The political economy of international agricultural protection

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The political economy of international agricultural protection

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The political economy of international agricultural protection

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Virender Gautam

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CHAPTER I
INTRODUCTION

I.1 The Problem

Governments across the world use a wide variety of policy tools to intervene in the agricultural sector. These policies directly or indirectly influence the production incentives and consumption patterns of various agricultural commodities. The last decade has witnessed an increasing interest in the political economy of agricultural protection. The topic that has received the most attention is the paradox of developing countries typically taxing and industrialized countries commonly subsidizing their agricultural sector. Most of the work in the area of political economy of agricultural protection (PEAP) has focused on the consequences of farm programs. A growing number of studies have recently attempted to explain the causes of farm programs as well. These studies have increasingly become analytically more realistic than the earlier simple descriptive attempts to examine the policy mechanisms. The more recent development in this regard is the treatment of policy intervention as endogenous rather than exogenous, within a public choice framework. In this new line of political economy literature, the policy is seen as an outcome of the interaction of rational policy-makers and trade-sensitive economic groups (Moore, 1990; Petit, 1993 and 1991).

The PEAP literature has progressed along two distinct paradigms of the interactions among the economic agents: what Bhagwati (1989) calls the self-willed government (SWG) models and the clearing house government (CHG) models. The first approach assumes that the government is an autonomous unit maximizing a social welfare function. The political leadership, in choosing the level of policy instrument, takes into account the economic surpluses of various economic agents in the society. The welfare connotations of the approach highlight the altruistic motives aimed at improving the societal well-being. The CHG approach, based on the works of Olson (1965), Peltzman (1976) and Becker (1983), treats the political process as a clearing house where a relatively passive government is
assumed to redistribute resources among different interest groups. The approach maintains that government policies are impacted upon by pressures from special interest groups and the policy-maker acts in rational self-interest.

The SWG and CHG approaches, therefore, represent two extremes of the policy formulation process. The SWG approach considers policy outcomes as results of altruistic motives while the CHG approach assumes that the government does not enjoy autonomy in decision-making and is assumed to simply reflect the influences of pressure groups. In practice, however, the truth lies somewhere in between these two paradigms. The distinction between the two approaches is increasingly being questioned (Foster and Rausser, 1992; McLaren, 1991; de Gorter, 1990; Paarlberg, 1989). It is suggested that the self-interest and social concern models are best viewed as complimentary explanations for government trade policy intervention. However, most of the work in this area to date falls in either of the two analytical viewpoints (see Chapter II). Therefore, there exists a need to study and verify the extent of complementarity between these two approaches.

Moreover, most of the studies on the econometric evidence of the patterns of agricultural protection do not provide explicit theoretical support for their ad hoc specification of the analysis. Increasingly, some studies have attempted to use explicit political economy models in order to explain agricultural protection (Balisacan and Roumasset, 1986; Gardner, 1987; Rausser and de Gorter, 1989; de Gorter and Tsur, 1991). Some of these studies have not empirically tested for the implications of their theoretical models, while others show a less explicit connection between the theory and the empirical analysis. Most of the empirical studies also suffer in terms of the goodness of fit and from the excluded variables bias or have regressed variables not suggested by their theoretical models. Moreover, the coverage of determinants as well as countries is rather restrictive in much of the earlier work.

The food security literature suggests that farm programs seem to be responsive in part to the consumers' attitude towards food security risks. The literature also unambiguously establishes a link between the consumers' food security concerns, price stabilization policies
and the government intervention. There is also considerable evidence to suggest that low income countries tend to adopt policies that stabilize average domestic producer prices significantly below the world price levels to support consumer concerns (Tyers and Chisholm, 1982; Sanderson and Mehra, 1990; Hopkins, 1986; Bigman, 1985; Bale and Lutz, 1981; Tullis and Hollist, 1986; Amat, 1982; Bouis and Herdt, 1982). While risk and uncertainty have been put forth as reasons for the social concerns view of the political economy, the work so far on the determinants of agricultural protection has not considered these as the causes of government intervention.

Agricultural protection is commodity-specific and the protection levels vary significantly from one commodity to the other. For instance, while wheat and rice are generally taxed in India, commodities like rapeseed and mustard receive substantial protection; while sugar, rice, wheat, milk etc. have received support and protection in the U.S., several other commodities like soybean and poultry have not received significant protection (USDA, 1993; OECD, 1992; Gardner, 1990b). Aggregating protection levels for all commodities or for a number of commodities, especially with negative and positive protection levels, may provide less meaningful insight into the patterns of agricultural protection and the protection levels for the agricultural sector as a whole may not reflect these special commodity-specific characteristics. However, studies by Honma and Hayami (1986a and 1986b), Anderson and Hayami (1986), de Gorter and Tsur (1990 and 1991), Balisacan and Roumasset, Gardner (1987) and others have not taken these factors into account and have rather concentrated on aggregate agricultural protection. A product-specific approach to the study of agricultural protection, therefore, seems necessary.

