solving the bargaining game in which the interest groups compete for resources such as time and money. The solution to this bargaining game can be represented as 1) a maximization problem of solving the political preference function which is a weighted sum of the group's objective functions, where weights depend on the relative political power of the groups or as 2) a game theoretic framework which regards public policies as the equilibrium outcome of a cooperative game among interest groups and the policy maker. Therefore, the political decision as well as the policy selection and actual levels of various policy instruments chosen, is

affected by the interaction between the government and the interest groups whose potential gains or losses can be substantial.

This study focuses mainly on the impact of the political process on farm program decision-making and its relationship to redistribution efficiency. The objectives of the study are to develop an endogenous model regarding U.S. domestic wheat programs and to investigate and measure the distributional effects of wheat policies.

The PPF approach, the game theoretic framework, and other approaches which endogenize the political process reflect various behavioral assumptions of economic agents and countries. These approaches also present techniques used to test model validation. However, there are some limitations in understanding and predicting farm policy behavior: 1) most studies neglect the formal structure of the political economy model concerning farm policy issues, 2) the political factors producing political power are not included in the model or framework, 3) even in the case where the frameworks include political factors, the hypotheses generated from the theory do not allow empirical verification, and 4) the interrelationship between political factors and group effectiveness in farm policy formulation is not considered.

Therefore, to understand the process of wheat program formulation and to determine the values of endogenous economic variables as well as those of the policy instruments, a system of economic and political relations-- a political economy -- should be recognized. Moreover, in developing the conceptual structure of political economy models, the focus should be on 1) the addition to the political economy model of political factors generating the political influence of interest groups, 2) the group effectiveness in making farm policy decisions, and 3) the empirical verification of various hypotheses generated from the theory.

Adding the political influence functions of interest groups to the PPF model permits the PPF to incorporate the formal structure of the political economy of public policies. The PPF approach treats the resulting set of preferences parameterically and provides decision-makers with rational policy outcomes based on the representation of policy preferences as revealed policy preferences. A set of weights in the PPF model reflects the political power and strength of various interest groups.

The domestic wheat programs model considers 1) the political link as it refers to the political process through which economic interests are translated into actual farm policies, 2) the economic link as it refers to the market structure through which the real income of each interest group is affected, and 3) the interactions between the factors affecting political pressure and market conditions. Thus, the total effect of the changes in the market parameters on the farm programs are derived from the effect of the political link, the effect of the economic link, and the interaction between the two links.

The PPF model, which includes the political influence functions of interest groups, derives the optimal choice of the policy control variables, P_t and P_l by maximizing the expected value of the PPF with respect to two control variables. The first and second order conditions and the optimal wheat policies yield the following results :

1) The optimal wheat programs, which simultaneously implement target price, loan rate, and acreage reduction programs, recommend a positive target price and loan if the government puts more weight on the producer group than the consumer group and the taxpayer group.

2) P_t is increasing and a convex function of w while P_l is a decreasing concave functions of w. That is, as the exertion of pressure by the producer group increases, the

levels of target prices increase at an increasing rate and the levels of the loan rates decrease at a decreasing rate.

3) ΔPS, ΔCS, and ΔTL are increasing convex functions of w. This implies that as the exertion of political influence by the producer group increases, a) the marginal gain to the producer from a given weight reduction is larger at a higher w, and b) the marginal loss to the consumer or the taxpayer from a given weight(w) reduction is smaller with a higher w. These results indicate why it is so difficult to make any substantial reform with respect to inefficient agricultural policies. As the welfare weight w increases, the level of target price and the welfare level of the producer group increase. Thus, the producer group has a strong incentive to produce political pressure by spending time and money on political activities. But, at the same time, the welfare level of the consumer and taxpayer group decrease as the political influence of the producer group increases. Thus, the consumer and taxpayer group also have incentives to form a consumer-taxpayer coalition because they are being made worse off as the political influence of the producers increases. However, the consumer and taxpayer are not as efficient as the producer in producing political influence because of the free-rider problem. Consequently, although the higher price support make the wheat program more inefficient, the producer group has a higher P_t and thus welfare level of the producer group increases as the political influence of the producer group increases. But the target price cannot be increased infinitely because of the public's counter group activities.

4) When the political process is endogenized in the model, the results of the comparative static analysis depend not only on the distribution of the political influence function, w, and the type of political instruments used but also on the relative magnitude

of the direct and indirect effects. Thus, the transfer efficiency is also affected by the same forces mentioned above.

The following results were obtained from the empirical analysis :

1) The mean value of the political influence of the producer group was 1.08, which implies that the welfare of producers was weighted about 8 percent more than that of the public (consumers and taxpayers) during the period covered in this study (1974 - 1991).

2) The mean values of w were 0.83, 1.06, 1.24, and 1.12 during the period of the 1973, 1977, 1981, and 1985 Farm Acts. The yearly values of w and the mean value of w during each Farm Act confirm that the producer group changes the political pressure to recover the economic loss caused by the changing economic conditions. The high political influence of 1.56 for the 1985 year reflects not only deteriorated wheat market conditions due to falling exports, lower market prices of wheat, and the declining real farm income but also serious financial stress due to high interest rates and declining land values. The political influence of the producer group has slowly decreased since 1986. These declining political weights of producers reflect that as the loan rates became lower than the world prices and thus wheat export was promoted with slowly declining target prices, the U.S. increased its competitiveness in the world wheat market. The imbalance in economic conditions resulting from excess supply leads to a policy disequilibrium. In order to recover economic losses from changing economic conditions, interest groups attempt to exert political pressure which, in turn, translates into a set of policy instruments. Therefore, the yearly values of w reflect the process of farm policy formulation, changes in kinds and levels of policy instruments, and changing wheat

market structure. A high value of w reflects disfavorable wheat market conditions while a low value of w indicates favorable market conditions.

3) Two different political influences can be derived from the optimal wheat policies. W_1 reveals the political influence from the wheat program that implements a target price policy while maintaining status quo intervention. W_2 reveals the political influence from the wheat program that implements a loan rate policy while maintaining status quo intervention. Since the weight, w_1, depends on P_t which in turn affects the changes in PS, the political influence of the producer group is identified by estimating w_1.

4) The behavior of policy instruments in the wheat program is not consistent with the hypothesis generated from the theoretical model. For example, w_1 is not equal to w_2. These inconsistencies indicate that the model is inappropriate. These problems may arise because the PPF framework is an unsatisfactory model of government behavior, or that the particular function chosen is wrong one.

5) Regression analysis was performed to estimate policy behavioral equations (PBE) by using a set of policy instruments in wheat programs as dependent variables, and a set of political and economic market variables as regressors (independent variables). OLS estimates of PBEs for the sample period yielded the following results :

a) Most coefficients of selected regressors had expected signs and were statistically significant. The explanatory power of all PBEs were satisfactory.

b) The behavior of the target price and ARP responded to the political influence produced by membership size and expenditure on political activities of the producer group. However, the policy behavior of the loan rate is not affected by the political influence of the producer group. Economic factors affecting shifts in demand and supply

are also responsible for explaining the behavior of policy instruments in the wheat program.

c) The Farm Acts' dummy variables, which represent the structural changes in wheat programs, and other policy instruments such as DRWH help explain the policy behavior of wheat programs. This result indicates that the behavior of the target price and loan rate policy were greatly influenced by several Farm Acts which were the outcomes of bargaining game among competing interest groups and reflected the macro economic and political circumstances.

6) From 1974 to 1991 the changes in PS, CS, and TL averaged 2641.1, - 1643.3, and 2688.9 million dollars respectively. Thus, the absolute deadweight loss for the wheat program averaged 1691.2 million dollars per year. The changes in PS were directly opposite of the changes in CS. The changes in TL steadily increased from 1974 to 1985. But the changes in TL did not change significantly over the period in which target prices were maintained at the same levels and loan rates became lower since 1986.

7) The deadweight losses arose from government intervention in the U.S wheat market in order to protect domestic producers at the expense of taxpayers and consumers before 1989. However, since 1989 the recent wheat programs supported the producer group and improved the welfare of the consumer group at the expense of the taxpayer group. Recent high taxpayer losses disclose that the clear loser from recent wheat programs are taxpayers.

8) The redistribution efficiency under all current wheat programs(target price, loan rate, and ARP) is greater than that in which only the target price changes while the loan rate and ARP are held constant. If the U.S. wheat program is evaluated in terms of the redistribution efficiency, the current wheat programs(combination of P_t, P_l, α) are

preferred to the wheat program in which only the target price is changed while the loan rate and ARP are held constant.