The results obtained in earlier quantitative studies are also influenced by their choice of the measure of protection levels (Gardner, 1989a, 1989b). The simplest and most commonly used measures of protection levels in such studies include the nominal protection coefficients \( NPC \) and nominal rate of protection \( NRP \) (Bigman, 1985; de Gorter and Tsur, 1989; Anderson and Hayami, 1986; Honma and Hayami, 1986a and 1986b; Herrmann, 1989; Balisacan and Roumasset, 1987). \( NPC \) and \( NRP \) are only a partial indication of how
government policies affect domestic production since they only capture the border measures and producer subsidies and taxes that change producer prices. Since measuring the level of protection accurately is essential for any empirical analysis examining the determinants of agricultural protection, the use of $NPC$ and $NRP$ may not provide a more complete estimate of the actual level of intervention and are usually biased downwards in industrialized countries.

In conclusion, then, as Gardner (1989a, p.1170) suggests, "perhaps, in future, more attention to jointly developed theory and empirical investigation will provide findings that are less ad hoc." Given these factors, there exists a need to address the issue of agricultural protection with an approach that would provide a more comprehensive explanation of the patterns of international agricultural protection levels.

### I.2 The Purpose of the Study

The purpose of this study is to investigate the prominent determinants of agricultural protection across industrialized and developing countries. The study is designed to explicitly introduce the supply of and demand for agricultural protection in the political market to analyze the patterns of government intervention in the agricultural sector in a single staple commodity framework. The aim is to develop, and empirically test, a theoretical framework which incorporates the two analytical viewpoints advanced in the PEAP literature. The analysis is intended to ascertain the superiority of one approach over the other or the degree of complementarity between the two. The self-interest of individuals seeking personal benefits is combined with the larger societal goals representing altruistic motives.

The aim here is to propose an alternative hypothesis to the political economy of agricultural protection. Consumers accept government intervention in the agricultural sector because of the benefits of food security accruing to them. It is postulated that the perceived benefits from improved food security through stabilization of food prices translates into preferences of the consumers. These perceived benefits constitute the demand for intervention from them. Since incomes and the size of risk in relation to income vary from
society to society, this generates varying degree of demand from consumers across countries.

The self-interest elements, on the other hand, are assumed to be the mainstay of the producer model. The producers are assumed to lobby the government in seeking agricultural subsidies to enhance their profits. The producer model is intended to explicitly take into account this political resource constraint.

Therefore, the overall demand for government intervention in the agricultural sector is assumed to be emanating from the producer and consumer interest groups. The political supply of intervention from the policy makers is assumed to respond to the welfare of both these groups. The hypotheses to be tested are that consumers' food security concerns and producers' pressure group characteristics play an eminent role in the determination of political market equilibrium in the agricultural sector. The methodology employed is designed to provide an integrated development of theoretical and empirical analysis.

Since an accurate measurement of the actual level of intervention is a prerequisite for the effectiveness of the investigation, a comprehensive comparative analysis of different measurement concepts and their coverage of effects under a variety of policy scenarios becomes an important exercise. The aim of the study is to employ a measurement concept which includes the effects of a wide range of policies, and which is suitable for analyzing the extent of government intervention across countries.

The present analysis is designed to improve upon earlier works on the determinants of agricultural protection in a number of other ways also. Patterns of protection are also studied for an individual agricultural commodity so as to provide more meaningful implications. The choice of countries is also much broader in that both industrialized as well as developing countries are included throughout the analysis. However, the focus here is not the examination of different policies and their effects on the protection levels, but rather to investigate the common determinants of agricultural protection across countries.¹

The empirical analysis uses the ordinary least squares, generalized least squares, pooled cross-section time-series, and Probit and Logit estimation techniques to test the data.

¹ It is beyond the scope of this study to examine the different policies, like buffer stocks schemes and other type of policies, designed to achieve price stabilization and their relative efficiency.
from 30 industrialized and developing countries for the period 1982-87. The relative effectiveness of the consumer and producer models have been examined using the non-nested as well as nested testing procedures.

Davidson and MacKinnon's pair-wise $J$ tests have been used to analyze the superiority of the two approaches in the PEAP literature. Model specification tests are performed in order to correctly specify the functional relationship between explanatory and the dependent variables. To evaluate the extent of complementarity between these approaches, the nested tests are performed on the political welfare function by imposing additional restrictions. The nested test would allow to determine whether the protection levels can be better explained by including the determinants from the individual consumer or producer models or from both together.

In order to ascertain the effects of the explanatory variables on the probability that the protection levels will be positive, the Probit and Logit estimation procedure are used. The results regarding the marginal effects of explanatory variables as well as their mean elasticities are also provided. This study, therefore, is the first comprehensive and systematic attempt to incorporate explicitly, in a stochastic environment, the consumers' concerns regarding stable food patterns. An integrated political economy approach to the study of protection levels across countries is presented using a much broader measurement concept.

I.3 Organization of the Study

The thesis is organized as follows. The literature on the political economy of agricultural protection is reviewed in Chapter II. The chapter highlights the different approaches in the PEAP literature and also emphasizes the food security concerns and their linkages to the determination of farm programs. Chapter III provides a broad analytical overview of the patterns of agricultural protection. The chapter develops a political market framework of agricultural protection to explain the divergent policy outcomes across industrialized and developing countries. The chapter also provides a comprehensive comparative analysis of various measurement concepts and their policy coverage under
different policy scenarios. The analysis also includes the case of domestic government as a price discriminating monopolist.

Theoretical models of consumer, producer and policy-maker are developed in Chapter IV. The chapter also highlights the interactions among these agents using a schematic representation of the political market of demand and supply in agriculture.

Chapter V provides the empirical analysis. The chapter begins with the details of sources and definitions of explanatory variables used in the study and the discussion of the pooled cross-section time-series estimation technique. The determinants identified in the theoretical models are subject to various econometric tests in the chapter. The results of the non-nested and nested tests as well as the Probit and Logit estimations are provided in this chapter. The last chapter summarizes the whole work. References are provided at the end of the manuscript.
CHAPTER II
REVIEW OF LITERATURE

This chapter reviews the PEAP literature relevant to the hypotheses being tested in the study. The chapter is divided into three broad sections. The next section highlights the two different sides of the political economy of protection literature and discusses its application in agriculture. An outline of these approaches is also provided. Section II.2 reviews some pioneer theoretical works emphasizing the role of pressure groups. The more recent applications of these works in a political market framework, along with empirical evidence, are also provided. The studies dealing with food security and price stabilization and treating these as motives for government intervention in the agricultural sector, are discussed in the last section.

II. 1 Alternative Approaches to the Political Economy of Protection

The role of policy-makers in the policy outcomes had generally been ignored in the models aimed at analyzing the consequences of distortionary trade policies. Increasingly, the studies in the political economy of protection have focused on the interactions between the "rational" political agents, especially elected officials, and the pressure groups affected by the outcomes of trade and other policies. The manner in which this interaction is modeled in the political economy of protection literature has espoused two different approaches: social concerns approach and the self-interest approach (Figure II. 1).

Studies in the social concern approach maintain that the government actions are primarily designed to promote national welfare. Policies effected in order to achieve the overall welfare motives have been explained via two distinct sets of models. The first lays great emphasis on the status quo and seeks to explain why major policy changes occur only at the time of deep crisis. This line of thought views government actions as correcting market failures whereby some sector of the economy witnesses a decline in incomes. The policies
Figure II.1: Alternative approaches to the political economy of protection
attempt to preserve the status quo even though incomes of some other sectors might rise enough to increase the overall societal welfare (Corden, 1974).

The equity concern models, on the other hand, argue that government actions are designed to compensate and protect those sectors of economy that are undergoing structural adjustments. In essence, the altruistic social concern argument goes, government policies effectuate income redistribution to compensate the poorer sections of the economy. The sectors employing low-wage workers are more likely to be awarded protection from foreign competition than the sectors where labor wages are relatively high (Cheh, 1974; Constantopoulos, 1974).

The second approach in the political economy of protection literature views policy outcomes as the results of interactions between self-interested political leadership and the pressure groups. The policy-makers are assumed to be interested in maximizing their own utility, defined over their probability of reelection or maintaining political power, rather than any altruistic motives. In this case, then, the sectors with the largest number of voters would stand to gain from the policies. This is the focus of the majority voting models. The pressure group models within this approach maintain that policy outcomes are influenced greatly by the lobbying activities of pressure groups. The members in a group contribute towards lobbying and pressurize the self-interested policy-makers to obtain favorable policy outcomes. The policy-makers supply the protection in return for favorable voting by group members. A comprehensive survey of the self-interest approach can be found in Hillman (1989).

The PEAP literature, on the other hand, has progressed along two narrowly defined variants of these models: the self-willed government (SWG) models and the clearing house government (CHG) models. In the SWG framework, the politician is assumed to maximize a utility function whose arguments are the economic surpluses of various groups. Studies in this area include Rausser and Freebairn (1974), Riethmuller and Roe (1986), Saaris and Freebairn (1983), Paarlberg and Abbott (1986 and 1984), Lopez (1989), and Vanzetti and Kennedy (1988), among others. These studies are reviewed in the next subsection. This
community welfare approach maintains that government regulations respond to market inefficiency and are designed to improve the welfare of the society. The groups witnessing a decline in their incomes or seeking risk-insurance are protected by the government. The policy outcomes are, thus, viewed as results of a social welfare function that assigns higher weights to the sectors bearing additional costs of structural adjustment. The protection awarded to agriculture in newly industrializing countries may be a case in point. Central to the SWG paradigm is the assumption that preference weights reflect societal desires and the policy preference function, \( W \), may be of the form:

\[
W = W\{CS, PS, GB\},
\]

where, \( CS \) and \( PS \) represent consumer and producer surpluses, respectively, and the \( GB \) is the government budget expenditure. The government chooses the policy instrument, \( \tau \), so as to maximize \( W \). The first order condition is

\[
dW/d\tau = w_1(dCS/d\tau) + w_2(dPS/d\tau) + w_3(dGB/d\tau),
\]

where, \( w_i \) are partial derivatives with respect to \( CS, PS \) and \( BG \), respectively. In this sense, the \( w_i \)'s represent policy weights (marginal values) assigned by the government to consumers, producers and taxpayers' interests. A description of these alternative approaches can also be found in MacLaren (1991 and 1992), Alston and Carter (1991), Carter et al. (1990), Rausser and Zusman (1992), Winters (1987), Moore (1990), Hillman (1989), Baldwin (1989) and Gardner (1983).