9) The political influence of the producer group has an inverse relationship with the slope of the surplus transformation curve (STC) and a positive relationship with the total deadweight loss (TDWL). These results indicate that w can be an indicator for measuring redistribution efficiency as the theoretical model predicted.

Recognizing that the U.S. wheat programs are the outcomes of the bargaining game among interest groups, the PPF approach is applied to endogenize the wheat programs' formation in the U.S. Adding the political influence functions of interest groups to the PPF approach can incorporate the formal structure of the political economy of U.S. wheat programs.

The model focuses not only on the interdependence between wheat policies and the political influence of interest groups but also on interactions between economic markets and political markets. In addition, based on the same PPF approach, the model analyzes the domestic wheat programs, particularly their distributional and efficiency consequences.

The empirical results suggest that the endogenizing PPF model for the U.S. wheat programs is an inappropriate approach for understanding the political process and distributional consequences with regard to the U.S. wheat programs. This result arises because of the inconsistency between the effects of the loan rate and target price programs.

Appendices

Appendix A

The Model for Wheat Trade Polices

This appendix extends the domestic wheat program model to an international wheat program model. Since the environment in which agricultural trade takes place is rapidly changing, the characteristics of the agricultural trade market should be addressed before developing the international wheat trade model.

The recent agricultural commodity market in international trade is characterized by the insulation of domestic markets from changes in the world market, extensive government intervention, and a high degree of market concentration. Many countries insulate their producers and consumers from changes in world prices by using a wide range of trade policy instruments which differentiate prices between domestic and international prices. These policy instruments include tariff on imports, export subsidies and taxes, import quotas and local content schemes.

However, the trading countries are policy interdependent through the effects of their domestic policies on the international commodity markets and other economic agents. Thus, each country's farm policies influence the magnitude of a country's excess demand or supply and thus change the nature of the country's relationship with the world market. Each government uses various strategic trade policies to achieve a policy target level. The commonly used strategic trade policies in agricultural commodity trade are export subsidies and import quotas. Farm trade policies, which attempt to solve domestic farm problems, deeply affect the level of the farm policy and the welfare level

in other countries. Therefore, because of the pervasive nature of government intervention in the agricultural commodity market and the strategic behavior of each country, countries should be treated as the appropriate units of analysis when evaluating the distributional effects and trade policies of other countries.

The Uruguay round of multilateral trade negotiations shows the importance of finding ways to control the use of nontariff trade barriers such as export subsidies and import quotas. The use of export subsidies to increase market share by the U.S. and E.E.C. leads to an export subsidy war. The United States introduced the Export Enhancement Program (EEP) in May 1985 to help alleviate the agricultural sector's financial stress. Payment-in-kind of export subsidies from government-owned stocks were authorized for select, or " targeted " import markets. Increased U.S. export sales were to be achieved through the displacement of subsidized European Community(EC) exports. As a form of price discrimination among import markets, targeted export subsidies potentially can benefit the subsidizing exporter.

Under the EEP, the Community Credit Corporation is to target countries for subsidized sales of U.S. commodities based on four criteria: additionality, targeting, cost effectiveness, and budget neutrality. The U.S. Department of Agriculture (USDA) may either determine its own subsidy programs or allow the bonus level to result from a bidding process.

The EEP offers several potential benefits to the United States. Commodity groups in the United States hail the program as a success, while competing exporters complain that it has disrupted world markets (Seitzinger and Paarlberg). With regard to the effects of export subsidies in the U.S. wheat programs, the EEP is responsible for about 30 percent of the 1986/87 wheat export expansion and about 20 percent of the

expansion since then. The EEP allows the United States to meet subsidized competition in world markets by lowering U.S. prices in targeted markets where competitor subsidies have eroded U.S. market shares. It provides a bonus to U.S export merchants in the form of commodity certificates redeemable for government held commodities(Bailey). For another example, Japan, one of the largest net importers of wheat in the world, uses bilateral import quotas and other barriers to restrict trade. Wheat imports are used as a source of revenue by the Japanese government to partially pay for the high production subsidies paid for domestic rice and wheat. The importation of wheat is rigidly controlled by the government through its Japanese Food Agency (JFA). Import quotas and high resale prices are the basic policy mechanism used by the JFA. The system of wheat import quotas and high domestic prices is profitable not only for the government but also for a select group of importing agents and flour millers. The way the Japanese government has managed food imports with discriminatory quotas can be explain by the model in which the choice of policies to benefit domestic pressure groups is constrained by the consequences for the welfare of influential foreigners(Alston, Carter, and Jarvis). The above examples of two countries present how non-tariff trade barriers, such as export subsidies and import quotas, greatly affect international and domestic economies.

Given the assumed strategic behavior of trading countries, the effects of non-tariff trade barriers (such as export subsidies and the import quotas) on the international market should be investigated. This study examines the relationship between each country's non-tariff trade policies and their impacts on another country's welfare focusing on the impacts of interest groups on international trade policy formation.

A.1. Additional Assumptions

To develop the international wheat trade model, the following additional assumptions are required.

1) The set of policy instruments in the model is composed of the export subsidy (s) and the import quota(q) for the export and import country, respectively. Thus, the vector of policy instruments is denoted by Z_m = (s, q).

2) It is assumed that the demand and supply equations in trading countries are linear. It is also assumed that linear excess demand and supply functions exist. Thus, the supply and demand equations in exporting and import countries are :

$S_0 = a_0 + b_0$ Ps, $D_0 = c_0 + d_0$ Pd. (exporting country) , and

$S_1 = a_1 + b_1$ Ps, $D_1 = c_1 + d_1$ Pd. (importing country).

3) Both the importing and exporting countries are large. Thus, the world price is affected by two countries. The model is " a static one-commodity, two large country " model.

4) Ps = Pw + s, Pq = Pw + q where s is the level of an export subsidy and q is the level of an import quota. Ps (Pq) is the changing price due to the export subsidy (import quota).

5) To guarantee an interior unique solution, stability conditions must hold. That is, the reaction function of the exporting country, s (q) is steeper than that of the importing country, q (s): Vss Vqq > Vsq Vqs.

6) Each country chooses the optimal trade policy taking the other country's optimal trade policy as given (non-cooperative behavior). Thus, each country maximizes the PPF given the other country's behavior.

A.2. The Economic Consequences of Imposing the Export Subsidy and Import Quota

The economic consequences of imposing the export subsidy and import quota in the international trade model are illustrated in Figure A-1.

D_0, S_0 and D_1, S_1 are the demand and supply curves of wheat in the exporting and importing countries, respectively. The demand curves are functions of a world wheat price and the supply curves are functions of policy incentive prices Ps and Pq. P_0 is the free trade price of wheat where there is no market intervention.