In terms of Figure II.2, the surplus transformation curve (STC) denotes the government's ability to maximize the policy preference function. The slope of the STC curve over a relevant range assumes that the welfare of one group would decrease at an increasing rate with an increase in the welfare of the other group. It is implicitly assumed in this approach that the government policies are designed in such a manner to fall along the efficient STC, resulting in minimal dead weight loss. The political equilibrium, given the STC and the political preference indifference curves (PPICs), is found where the two curves are tangent to each other (point \( a \)). In other words, it is the point where the marginal gain in producer surplus for a marginal decrease in consumer surplus equals the slope of the PPIC. However, in the absence of government intervention, the market equilibrium is at point \( d \).
where a unit increase in producer surplus is associated with a unit decline in the consumer surplus. This may be represented by the zero-intervention line (ZIL) which has a slope of negative one. Therefore, the efficient redistributions would lie on the ZIL while any distance from it would represent the deadweight loss from the policy (the distance \(ab\) in this case).

![Surplus transformation curve and self-willed government behavior](image)

**Figure II.2:** Surplus transformation curve and self-willed government behavior

The empirical SWG literature has focused on either estimating implicit welfare weights, \(w_i\), or estimating reduced form policy choice equations. The first technique is a low payoff exercise since the results provide little insight into the policy formation process, while the second technique has not yielded any substantial empirical results so far (Alston and Carter, 1991 and Carter et al., 1990).

The clearing house government (CHG) approach, based upon the works of Peltzman (1976) and Becker (1983), provides an alternative explanation of the PEAP literature. The political market framework advanced under this approach views the demand for intervention as coming from the lobbying by these special interest groups. The self-interested politicians, acting so as to maximize their chances of reelection, supply the protection. The government is, therefore, viewed as weighing the influence of pressure groups who wield voting power.
This approach views policies as being consequences of an influence function rather than a social welfare function. The influence of pressure groups in this framework constitutes a zero-sum game while the tax-subsidy outcomes may represent a negative sum due to the deadweight cost. In terms of Figure II.2, since the CHG approach does not consider a political preference function, there are no PPICs either. The political equilibrium lies somewhere on the STC curve, representing the interactions of the interest groups and the government. For example, in case where the producer group is more successful in its lobbying activities, the policy outcome may be somewhere around point c, where the slope of STC would represent the cost of the redistribution. Several recent works using the CHG approach, for example, Gardner (1987), Balisacan and Roumasset (1987), Miller (1989), de Gorter and Tsur (1991) and von Witzke (1989), are discussed in Section II.2.

The SWG approach assumes that markets are fragile and tend to operate inefficiently while the government policies, designed to correct these market failures or inequities, are assumed to be costless. The political power of private interest groups is the force that dominates the CHG paradigm. This approach differs from the SWG in that no weights are attached to the welfare of different groups. The government trades off political pressure among interest groups. Following the diagrammatic exposition of these two approaches, it may be possible to formulate the political equilibrium in case of two representative developing and industrialized countries or in case of changing protection patterns associated with economic development within a country, as shown in Figure II.3.

In industrialized and developing countries, the index of transfers between consumer and producer groups may be indicated by the efficient surplus transformation curves STC and STC\textsubscript{p}, respectively. The relative surplus transformation curves would be influenced by a number of factors such as market structure of consumer and producer behavior, as well as available technology. In case of industrialized countries, per unit increase in producer surplus may be expected to correspond to a relatively lower decrease in consumer surplus. This may be due, in part, to the large number of consumers with relatively lower Engel coefficients. The opposite would be true in case of developing countries. The large number
of producers in developing countries make a unit increase in producer surplus infeasible without an associated greater loss in consumer surplus. The PPICs would, on the other hand, depend upon the weights assigned to different groups in the political preference function which, in turn, may be constrained by the state of managerial ability of politicians, index of relative cost of political organization and the state of conceptual foundations on which policies and institutions are build (Rausser and Foster, 1990).

![Producer Surplus vs. Consumer Surplus](image)

**Figure II.3: Comparisons of political equilibriums across industrialized and developing countries**

Consequently, the free-market equilibrium in industrialized and developing countries would be at point $a$ and $a'$, respectively, where the STC curves have a negative unit slope. In case of an industrialized country, the political equilibrium under the SWG approach would be achieved on point $b$, which is to the left of the free-market equilibrium. This reflects
relatively higher weights assigned to the producer welfare relative to consumers. However, in case of a representative developing country, the political market equilibrium will be to the right of the free-market equilibrium. In these countries, the policy formulation generally favors the consumers at the expense of agricultural producers. Using the CHG approach, the corresponding equilibriums may be achieved at points c and c' for industrialized and developing countries, respectively. In case producers in industrialized countries are less successful in their lobbying activities as compared to the consumers, the equilibrium point may shift to the right of the free-market equilibrium. Correspondingly, the equilibrium in developing countries would be to the left of a' if consumers are less influential in gaining political favors.

The institution of a political economic resource transactions policy (what Rausser calls "PERTs"), such as research and extension in agriculture, may shift the STC upward, as indicated by STC', reflecting a movement from a lower level of total available surplus to a higher level. Given the same policy preference functions as earlier, the new equilibrium may now be obtained at b'', reflecting a benefit to both the producer and consumer groups. This may reflect an expansion in the size of the total pie. However, the cost of organizing to the interest group may also change, affecting the relative weights of the economic groups. This may be reflected in a different set of PPICs (not shown). Whether this PERT activity benefits both groups, benefits the producer group and harms the consumer group, or benefits the consumer group and harms the producer group, would also depend upon the new political preference function.

The extreme stances taken by these two approaches are increasingly being questioned and the complementarity between the two is being stressed (see, for example, McLaren, 1991; de Gorter, 1990). In a review article on the recent developments in agricultural policy and trade theory, McLaren contends that both these motives may have some bearing on the outcome in the political market for agricultural protection. For example, special interest considerations are enhanced by invoking equity and nationalist arguments. This widens the source of political support to enable protectionistic policies to be politically feasible. He
further contends that "it is apparent from casual observation of agricultural trade policy that efficiency is not of paramount concerns to governments: instead they appear to respond to the income concerns of certain domestic groups, e.g. producers."

Moreover, risk and uncertainty have been put forward as the reasons for the social concerns view of the political economy of protection. However, income risk is also compatible with the political self-interest explanation. In the context of agricultural trade policy, the two approaches are therefore complementary. Baldwin (1989) also suggests integrating the two approaches. In addition, as Varyiam, Jordan and Epperson (1990) assert in their analysis of a survey of public attitudes towards farm programs in the United States, doubts can be cast on the altruistic motivation as a cause of redistributional farm policy. They find self-interest as the primary motivational force, which is the focus of the CHG approach. In another study using a similar data base, Duffy and Molnar (1989) conclude that both producer and consumer groups are generally supportive of government involvement in agriculture and do not favor farmers competing in a free-market situation. The public seems to be supportive of agriculture and the family farm concept while corporate agriculture is not viewed favorably.

Paarlberg (1989) contends that the public choice approach of the CHG models that the government has no autonomy and cannot act on its own seems to be too extreme. de Gorter (1990) and Rausser and Foster (1990 and1992) also question the limited rationale imposed by the boundaries of these two extreme approaches. They argue for a third middle-of-the-road approach. Such an approach is attempted in the next chapter, which involves the interaction between rational self-interested politician and the farm lobby, incorporating some social welfare characteristics such as ensuring food security for low income consumers. Politicians maximize support and voters act strategically in affecting government policy. Politicians choose policy to get elected and not vice-versa.

The main criticism of the SWG approach in Alston and Carter (1991) relies on the fact that group weights estimated under this approach do not provide any additional information. The information on relative weights can easily be obtained by much simpler approaches, such
as calculating the nominal protection coefficient. Moreover, the distinction between the causality and correlation is not well identified in this approach. The reduced form equation approach suggested in SWG models is more useful but results have been less satisfactory thus far. The CHG models, on the other hand, are based on a more persuasive theoretical modeling but the empirical testing of theoretical results is often problematic. The empirical estimation thus far has been restricted to analyzing the relative influence of producer and consumers only. The next subsection reviews some sample studies in the SWG literature as shown in Figure II.1.

II.1.1 Self-Willed Government Models

Initial attempts in the SWG literature on estimating the relative weights of different economic groups include Rausser and Freebairn (1974), Saaris and Freebairn (1983) and Paarlberg and Abbott (1986). In one of the first papers in this area, Rausser and Freebairn estimate the implicit welfare weights of producers and consumers consistent with the U.S. policy on beef import quotas. They conclude that during the period 1959-69, the U.S. beef policy favored consumers over producers. Saaris and Freebairn model the net effects of domestic policies as the solution to a domestic welfare optimization problem. The results are then empirically tested by a world economy model including 21 wheat-trading countries. Using averages for 1978-79 and 1979-80, they estimate the relative weights for producer and consumer groups as well as for the government. The findings suggested lower weights for producer groups only in case of four countries while consumer weights were lower in other nine countries. Equal weights were observed for producers and consumers in the rest of the countries. The major trading blocs such as the European Community and the United States were found to have significant influence on the world market prices and supplies of wheat. Vanzetti and Kennedy (1988) extended the Saaris and Freebairn framework by allowing for endogenous world wheat prices while it was considered as exogenous in the latter model.