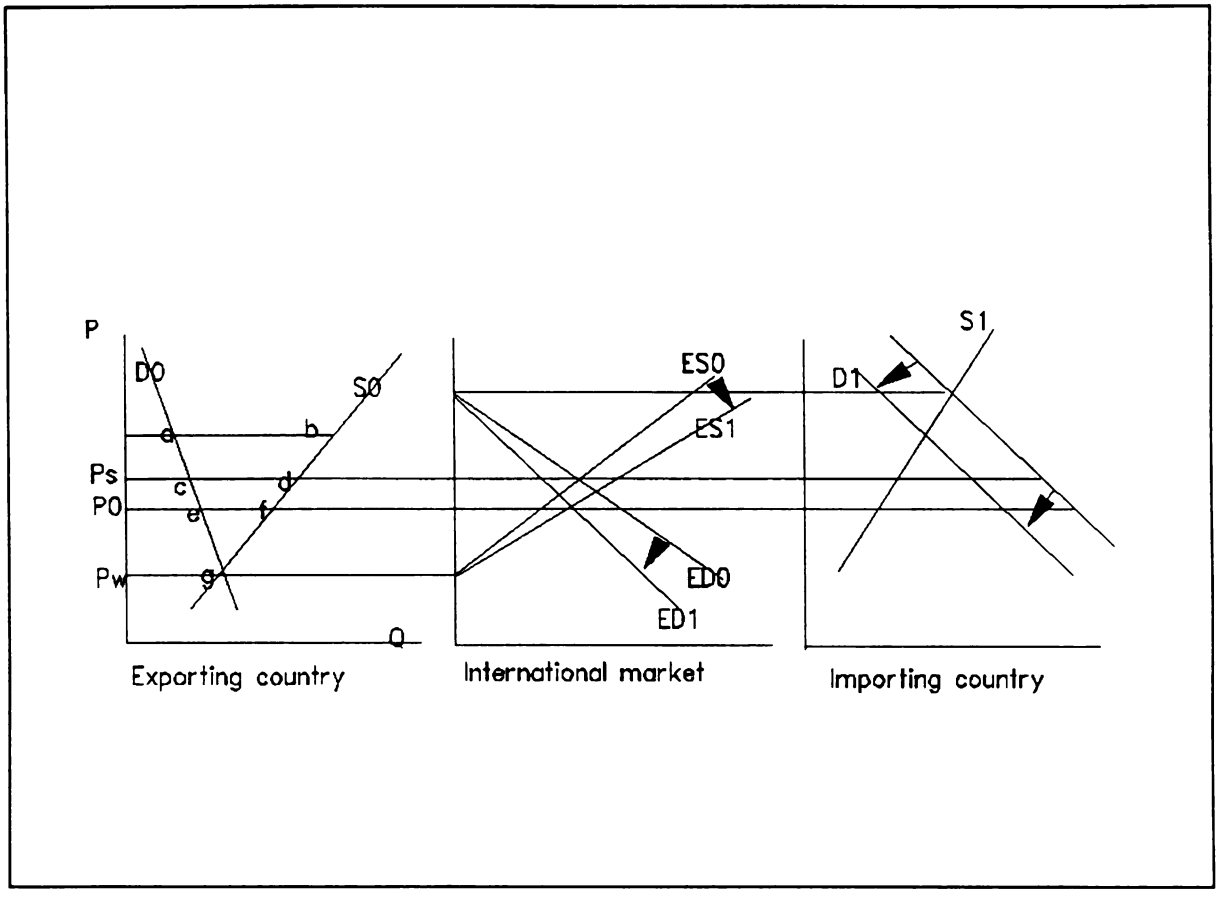
When the government of the exporting country offers an export subsidy, exporters will export wheat up to the point where the domestic price exceeds the world price by the amount of the subsidy. The price in the exporting country rises from P_0 to Ps. Since producers in the exporting country supply more at the higher price, excess supply in the international market exists and the new world price becomes lower. In the exporting country, consumers and producers gain because of lower world price and higher domestic price, but the government has expanded the financial burden due to supporting the price Ps resulting from an export subsidy.

An import quota is a direct restriction on the quantity being imported. The restriction is usually enforced by issuing licenses to some group of individuals or firms. When imports are limited, the demand for wheat exceeds domestic supply plus imports. This causes the price to be bid up until the market clears. In the end, an import quota

will raise domestic prices by the same amount as the tariff that limits imports to the same level. The import quota leads to the reduced excess demand which results in the lower world price. Due to the higher domestic price and lower world price, consumers and producers gain and the government's tax revenue increases (taxpayers gain).

In a static competitive economy, a tariff and an import quota are equivalent. But, it is well known that they are not equivalent beyond a static competitive economy. The difference in effect between a quota and a tariff is that the government receives no revenues with a quota. When a quota instead of a tariff is used, the sum of money that would have appeared as rents causes the costs of a quota to be substantially higher than the equivalent tariff. Beyond the quota rents, if dynamic and uncertainty effects are considered, import quotas are not equivalent with tariffs. When the parameters of the economy shift over time, the demand or supply curve are subject to change. Thus, quotas and tariffs affect the market for good in quite different ways(dynamic nonequivalence). In the presence of uncertainty, where the parameters of the economy exhibit fluctuations which are unknown ex ante, two policies tariffs and quotas must also differ(Vousden). However, it is assumed that an import quota and a tariff are equivalent for the simplicity of analysis. Imposing both an import quota and an export subsidy causes the world price to be lower; thus their welfare effects are more significant than that of imposing one trade policy.

Figure A-1. The Economic Consequences of Imposing the Export Subsidy and Import Quota in International Trade Model



A.3. The Model Specification

As in the domestic wheat model, each government is willing to maximize the weight sum of the changes in producer and consumer surplus and taxpayer loss. For simplicity, the consumers' and taxpayers' welfare weights are normalized by 1 and the welfare weight of the producer group is represented by w_i where i is 0 and 1. 0 signifies the exporting country and 1 the importing country. The weight w indicates the resolution of the conflicts between the various groups in a country. The properties of the government objective function(V or PPF) are the same as in the domestic wheat model.

Thus, the government's behavior in the exporting country is specified as

$$Max \quad V_0 = w_0 * \Delta PS_0 + \Delta CS_0 - \Delta TL_0$$

$$s.t \qquad \Delta PS_0 = \int_{P_0}^{P_s} S_0(P)dP$$

$$\Delta CS_0 = \int_{P_w}^{P_0} D_0(P)dP$$

$$\Delta TL_0 = s \cdot X = s[S_0(P_s) - D_0(P_w)]$$

Similarly, the government's behavior in the importing country is specified as

$$Max \quad V_1 = w_1 * \Delta PS_1 + \Delta CS_1 - \Delta TL_1$$

$$s.t \qquad \Delta PS_1 = \int_{P_0}^{P_q} S_0(P)dP$$

$$\Delta CS_1 = \int_{P_w}^{P_0} D_0(P)dP$$

$$\Delta TL_1 = - q \cdot M = q[D_1(P_w) - S_1(P_q)]$$

A.4. Derivation of the Changes in Costs and Benefits from Wheat Trade Policies.

The export subsidy increases the amount of exports in the international market and decreases the amount of domestic supply which leads to an increase in the domestic wheat price (Ps > Pw). Thus, the changes in total producer surplus in the exporting country are the welfare gain to producers from having to sell much of the wheat at the price Ps when imposing an export subsidy compared to the free clearing price. The gains in producer surplus is equal to the area P_0Psbd in Figure A-1. Thus, the gains in producer surplus are

$$\Delta PS_0 = \int_{P_0}^{P_s} S_0(P)dP \qquad (5.1)$$

Substituting $a_0 + b_0P$ into the supply curve S_0, then

$$\Delta PS_0 = \int_{P_0}^{P_s} S_0(a_0+b_0P)dP = a_0s+\frac{b_0}{2}s^2+b_0P_ws+a_0(P_w-P_0)+\frac{b_0}{2}(P_w^2-P_0^2) \qquad (5.2)$$

The change in total consumer surplus in the welfare gain to buyers from having to purchase a little more wheat at the lower world price with the export subsidy compared to the free market clearing price (P_0) is shown in Figure A-1. The change in consumer surplus is the area behind the curve from P_w to P_0 which is equal to area P_wP_0ce. Thus, the gain in consumer surplus is measured as

$$\Delta CS_0 = \int_{P_w}^{P_0} D_0(P)dP = c_0(P_0-P_w)+\frac{d_0}{2}(P_0^2-P_w^2) \qquad (5.3)$$

Taxpayers support the excess supply produced at the Ps which is equal to the difference between the Ps and Pw times the amount of excess supply. Thus, the change in taxpayer losses is measured as

$$\Delta TL_0 = s\cdot X = s[S_0(P_s)-D_0(P_w)] = [a_0+b_0(P_w+s)-c_0-d_0P_w]s \qquad (5.4)$$

$$\Delta TL = s(a_0+b_0P_w-c_0-d_0P_w)+b_0s^2 \qquad (5.5)$$

Similarly, the import quota decreases the amount of import in the domestic market and results in an increasing level of domestic wheat prices (Pq > Pw). In addition, imposing the import quota causes the government tax revenue to increase. Thus, the changes in producer and consumer surplus, and in taxpayer loss in the importing country are, respectively

$$\Delta PS_1 = \int_{P_0}^{P_q} S_1(P)dP = a_1q+b_1P_wq+\frac{b_1}{2}q^2+a_1(P_w-P_0)+\frac{b_1}{2}(P_w^2-P_0^2) \qquad (5.6)$$

$$\Delta CS_1 = \int_{P_w}^{P_0} D_1(P)dP = c_1(p_0 - p_w) + \frac{d_1}{2}(p_0^2 - p_w^2) \tag{5.7}$$

$$\Delta TL_1 = -q \cdot M = -q[D_1(P_w) - S_1(P_q)] = -(c_1 + d_1 P_w - a_1 - b_1 P_w)q - b_1 q^2 \tag{5.8}$$

A.5. Optimal Export Subsidy and Import Quotas (Equivalent to Tariff)