Using a revealed preference methodology, Paarlberg and Abbott determine the relative weights for five groups: producers, consumers, taxpayers, livestock feeders and
private stock holders. The study analyzes government intervention in wheat sectors in the case of Canada, U.S., E.C., Japan and Australia during the period 1960-61 to 1976-77. Their study also represents an extension of the Saaris and Freebairn framework in that they combine the endogenous treatment of domestic policies as influenced by pressure groups with the consideration of market power in international trade. The results show that in case of the U.S., the consumer weights were greater than unity only during the last year of the study coinciding with the emergence of the consumer lobby. The results also suggest that the relative weights accorded to each group do not necessarily coincide with a national welfare function and that the weights are also subject to change over time.

In an intuitively appealing framework within the SWG approach, Riethmuller and Roe (1986) study the government intervention in Japanese rice and wheat markets. A conceptual framework is developed where the utility of the politician is dependent upon the consumer and producer welfare and the budgetary outlays. The politician is postulated to choose the levels of seven policy instruments so as to maximize the utility function. The empirical results suggest that changes in the international wheat prices seem to induce changes in domestic prices for rice. The world rice prices are reported to have no such effects. It is suggested that cost of production for rice and wheat are relatively higher in Japan and that its policies have served to subsidize producers and tax consumers.

An extension of the Riethmuller and Roe's theoretical framework is advanced in Lopez (1989) and Lopez and Sachtler (1989). These articles study the political economic decision-making process with respect to sugar policies in the United States. Government forms preferences over the welfare of domestic consumers, producers, net treasury position and foreign interests. The level of policy instrument is shown to be set such that the marginal rate of substitution between the producers' and consumers' interests is equal to the market welfare trade-offs. Sugar target prices and import-quota decisions seem to be significantly correlated with consumer and producer surpluses.

The policy instrument approach of Riethmuller and Roe and Lopez is criticized by Alston and Carter (1990) on the grounds that they provide little insight into policy
formulation and their results were statistically less than satisfactory. They conclude that the estimated welfare weights tend to be implausible or they shed little new light on the process that underlies policy formulation.

In a descriptive paper, MacLaren (1992) illustrates the differences between the SWG and CHG methodologies by applying these to explain the agricultural policies in the European Community and Australia. The pace of agricultural reform in these countries is related to the economic philosophy of the government, to the budgetary constraints, and the power of the farm lobby. MacLaren contends that the Australian government has "behaved more like the Puppet Government of applied welfare economics," that is, as the omniscient planner maximizing the social welfare. In this sense, the government policy formulation follows the SWG ideology more closely than the CHG one. In addition, he reports that the CHG model remained supreme at the national level in the E.C.

These approaches are, however, considered as too limiting and representative of two extreme viewpoints by Rausser and coauthors. In an important contribution to the literature in this field, Rausser (1982) considers endogenous government behavior in an attempt to test distinguishable hypotheses about market failure and government failure. He defines political economic resource transactions (PERTs) as policies designed to reduce transaction costs of market failure and increase general welfare. The political economic-seeking transfers (PESTs), on the other hand, refer to the case where the government has no autonomy and policies are based on the outcome of rent-seeking actions of politically powerful groups in the economy. The paper critically evaluates the supply side approach of political economy advanced by Downs and the demand side as proposed by Olson. He contends that the weights attached to the interests of different groups in the political preference function may be affected by these supply and demand factors. However, the analysis advanced by the author needs to be empirically verified.

The forward and backward linkages between political and economic markets advanced by Rausser have been further discussed in a partial equilibrium setting in Rausser and de Gorter (1989). They provide an explicit model of a democratic government with
endogenous policy formulation. The politicians compete for political support from two interest groups -- producers and consumers/taxpayers -- in an Olson-Becker framework. The policy maker's utility function is defined over the probability of support from each group where the support functions of producers and consumers are assumed to be generated by, among other factors, profit function and the indirect utility function, respectively. However, the analysis is, again, not empirically supported.

A political preference function is specified in Rausser and Foster (1990 and 1992) which is defined over a weighted average of the producers' and consumers' surplus measures. They offer a middle ground in their paper to the SWG and CHG approaches. The national policies are viewed from two interrelated standpoints, PESTs and PERTs. The PEST policies here are viewed as a way of compensating the farmers for the losses that they suffer due to the PERT policies such as public investments in science and technology. They maintain that the national welfare enhancing agricultural policies -- the PERTs -- and the national welfare reducing agricultural policies -- the PESTs -- operate in tandem. Collin (1989), in his review of the PERT-PEST framework of Rausser, comments that if these policies operate simultaneously, then the policy choices may also be interdependent.