Maximizing the expected values of the PPFs of each country with respect to trade control variables, the optimal levels of s and q are obtained. Thus, the level of the optimal export subsidy is

$$\frac{\partial V}{\partial s} : w_0(a_0 + b_0 P_w + b_0 s) - (a_0 + b_0 P_w - c_0 - d_0 P_w) - 2b_0 s = 0 \tag{5.9}$$

$$s^* = \frac{(a_0 + b_0 P_w)(1 - w_0) - (c_0 + d_0 p_w)}{(w_0 - 2)b_0} \tag{5.10}$$

$$s^* = \frac{S_0(P_w)(1 - w_0) - D_0(P_w)}{(w_0 - 2)b_0} \tag{5.11}$$

The second order condition shows that $w_0 < 2$. It is assumed that w is greater than 0. Thus,

$$0 < w_0 < 2 \tag{5.12}$$

Similarly, the optimal level of an import quota is

$$\frac{\partial V}{\partial s} : w_1(a_1 + b_1 P_w + b_1 q) - (a_1 + b_1 P_w - c_1 - d_1 P_w) - 2b_1 q = 0 \tag{5.13}$$

The second order condition shows that $w_1 < 2$. It is assumed that $w_1 > 0$. Thus,

$$q^* = \frac{(a_1+b_1P_w)(1-w_1)-(c_1+d_1P_w)}{(w_1-2)b_1} \tag{5.14}$$

$$q^* = \frac{S_1(P_w)(1-w_1)-D_1(P_w)}{(w_1-2)b_1} \tag{5.15}$$

$$0 < w_1 < 2 \tag{5.16}$$

If $1 < w_0, w_1 < 2$, $s^*, q^* > 0$

$0 < w_0, w_1 < 1$, $s^*, q^* < 0$

These results indicate that if the government of the exporting(importing) country puts more weight on the producer group than the consumer group and the taxpayer group, the level of the optimal export subsidy (import quota) is positive. Although the performance variables of the government objective function (PPF) are different, the results are the same as the results obtained by Paarlberg (1987)[24].

From Eq. (5.10) and Eq. (5.14), the optimal export subsidy and import quota can be expressed by the world price P_w.

$$s^* = \frac{a_0(1-w_0)-c_0}{(w_0-2)b_0} + \frac{(b_0(1-w_0)-d_0)}{(w_0-2)b_0} \cdot P_w \tag{5.17}$$

$$q^* = \frac{a_1(1-w_1)-c_1}{(w_1-2)b_1} + \frac{(b_1(1-w_1)-d_1)}{(w_1-2)b_1} \cdot P_w \tag{5.18}$$

A.6. The Free Trade Price and New World Price

[24]Paarlberg(1987) used producer surplus, consumer surplus, and taxpayer loss as performance variables in developing the government objective function for the U.S. He argued that if w > 1,then the export subsidy policy is optimal.

The following relationship is used to derive the market clearing free-trade price. :

$$M(P_0) = X (P_0)$$

$$c_1 + d_1 P_0 - a_1 - b_1 P_0 = a_0 + b_0 P_0 - c_0 - d_0 P_0.$$

Thus, the market clearing free trade price is

$$p_0 = \frac{(c_1+c_0)-(a_0+a_1)}{(b_0+b_1)-(d_0+d_1)} \qquad \textbf{(5.19)}$$

The market clearing price, P_0 is not a function of s and q, but a function of the parameters of the demand and supply function in both trade countries.

However, imposing the export subsidy and import quota in both countries, the world price Pw is affected by s and q. The import function, M (Pw), and the export function, X (Pw), can be represented as

$$X(Pw) = [S_0 (Ps) - D_0 (Pw)],$$

$$M(Pw) = [D_1(Pw) - S_1 (Pq)]$$

$$X(Pw) = [S_0(Ps) - D_0 (Pw)]$$

$$= [D_1(Pw) - S_1 (Pq)] = M(Pw)$$

$$P_w = \frac{(c_0-a_0)+(c_1-a_1)}{(b_0-d_0)+(b_1-d_1)} - \frac{b_0}{(b_0-d_0)+(b_1-d_1)} \cdot s - \frac{b_0}{(b_0-d_0)+(b_1-d_1)} \cdot q \qquad \textbf{(5.20)}$$

Thus, the world price can be expressed by s and q

$$Pw = \alpha + \beta s + \gamma q$$

where

$$\alpha = \frac{(c_0-a_0)+(c_1-a_1)}{(b_0-d_0)+(b_1-d_1)} > 0 \qquad \textbf{(5.21)}$$

$$\beta = - \frac{b_0}{(b_0 - d_0) + (b_1 - d_1)} < 0 \qquad (5.22)$$

$$\gamma = - \frac{b_0}{(b_0 - d_0) + (b_1 - d_1)} < 0 \qquad (5.23)$$

Thus, the world price depends on s and q. Since s and q are functions of the political influence functions, w_0 and w_1, in the two countries, the world price is affected by the political influence functions, w_0 and w_1, holding the market structures of the two countries constant. That is,

$$Pw = Pw (s, q : Xi)$$

$$= Pw [s(w_0, w_1 : Xi), q (w_0, w_1 : Xi)] = Pw (w_0, w_1 : Xi)$$

A.7. The Nash Equilibrium

Since it is assumed that each government chooses its optimal policies to maximize PPF taking the trade policies of another country's government given (noncooperative behavior), the exporting country and importing country choose s, q to maximize their government objective functions V_0 and V_1. The first-order conditions provide the reaction functions s (q) [q (s)] which denote the exporting country's (importing) optimal export subsidy (import quotas) as a function of the importing country (exporting) import quotas(export subsidy). Thus, the reaction curves s (q) and q(s) show the exporting and importing country's welfare maximizing levels of s (q) and q(s).

The determination of the Nash equilibrium level of s and q is illustrated by drawing the reaction functions in the s and q space in Figure 5-2. Each country's reaction curve is a downward sloping curve which results in an unique Nash equilibrium.

Each country's reaction curve 1) is single valued (i.e. there is a unique best export subsidy (s) response to any import quota (q) set by the other country), 2) has a positive intercept on its own axis at its optimal level of s, 3) involves a positive tariff when the other country is imposing its optimal q, and 4) intercepts the other country's q axis. These properties are sufficient to ensure that the Nash equilibrium is not associated with the elimination of trade (Vousden).

Figure A-2 shows the core and the case of free trade. The core is the area ABEC and the BOC line represents the case in which the free trade occurs. Stability of the Nash-equilibrium at E requires that q (s) should be flatter than s (q). Therefore, a sufficient condition for stability of the Nash equilibrium in the exporting country is

$$\Delta = \begin{bmatrix} V_{ss} & V_{sq} \\ V_{qs} & V_{qq} \end{bmatrix} > 0 \qquad (5.24)$$

The corresponding stability condition for the Nash equilibrium in the importing country is

$$\Delta^* = \begin{bmatrix} V^*_{ss} & V^*_{sq} \\ V^*_{qs} & V^*_{qq} \end{bmatrix} > 0 \qquad (5.25)$$

These stability conditions are algebraically proved in Appendix E.

A.8. The Effects of Changes in the Trade Policy in One Country on the Trade Policy Level and Welfare Level in Another Country.

There are two methods to prove the effects of changes in the level of export subsidy, s (q), on the level of import quotas, q (s), and the welfare level of the

importing country. One is a diagram method in which the effects of the export subsidy is explained by the changes in the level of the optimal trade policies in the diagram. The other is an algebraic method in which the effects are proved by the mathematical manipulations with the first order conditions.

The Nash equilibrium and the effects of changes in the level of export subsidy, s(q), on the level of import quotas, q (s), are diagrammed in Figure A-2. The algebraic proofs are illustrated in Appendix E.

In Figure A-2, the iso-welfare contours are shown for the exporting country and importing country. For example, to the left of the reaction curve s (q) of the exporting country, the iso-welfare contours are upward sloping because a higher value of s increases the welfare level of the exporting country. Similarly, to the right of s(q), a higher s reduces the welfare level of the exporting country. Therefore, the iso-welfare contours are downward sloping to the right of s (q). Lower contours present the lower level of welfare for the exporting country. By the same reasoning, the iso-welfare contours for the importing country can be developed.

Under $1 < w_0 < 2$, if the producer group in the exporting country increases the political influence w_0, the reaction curve s(q) shifts to the right s'(q); thus the level of an export subsidy is increased from s_0 to s' and the level of an import quota is decreased from q_0 to q'. Thus, the new equilibrium is achieved at E' where the welfare level of the exporting country becomes lower, and the welfare level of the importing country becomes higher. These effects are similar to the effects of decreasing the political influence of the producer group in the importing country, w_1 indirectly. Thus, the effects of increasing w_0 are the same if the political influence of the producer group is indirectly lessened.