In a comment on Rausser and Foster's paper, however, Tweeten and Coggins (1992) disagree. They argue that the evidence suggests that publicly funded agricultural research has been beneficial not detrimental to the farming sector. They also express dissatisfaction with the ability of this dichotomy to explain the causes of farm programs across countries. In a rebuttal, Rausser and Foster comment that public policy reveals that not only there exists a trade-off between PERT and PEST policies but also some degree of coordination between the two. They demonstrate that in case of two competing groups, the relative weights may change as the overall social welfare changes. The apparent weight given to one group may increase as the total social welfare increases in favor of the other group. This might explain, they argue, the prevalence of inefficient wealth transfer policies in a world of rational utility maximizers. Moreover, the simultaneous existence of farm policies of protection as well as
public investments in research and technology in industrialized countries might also be explained via this framework.

Rausser and Zusman (1992) discuss the two extreme perspectives of political economy protection that have emerged over the years in the profession of economics. They opine that the public choice perspective which focuses on allocation of public resources in a political market emphasizing redistribution to interest groups, such as that of Downs, Buchanan and Tullock, Olson, and Becker, confines to an extremely limited view of the government. They point out that the paradigm in these studies "is limited by its profoundly cynical view of the political process." The literature aimed at explaining the protectionistic policies from a "market failure" perspective is stated to presume that the "first best outcomes" are feasible. The two approaches are, then, combined to propose an example of a "central coordinator" where protectionistic policies are viewed as rational outcomes of the policy formulation process. The weights accorded to different interest groups in the coordinator's optimization function are shown to be contingent upon his evaluation of the group's objectives.

Gardner (1983) provides an extensive analysis of social transformation framework to estimate the cost of redistribution by a social welfare function defined over aggregate utilities of producers and consumers. The production control and deficiency payment programs are analyzed under the SWG approach. He suggests that this framework can be useful in evaluating farm programs under the assumption that the observed policies represent efficient outcomes of interactions among the interest groups. The paper represents a shift in the focus of research in this area, as noticed by Beghin and Foster (1992), from analysis of policy effects towards the determination of causes of farm programs. They also contend that policies may be viewed as the outcomes from a single aggregate optimization problem, as represented by a political preference function that balances the interests of conflicting pressure groups. Using a linear criterion function of welfare measures, they analyze the models advanced by Becker and Zusman as well as the standard CHG model. The paper also suggests various simplified approaches to the empirical testing of the political economy
models. Unlike Becker, they introduce a policy-maker who maximizes an objective function and modify the Zusman model to a two-groups game theoretic framework. Under Nash behavioral assumptions, they show that only one of the groups will contribute towards lobbying to achieve Pareto efficient equilibrium.

Yamauchi and Kwon (1989) also recognize these alternative approaches to analyze the protectionistic patterns. They conceptualize a political preference function where political weights represent the willingness of policy-makers to favor one interest group over the other. They estimate the weights assigned to producer and consumer groups as well as the government in case of East Asia. Their empirical model is based on a simultaneous equation approach that considers the economic structural equations, endogenous policy decision equations and the political macroeconomic system equations.

II.2 Clearing House Government Models

Pioneering analytical works of Olson, Stigler, Pincus, Becker, Peltzman and others laid the groundwork for models endogenizing the determination of the level of protection. The recent explicit theoretical modeling in agricultural protection found in Gardner, Miller, von Witzke, de Gorter and Tsur, Balisacan and Roumasset and others, derives from the pressure group models of Peltzman and Becker. The pressure group models have been reviewed in the next subsection. A more explicit exposition of the political supply and demand analysis advanced by Downs, Buchanan and Tullock and Breton, have been further analyzed in Honma, Hayami, Anderson and Tyers and are reviewed in subsection II.2.2. Studies providing empirical evidence on patterns of agricultural protection are reviewed in the last subsection.

II.2.1 Pressure Group Models

In his seminal work, *The Logic of Collective Action*, Mancur Olson (1965) points out that the groups that are successful in obtaining a collective good tend to be small in size.

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1 It may be noted that some studies reviewed in this section may also contain some characteristics of the SWG framework and may not necessarily be pure CHG studies.
Using a simple mathematical framework, he shows that for any group, the collective good will be provided if the benefits to an individual in the group from the provision of this good, would exceed the total costs of obtaining the good, C. In other words, the necessary condition for any collective good to be provided is that

\[(V_g - C) > (V_e - V_i) \nabla T\]

where, \(T\) is the level of collective good, and \(V_g\) and \(V_i\) represent the value of benefits from receiving \(T\) to the entire group and to the representative \(i^{th}\) individual, respectively. That is, in terms of Figure II.4, the collective good will be provided only within the shaded region where the total cost curve, \(TC\), falls below the ray, \(IG\), showing the individual gains. The other ray labeled \(GG\) represents the value of the good provided to the whole group. In this case,

\[(T_{ig} - T_{ge}) > (T_{fg} - T_{gf})\]

must hold for the group to receive any \(T\) at all. Alternatively, \(eg\) must be greater than \(fg\) at the level of the collective good provided.