Thus, in the case in which the political influence of the producer groups in trading countries is greater than that of the consumer groups ($1 < w_0, w_1 < 2$), the effects of increasing the political influence of the producer group in the exporting country on the import quota and welfare level of the importing country are summarized as follows :

$$\frac{\partial s}{\partial w_0} > 0, \frac{\partial q}{\partial w_0} < 0, \frac{\partial V_0}{\partial w_0} < 0, \frac{\partial V_1}{\partial w_0} > 0 \qquad \textbf{(5.26)}$$

Similarly,

$$\frac{\partial q}{\partial w_1} > 0, \frac{\partial s}{\partial w_1} < 0, \frac{\partial V_1}{\partial w_1} < 0, \frac{\partial V_0}{\partial w_1} > 0 \qquad \textbf{(5.27)}$$

In summary, in the case in which the political influence of the producer groups in trading countries is greater than that of the consumer groups ($1 < w_0$ and $w_1 < 2$), as the political influence of the producer group in the home country, w_0, increases, the level of export subsidy increases and the welfare level in the home country worsens. However, the level of import quotas decreases and the welfare level in the foreign country improves. The increase in w_0 has the same effect as the political influence of the producer group in the foreign country, w_1, is decreased indirectly.

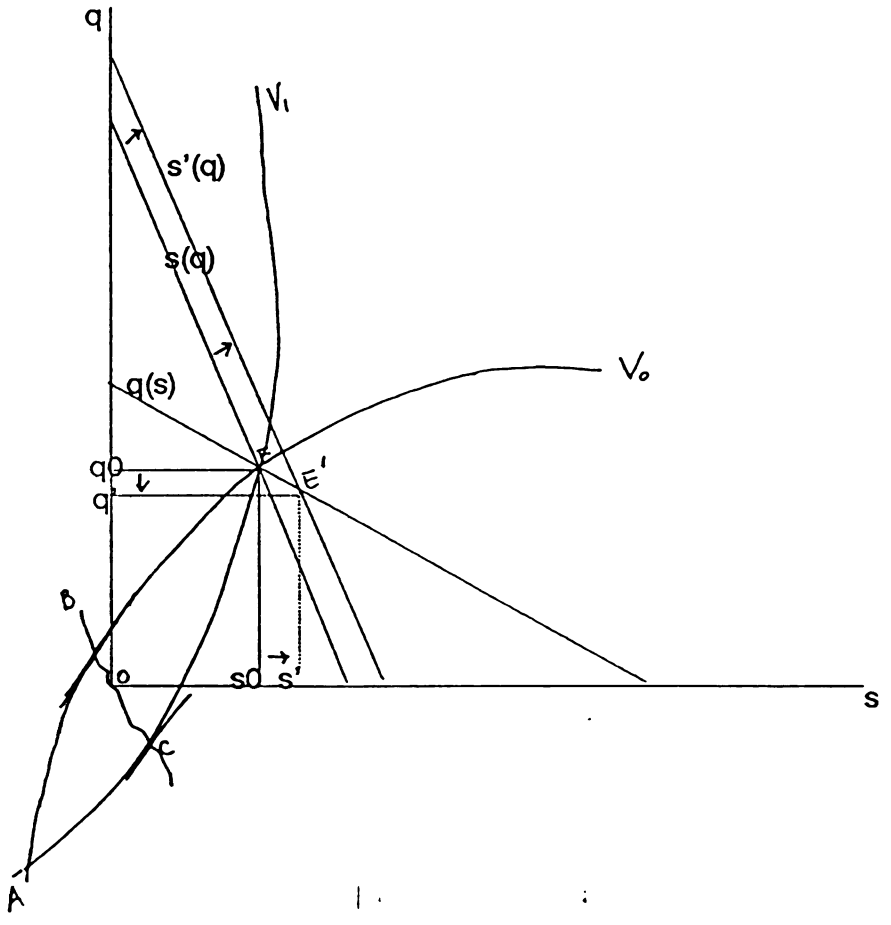
Furthermore, in connecting the results obtained from the domestic wheat programs model, the impact of political factors of one country on trade policies and transfer efficiency on another country can be examined. The domestic political factors such as expenditures on the political activities and the membership size of various interest groups, affect the level of trade policies and welfare in the other country. When imposing the export subsidy and import quota in trading countries, the increasing

expenditure on the political activities (or decreasing the size) of the producer group to increase the level of the export subsidy results in a lower level of the import quota and a higher welfare level in the importing country. The reverse case is also accomplished. Thus, the following results are obtained from Eq. (5.26) and Eq. (5.27):

$$\frac{\partial s}{\partial C_{s0}} > 0,\ \frac{\partial q}{\partial C_{s0}} < 0,\ \frac{\partial V_0}{\partial C_{s0}} < 0,\ \frac{\partial V_1}{\partial C_{s0}} > 0 \qquad \textbf{(5.28)}$$

In the case Ns, the signs are opposite. As a result, the relative political influence of the two countries affects the transfer efficiency of governments participating in international trade.

Figure. A-2. The Nash Equilibrium and Effects of the Changes in s(q) on q(s)



Appendix B.

Comparative Static Analysis

1) P_t

(1)dP_t/da_1

The impacts of supply shifts on the target price depend on the direct effect and indirect effect. Thus,

$$\frac{dP_t}{da}=\frac{\partial P_t}{\partial a}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial a}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial a} \tag{6.1}$$

The first and second term of Eq(6.1) are the direct and indirect effects, respectively.

$$\frac{\partial P_t}{\partial a_1}=\frac{-b_1+d_1(1-w)}{b_1(b_1+d_1(w-2))}.\quad Thus, if 0<w<2,\quad \frac{\partial P_t}{\partial a_1}<0. \tag{6.2}$$

The sign of $\frac{\partial P_t}{\partial a_1}$ depends on w and b_1 and d_1.

From Eq.(6.2) and assumptions, Eq.(3.2) and Eq.(3.3) in Chapter 3,

$$\frac{\partial P_t}{\partial w}>0,\quad \frac{\partial w}{\partial C_s}>0,\quad \frac{\partial w}{\partial N_s}<0. \tag{6.3}$$

To examine the sign of $\frac{\partial C_s}{\partial a_1}$, $\frac{\partial N_s}{\partial a_1}$, the following relationship is used from the second stage of the optimization process. Thus,

$$F_{cal}=\frac{\partial}{\partial a_1}\left(\frac{\partial \Delta PS}{\partial w}\right)\left(\frac{\partial w}{\partial C_s}\right)=\left(\frac{\partial^2 \Delta PS}{\partial w \partial a_1}\right)\left(\frac{\partial w}{\partial C_s}\right) \tag{6.4}$$

Therefore, using the implicit function theorem, the sign of $\frac{\partial C_s}{\partial a_1}$, $\frac{\partial N_s}{\partial a_1}$ derived by following steps.

$$\frac{\partial^2 \Delta PS}{\partial a_1 \partial w} = \frac{-2d_1^2(a_1 d_1 - b_1 c_1)}{b_1(b_1 + d_1(w-2))^3} \tag{6.5}$$

$$F_{ca1} = \left(\frac{\partial^2 \Delta PS}{\partial w \partial a_1}\right)\left(\frac{\partial w}{\partial C_s}\right) = (+)\cdot(+) > 0.$$

$$\frac{\partial C_s}{\partial a_1} = -\frac{\partial F_{ca1}}{\partial F_{cs}} = (-)\cdot\frac{(+)}{(-)} > 0.$$

Similarly,

$$F_{na1} = \frac{\partial}{\partial a_1}\left(\frac{\partial \Delta PS}{\partial w}\right)\left(\frac{\partial w}{\partial N_s}\right) = \left(\frac{\partial^2 \Delta PS}{\partial w \partial a_1}\right)\left(\frac{\partial w}{\partial N_s}\right) \tag{6.8}$$

$$F_{na1} = \left(\frac{\partial^2 \Delta PS}{\partial w \partial a_1}\right)\left(\frac{\partial w}{\partial N_s}\right) = (+)\cdot(-) < 0.$$

$$\frac{\partial N_s}{\partial a_1} = -\frac{\partial F_{ca1}}{\partial F_{ns}} = (-)\cdot\frac{(-)}{(-)} < 0.$$

Thus, the sign of dP_t/da_1 can be identified from Eq.(6.2), Eq.(6.4), and Eq.(6.8).

$$\frac{dP_t}{da} = \frac{\partial P_t}{\partial a} + \frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial a} + \frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial a}$$

$$\frac{dP_t}{da_1} = (-) + (+)\cdot(+)\cdot(+) + (+)\cdot(-)\cdot(-) = ?$$

The sign of dP_t/da_1 is ambiguous. However if the direct effect is greater than the indirect effect, then the total effect is negative. Similarly, if the indirect effect is greater then the direct effect, then the total effect is positive.

Applying the same method to other policy instruments and other parameters of economic variables, the results are as below :

(2)dP_t/db_1

$$\frac{dP_t}{db_1}=\frac{\partial P_t}{\partial b_1}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial b_1}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial b_1}$$

$$\frac{\partial P_t}{\partial b_1}=\frac{a_1b_1^2-b_1^2c_1-2a_1b_1d_1+2a_1d_1^2+2a_1b_1d_1w-3a_1d_1^2w+a_1d_1^2w^2)}{b_1^2(b_1+d_1(w-2))^2}. \quad if 0<w<2, \quad \frac{\partial P_t}{\partial b_1}<0.$$

$$F_{cb1}=\frac{\partial}{\partial b_1}(\frac{\partial \Delta PS}{\partial w})(\frac{\partial w}{\partial C_s})=(\frac{\partial^2 \Delta PS}{\partial w \partial b_1})(\frac{\partial w}{\partial C_s})$$

$$\frac{\partial^2 \Delta PS}{\partial b_1 \partial w}=\frac{-2b_1^2c_1+4a_1b_1d_1-2b_1c_1d_1-2a_1d_1^2+b_1c_1d_1w+a_1d_1^2w}{b_1^2(b_1+d_1(w-2))^4}$$

Thus,

$$F_{cb1}=(\frac{\partial^2 \Delta PS}{\partial w \partial b_1})(\frac{\partial w}{\partial C_s})=(-)\cdot(+)<0.$$

Therefore, using the implicit function theorem,

$$\frac{\partial C_s}{\partial b_1}=-\frac{\partial F_{cb1}}{\partial F_{cs}}=(-)\cdot\frac{(-)}{(-)}<0.$$

Similarly,

$$F_{nb1}=\frac{\partial}{\partial b_1}(\frac{\partial \Delta PS}{\partial w})(\frac{\partial w}{\partial N_s})=(\frac{\partial^2 \Delta PS}{\partial w \partial b_1})(\frac{\partial w}{\partial N_s})$$

$$F_{nb1}=(\frac{\partial^2 \Delta PS}{\partial w \partial b_1})(\frac{\partial w}{\partial N_s})=(-)\cdot(-)>0.$$

$$\frac{\partial N_s}{\partial b_1}=-\frac{\partial F_{cb1}}{\partial F_{ns}}=(-)\cdot\frac{(+)}{(-)} > 0.$$

Thus, the sign of dP_t/db_1 are

$$\frac{dP_t}{db_1}=\frac{\partial P_t}{\partial b_1}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial b_1}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial b_1}$$

$$\frac{dP_t}{db_1} = (-) + (+)\cdot(+)\cdot(-) + (+)\cdot(-)\cdot(+) = < 0$$

The sign of dP_t/db_1 is negative.

(3)dP_t/dc_1

$$\frac{dP_t}{dc_1}=\frac{\partial P_t}{\partial c_1}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial c_1}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial c_1}$$

$$\frac{\partial P_t}{\partial c_1}=\frac{1}{b_1+d_1(w-2)}. \quad if 0<w<2, \quad \frac{\partial P_t}{\partial c_1}>0.$$

$$F_{cc1}=\frac{\partial}{\partial c_1}(\frac{\partial \Delta PS}{\partial w})(\frac{\partial w}{\partial C_s})=(\frac{\partial^2 \Delta PS}{\partial w \partial c_1})(\frac{\partial w}{\partial C_s})$$

$$\frac{\partial^2 \Delta PS}{\partial c_1 \partial w}=\frac{2d_1(-b_1c_1+a_1d_1)}{(b_1+d_1(w-2))^3}$$

$$F_{cc1}=(\frac{\partial^2 \Delta PS}{\partial w \partial c_1})(\frac{\partial w}{\partial C_s})=(+)\cdot(+)>0.$$

Therefore,

$$\frac{\partial C_s}{\partial c_1}=-\frac{\partial F_{cc1}}{\partial F_{cs}}=(-)\cdot\frac{(+)}{(-)} > 0.$$

Similarly,

$$F_{nc1}=\frac{\partial}{\partial c_1}(\frac{\partial \Delta PS}{\partial w})(\frac{\partial w}{\partial N_s})=(\frac{\partial^2 \Delta PS}{\partial w \partial c_1})(\frac{\partial w}{\partial N_s})$$

$$F_{nc1}=(\frac{\partial^2 \Delta PS}{\partial w \partial c_1})(\frac{\partial w}{\partial N_s})=(+)\cdot(-)<0.$$

$$\frac{\partial N_s}{\partial c_1}=-\frac{\partial F_{cc1}}{\partial F_{ns}}=(-)\cdot\frac{(-)}{(-)} < 0.$$

Thus, the sign of dP_t/dc_1 are

$$\frac{dP_t}{dc_1} = (+) + (+)\cdot(+)\cdot(+) + (+)\cdot(-)\cdot(-) = > 0$$

The sign of dPt/dc1 is positive.

(4)$dP_t/dd1$

$$\frac{dP_t}{dd_1}=\frac{\partial P_t}{\partial d_1}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial d_1}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial d_1}$$

$$\frac{\partial P_t}{\partial d_1}=\frac{a_1-c_1(w-2)}{(b_1+d_1(w-2))^2}. \quad if 0<w<1, \quad \frac{\partial P_t}{\partial d_1}>0. \quad if 1<w<2, \quad \frac{\partial P_t}{\partial d_1} < 0$$

Therefore, using the implicit function theorem,

$$F_{cd1}=\frac{\partial}{\partial d_1}(\frac{\partial \Delta PS}{\partial w})(\frac{\partial w}{\partial C_s})=(\frac{\partial^2 \Delta PS}{\partial w \partial d_1})(\frac{\partial w}{\partial C_s})$$

$$\frac{\partial^2 \Delta PS}{\partial d_1 \partial w}=-\frac{(b_1c_1-a_1d_1)(b_1c_1-3a_1d_1+4c_1d_1-2c_1d_1w)}{(b_1+d_1(w-2))^4}$$

$$F_{cd1}=(\frac{\partial^2 \Delta PS}{\partial w \partial d_1})(\frac{\partial w}{\partial C_s})=(-)\cdot(+)<0.$$

$$\frac{\partial C_s}{\partial d_1}=-\frac{\partial F_{cd1}}{\partial F_{cs}}=(-)\cdot\frac{(-)}{(-)}\ <\ 0.$$

Similarly,

$$F_{nd1}=\frac{\partial}{\partial d_1}(\frac{\partial \Delta PS}{\partial w})(\frac{\partial w}{\partial N_s})=(\frac{\partial^2 \Delta PS}{\partial w \partial d_1})(\frac{\partial w}{\partial N_s})$$

$$F_{nd1}=(\frac{\partial^2 \Delta PS}{\partial w \partial d_1})(\frac{\partial w}{\partial N_s})=(-)\cdot(-)>0.$$

$$\frac{\partial N_s}{\partial d_1}=-\frac{\partial F_{cd1}}{\partial F_{ns}}=(-)\cdot\frac{(+)}{(-)}\ >\ 0.$$

$$\frac{dP_t}{dd_1}=\frac{\partial P_t}{\partial d_1}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial d_1}+\frac{\partial P_t}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial d_1}$$

$$If\ 0<w<1, \frac{dP_t}{dd_1} = (+) + (+)\cdot(+)\cdot(-) + (+)\cdot(-)\cdot(+) = ?.$$

$$If\ 1<w<2, \frac{dP_t}{dd_1} = (-) + (+)\cdot(+)\cdot(-)+(+)\cdot(-)\cdot(+) = < 0.$$

The sign of dP_t/db_1 depends on the range of the distribution of political influence function. If government put more weight on the producer group than the consumer group($1 < w < 2$), the effect of d_1 on the target price is negative.

2) Pl

(1)dP_l/da_1

$$\frac{dP_l}{da_1}=\frac{\partial P_l}{\partial a_1}+\frac{\partial P_l}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial a_1}+\frac{\partial P_l}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial a_1}$$

$$\frac{\partial P_l}{\partial a_1}=\frac{1}{b_1+d_1(w-2)}.\quad Thus, if 0<w<2,\quad \frac{\partial P_l}{\partial a_1}<0.$$

$$\frac{\partial P_l}{\partial w}<0,\quad \frac{\partial w}{\partial C_s}>0,\quad \frac{\partial w}{\partial N_s}<0.$$

Thus, the sign of dP_l/da_1 are

$$\frac{dP_l}{da_1}=\frac{\partial P_l}{\partial a_1}+\frac{\partial P_l}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial a_1}+\frac{\partial P_l}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial a_1}$$

$$\frac{dP_l}{da_1} = (-) + (-)\cdot(+)\cdot(+) + (-)\cdot(-)\cdot(-) = < 0$$

The sign of dP_l/da_1 is negative.

(2)dP_l/db_1

$$\frac{dP_l}{db_1}=\frac{\partial P_l}{\partial b_1}+\frac{\partial P_l}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial b_1}+\frac{\partial P_l}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial b_1}$$

$$\frac{\partial P_l}{\partial b_1}=\frac{a_1+c_1(w-2)}{(b_1+d_1(w-2))^2}.\ If 0<w<1,\ \frac{\partial P_t}{\partial b_1}>0.\ \ If 1<w<2,\ \frac{\partial P_t}{\partial b_1}<0.$$

Thus, the sign of dP_l/db_1 are

$$If 0<w<1,\ \ then\ \frac{dP_l}{db_1}=(+)+(-)\cdot(+)\cdot(-)+(-)\cdot(-)\cdot(+)=>0$$

$$If\ 1<w<2,\ \ then\ \frac{dP_l}{db_1}=(-)+(-)\cdot(+)\cdot(-)+(-)\cdot(-)\cdot(+)=?.$$

The sign of dP_l/db_1 is ambiguous.

(3)dP_l/dc_1

$$\frac{dP_l}{dc_1}=\frac{\partial P_l}{\partial c_1}+\frac{\partial P_l}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial c_1}+\frac{\partial P_l}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial c_1}$$

$$\frac{\partial P_l}{\partial w}>0,\quad \frac{\partial w}{\partial C_s}>0,\quad \frac{\partial w}{\partial N_s}<0.$$

The sign of dP_l/dc_1 are ambiguous.

(4)dP_l/dd_1

$$\frac{dP_l}{dd_1}=\frac{\partial P_l}{\partial d_1}+\frac{\partial P_l}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial d_1}+\frac{\partial P_l}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial d_1}$$

The sign of dP_l/dd_1 are

$$\frac{\partial P_1}{\partial d_1}=\frac{(w-2)(a_1+c_1(w-2)}{(b_1+d_1(w-2))^2}.\ if\ 0<w<1,\quad \frac{\partial P_1}{\partial d_1}>0.\ if\ 1<w<2,\quad \frac{\partial P_1}{\partial d_1}<0$$

$$\frac{dP_1}{dd_1}=\frac{\partial P_1}{\partial d_1}+\frac{\partial P_1}{\partial w}\cdot\frac{\partial w}{\partial C_s}\cdot\frac{\partial C_s}{\partial d_1}+\frac{\partial P_1}{\partial w}\cdot\frac{\partial w}{\partial N_s}\cdot\frac{\partial N_s}{\partial d_1}$$

$$If\ 0<w<1,\frac{dP_1}{dd_1}=(-)+(-)\cdot(+)\cdot(-)+(-)\cdot(-)\cdot(+)=?.$$

$$If\ 1<w<2,\frac{dP_1}{dd_1}=(+)+(-)\cdot(+)\cdot(-)+(-)\cdot(-)\cdot(+)=>0.$$

The sign of dP_1/db_1 depends on the range of the distribution of political influence function. If government put more weight on the producer group than the consumer group($1 < w < 2$), the effect of d1 on the target price is positive.

Appendix C.

Data for the Empirical Analysis

obs	ASAWHF	CPI	DICD	DPMWHF	DRWH	EFPWHF
1974	0.000000	0.493000	9849.188	0.000000	0.000000	3.950000
1975	0.000000	0.538000	9835.320	0.000000	0.000000	4.090000
1976	0.000000	0.569000	10096.57	0.000000	0.000000	3.550000
1977	0.000000	0.606000	10334.56	0.000000	0.000000	2.730000
1978	9.600000	0.652000	10688.68	14.84584	0.170000	2.350000
1979	8.200000	0.726000	10583.88	2.235138	0.170000	2.970000
1980	0.000000	0.824000	10219.97	0.000000	0.000000	3.780000
1981	0.000000	0.909000	10170.39	0.000000	0.000000	3.910000
1982	5.800000	0.965000	10078.36	-0.184975	0.170000	3.650000
1983	30.00000	0.996000	10382.72	17.24229	0.390000	3.650000
1984	18.60000	1.039000	10832.69	7.056389	0.400000	3.510000
1985	18.80000	1.076000	11025.61	12.17307	0.300000	3.390000
1986	21.00000	1.096000	11379.81	17.31107	0.250000	3.080000
1987	23.90000	1.136000	11525.56	33.34622	0.275000	2.420000
1988	22.50000	1.183000	11935.87	25.29352	0.275000	2.570000
1989	9.600000	1.240000	12075.71	3.759117	0.100000	3.720000
1990	7.500000	1.307000	12008.00	5.930611	0.025000	3.720000
1991	15.20000	1.362000	11799.00	26.76911	0.150000	2.610000

obs	EFPWHF	EPWHDF	FPWHF	IRLB	LRWH	NWHDF
1974	3.950000	199.2220	4.090000	8.140000	1.370000	175.1585
1975	4.090000	180.9469	3.550000	8.690000	1.370000	141.3383
1976	3.550000	147.1622	2.730000	8.660000	2.250000	91.21089
1977	2.730000	100.0447	2.330000	8.390000	2.250000	70.46369
1978	2.350000	87.42661	2.970000	8.350000	2.350000	96.73006
1979	2.970000	89.39209	3.780000	9.200000	2.500000	127.0882
1980	3.780000	100.4407	3.910000	10.39000	3.000000	102.2148
1981	3.910000	88.71178	3.650000	11.27000	3.200000	77.70628
1982	3.650000	75.13300	3.550000	12.27000	3.550000	72.53368
1983	3.650000	87.71136	3.510000	11.63000	3.650000	81.85141
1984	3.510000	76.61214	3.390000	11.73000	3.300000	73.64967
1985	3.390000	80.49918	3.080000	12.25000	3.300000	59.85130
1986	3.080000	80.34956	2.420000	12.10000	2.290000	34.28651
1987	2.420000	72.13712	2.570000	11.10000	2.280000	43.64348
1988	2.570000	64.07873	3.720000	10.10000	2.210000	62.90110
1989	3.720000	71.69929	3.720000	10.60000	2.060000	49.76936
1990	3.720000	71.08158	2.610000	10.50000	1.950000	32.29915
1991	2.610000	57.62133	3.050000	9.900000	2.040000	31.47944

obs	POP	QWHF	RHTWHF	TAWSAF	TPWH	UWHF
1974	213.8540	1782.000	1.000000	65.40000	2.050000	1691.000
1975	215.9730	2127.000	1.000000	69.50000	2.050000	1900.000
1976	218.0350	2149.000	1.000000	70.90000	2.290000	1704.000
1977	220.2390	2046.000	1.000000	66.70000	2.900000	1984.000
1978	222.5850	1776.000	0.886970	63.70000	3.000000	2031.000
1979	225.0550	2134.000	0.910415	68.65000	3.400000	2158.000
1980	227.7570	2381.000	1.000000	71.10000	3.630000	2296.000
1981	230.1380	2785.000	1.000000	80.60000	3.810000	2618.000
1982	232.5200	2765.000	0.947113	82.25000	4.050000	2417.000
1983	234.7990	2420.000	0.731824	83.90000	4.300000	2540.000
1984	237.1000	2595.000	0.827458	80.85000	4.380000	2578.100
1985	239.2790	2424.000	0.821066	78.80000	4.380000	1961.000
1986	241.6000	2091.000	0.793983	76.45000	4.380000	2197.000
1987	244.0000	2108.000	0.757328	73.86500	4.380000	2684.000
1988	246.4000	1812.000	0.759187	70.07500	4.230000	2394.000
1989	248.8000	2037.000	0.896239	69.39000	4.100000	2225.000
1990	251.4200	2736.000	0.924905	74.90500	4.000000	2454.000
1991	254.0800	1981.000	0.834998	69.09000	4.000000	2642.848

obs	YWH	CSTERWH	NUMWHF	NUMWHF	NUMPWP	EXPWH
1974	27.30000	1.00E-05	533520.0	533520.0	692270.0	4.540000
1975	30.60000	16.79000	516244.5	516244.5	678160.0	4.160000
1976	30.30000	15.85000	500268.4	500268.4	664051.0	3.650000
1977	30.70000	15.16000	484292.3	484292.3	649940.0	2.860000
1978	31.40000	15.50000	378574.0	378574.0	635831.0	3.560000
1979	34.20000	20.03000	452340.1	452340.1	621722.0	4.410000
1980	33.50000	27.00000	436364.0	436364.0	666143.0	4.790000
1981	34.50000	32.65000	420387.9	420387.9	782608.0	4.790000
1982	35.50000	32.87000	446075.0	446075.0	222912.0	4.380000
1983	39.40000	33.02000	388435.7	388435.7	498013.0	4.300000
1984	38.80000	31.45000	372459.6	372459.6	317565.0	4.160000
1985	37.50000	30.35000	356483.5	356483.5	472886.0	3.730000
1986	34.40000	23.95000	340507.4	340507.4	456725.0	3.180000
1987	37.70000	23.97000	352237.0	352237.0	557203.0	3.100000
1988	34.10000	26.76000	308555.2	308555.2	547012.0	3.970000
1989	32.70000	29.70000	292579.1	292579.1	433758.0	4.650000
1990	39.50000	30.11000	276603.0	276603.0	468880.0	3.720000
1991	34.30000	30.43000	260626.9	260626.9	NA	3.510000

Appendix D.

The Results of OLS Estimation for Policy Behavior Equations

LS // Dependent Variable is TPWH (Target Price)
Date: 5-13-1992 / Time: 13:00
SMPL range: 1974 - 1990
Number of observations: 17

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-7.8124575	1.2841157	-6.0839205	0.0001
NUMPWP	-4.177E-08	3.895E-07	-0.1072450	0.9165
DPMWHF	0.0125335	0.0048085	2.6065585	0.0244
IRLB	0.3646651	0.0434332	8.3959908	0.0000
D7780	0.5199596	0.1056772	4.9202606	0.0005
POP	0.0320947	0.0055454	5.7875921	0.0001

R-squared	0.974931	Mean of dependent var	3.607647
Adjusted R-squared	0.963536	S.D. of dependent var	0.843657
S.E. of regression	0.161100	Sum of squared resid	0.285485
Log likelihood	10.61566	F-statistic	85.55876
Durbin-Watson stat	2.275843	Prob(F-statistic)	0.000000

LS // Dependent Variable is LRWH (Loan Rate)
Date: 5-13-1992 / Time: 13:02
SMPL range: 1962 - 1990
Number of observations: 29

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	6.7310894	1.2940178	5.2016977	0.0000
NUMPWP	2.281E-07	3.578E-07	0.6376435	0.5309
DPMWHF	-0.0027758	0.0053836	-0.5155917	0.6118
IRLB	0.1337778	0.0599692	2.2307767	0.0373
CSTERWH	0.0248187	0.0130852	1.8967055	0.0724
POP	-0.0361165	0.0077319	-4.6710766	0.0001
TPWH	0.5322170	0.1651415	3.2227945	0.0043
D7780	0.3283261	0.1366444	2.4027783	0.0261
D8184	0.4692089	0.1951692	2.4041126	0.0260

R-squared	0.947888	Mean of dependent var	2.043103
Adjusted R-squared	0.927043	S.D. of dependent var	0.801339
S.E. of regression	0.216446	Sum of squared resid	0.936976
Log likelihood	8.620491	F-statistic	45.47355
Durbin-Watson stat	2.691882	Prob(F-statistic)	0.000000

LS // Dependent Variable is LRWH (Loan Rate)
Date: 5-13-1992 / Time: 13:03
SMPL range: 1961 - 1991
Number of observations: 31
Convergence achieved after 7 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	5.7023137	0.8443385	6.7535872	0.0000
IRLB	0.1225488	0.0383324	3.1970017	0.0040
CSTERWH	0.0207610	0.0109611	1.8940609	0.0709
POP	-0.0288079	0.0047793	-6.0276443	0.0000
TPWH	0.4197137	0.0832517	5.0415029	0.0000
D7780	0.4144549	0.0915056	4.5292857	0.0002
D8184	0.6543569	0.1555453	4.2068574	0.0003
AR(1)	-0.3904291	0.2062325	-1.8931504	0.0710

R-squared	0.951774	Mean of dependent var	2.034839
Adjusted R-squared	0.937096	S.D. of dependent var	0.775499
S.E. of regression	0.194500	Sum of squared resid	0.870098
Log likelihood	11.39652	F-statistic	64.84543
Durbin-Watson stat	2.230885	Prob(F-statistic)	0.000000

LS // Dependent Variable is ARP (Acreage Reduction Program)
Date: 5-13-1992 / Time: 13:05
SMPL range: 1962 - 1990
Number of observations: 29

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-0.9384700	0.3056530	-3.0703766	0.0058
NUMPWP	1.354E-07	4.157E-08	3.2583527	0.0038
DPMWHF	0.0038701	0.0005453	7.0977181	0.0000
CSTERWH	-0.0032799	0.0013795	-2.3776145	0.0270
DICD	-6.363E-05	2.396E-05	-2.6557160	0.0148
POP	0.0071873	0.0024453	2.9392908	0.0078
DRWH	0.5270850	0.0578926	9.1045376	0.0000
DUMALP	-0.0462132	0.0207893	-2.2229266	0.0373

R-squared	0.960531	Mean of dependent var	0.145216
Adjusted R-squared	0.947374	S.D. of dependent var	0.117388
S.E. of regression	0.026929	Sum of squared resid	0.015229
Log likelihood	68.35275	F-statistic	73.00852
Durbin-Watson stat	1.933084	Prob(F-statistic)	0.000000

Appendix E.

The Effects of w_0 on q(s) and w_1 in another country

From the first conditions Eq. (5.9) and Eq. (5.13), let $\frac{\partial V}{\partial s}$ define A(s, q) and let $\frac{\partial V}{\partial q}$ define B (s, q). Thus, the following relationship are achieved from the first order conditions.

$$\frac{dV}{ds} = A(s,q) \tag{7.1}$$

$$\frac{dV}{dq} = B(s,q) \tag{7.2}$$

Since an increase in one country's welfare level reduces the welfare level in another country, the second conditions have the following signs.

As < 0, Aq < 0, Bs < 0, and Bq < 0 where As and Bq are $\frac{\partial A}{\partial s}$, $\frac{\partial B}{\partial q}$

The slope of the reaction curves in the exporting and importing country are as follows :

Slope of s(q) in Figure 5-2 = $(\frac{dq}{ds}) = -\frac{A_s}{A_q} < 0$

Slope of q(s) in Figure 5-2 = $(\frac{ds}{dq}) = -\frac{A_q}{A_s} < 0$

To hold stability conditions, the reaction function of the exporting country, s(q), should be steeper than that of the importing country, q (s): Vss Vqq > Vsq Vqs. Therefore, a sufficient condition for stability of Nash equilibrium in the exporting country is

$$\Delta = \begin{bmatrix} V_{ss} & V_{sq} \\ V_{qs} & V_{qq} \end{bmatrix} > 0$$

The corresponding stability condition for the Nash equilibrium in the importing country is

$$\Delta^* = \begin{bmatrix} V^*_{ss} & V^*_{sq} \\ V^*_{qs} & V^*_{qq} \end{bmatrix} > 0$$

Assuming these condition to hold, the comparative static analysis can be applied. Differentiating Eq. (7.1) and Eq. (7.2) with respect to w_0,

$$A_s \cdot \frac{ds}{dw_0} + A_q \cdot \frac{dq}{dw_0} = \frac{d^2V}{\partial s \partial w_0}$$

$$B_s \cdot \frac{ds}{dw_0} + B_q \cdot \frac{dq}{dw_0} = \frac{d^2V}{\partial q \partial w_0}$$

Solving above two equations for $\frac{ds}{dw_0}$, $\frac{dq}{dw_0}$, then

Result 1. $\frac{ds}{dw_0} > 0.$, $\frac{dq}{dw_0} < 0.$, and $\frac{dq}{ds} < 0.$

Result 2.

$$\frac{dV_0}{dw_0} = \frac{\partial V_0}{\partial s} \cdot \frac{ds}{dw_0} = (-) \cdot (+) < 0.$$

$$\frac{dV_1}{dw_0} = \frac{\partial V_1}{\partial q} \cdot \frac{dq}{dw_0} = (-) \cdot (-) > 0.$$

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