![Figure II.4: Provision of collective good in Olson's Model](image-url)
He further theorizes that the larger the disparity among the group members in terms of their shares in the total benefits, the more optimal amount of collective good would be provided for. In addition, as the share of the largest member in the group decreases, the suboptimality will be more serious. This conclusion is then linked to the size of the group. According to Olson, the ability of any group to obtain a collective good for itself "depends to a striking degree upon the number of individuals in the group" (p. 45). The larger the number of individuals in a group, the higher will be the costs of organization and the smaller the share of total benefits accruing to any individual. Large groups often face the free-rider problem where individual incentives for contributing to the efforts aimed at acquiring the collective good would not be perceptible. Moreover, the costs of organization may also become formidable as the size of the group increases. These factors, he asserts, keep larger groups from fostering their own interests since size and share of members seem to be negatively related to the optimality in providing the public good. "Small groups will further their common interests better than large groups," and "only when groups are small, ... will they organize or act to achieve their objectives," he concludes.

In his later works, Olson (1985, 1986, 1987 and 1988) has applied his theory of the group size to seek an answer to the paradox of industrialized countries subsidizing their agricultural producers and developing countries taxing theirs. These divergent policies culminate in lower than free-market price (in the absence of intervention) received by agricultural producers in the developing countries and higher than the free-market price received by such producers in developed countries. These papers deals extensively with the issues of size of lobbying group and collective action emphasizing the organizational problems of large and geographically dispersed groups in seeking political protection.

Becker (1983) provides a theory of the political redistribution of income which is based upon the competition among pressure groups for political favors. Each group maximizes its income under the Cournot-Nash assumption by spending time, energy and

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3 These costs have been identified by Olson as including the costs of communication and bargaining among the members and the costs of formally establishing the physical organization (p. 47).
money in generating political pressure. The political equilibrium is determined by the following equation:

\[ n_i F(R_i) = -I' \equiv n_s G(R_s) = I' \]

where, \( t \) and \( s \) refer to taxpayers and subsidy recipients, respectively; \( n_i \) refers to the numbers in the \( i^{th} \) group; \( R_i \) is the vector of taxes/subsidies; \( I' \) refers to the influence function of the \( i^{th} \) group; and \( F \) and \( G \) are the deadweight losses associated with taxes and subsidies, respectively. Equilibrium in the political market, then, depends upon the number of members in the competing groups, the deadweight cost of the policy, the efficiency of each group in generating pressure and the effect of additional pressure on their influence. Efficiency in generating political pressure also depends upon controlling free-riding among the members. He points out that the "most important variables" in his framework are the deadweight costs.

He further contends that the deadweight costs may explain why farmers are subsidized in rich countries and urban dwellers in poor countries. Deadweight cost to taxpayers falls as the number of taxpayers increases. This decreases their opposition to the subsidization of the other group. Successful groups tend to be small compared to the groups who pay for their subsidies. Becker's framework also seems to admit altruism motives besides only self-interest on the part of the economic agents.

In a path breaking work, Stigler (1971) developed a theory of economic regulation within a demand and supply framework. The demand for political intervention arises from the recognition, on the part of the lobbying groups, that the political clout of the groups can be used to further the group's economic betterment. The features of the small groups emanate the characteristics that provide elements of the supply of protection. The factors that might positively influence the ability of a group to secure political power are appropriately identified as the number and incomes of the members within a group as well as their concentration and proximity to the center of government. He also acknowledges the adverse effects of the problem of free riders for large groups which is dealt with in more detail in his later work (1974). He asserts that, similar to Olson, the extent of heterogeneity among the members within a group would positively influence the probability of collective action.
Following Stigler's work, Posner (1974) critically analyzes the *public interest* and *interest group* theories of economic regulation. He concludes that neither of these approaches had thus far been rectified empirically. However, the *interest group* theory variant advanced by economists seemed more promising than the altruistic *public interest* approach based on unrealistic assumptions of fragile and inefficient markets and costless government regulations. These assumptions would incorrectly imply, according to Posner, that highly concentrated industries and industries that generate substantial costs or benefits would be greatly regulated.

A model of supply of and demand for protection in a political market framework is developed by Peltzman (1976). Peltzman generalizes the theory of economic regulation proposed by Stigler, which, by his assertions, is a theory of optimal size of effective political coalitions. The regulator in this case maximizes his support, via a majority generating function, where policy setting equates the political cost of unfavorable policy outcomes to the political benefits from the favored groups.

Krueger (1974 and 1990) demonstrates the importance of incorporating the effects of rent-seeking by interest groups in the estimation of trade distortion under traditional trade theory. She compares the welfare implications of trade policies under import restrictions with and without rent-seeking. It is found that such distortionary trade policies resulted in a net social welfare loss of equivalent to fifteen percent of the gross national product in case of Turkey and about seven percent in case of India.

The marginal political costs of instituting unfavorable policies are balanced by the policy-makers against gains in political support from the favored groups in a CHG model developed by Young and Magee (1986). The interest groups lobby politicians for favorable policy outcomes while politicians attempt to maximize their own political returns. Using the Heckscher-Ohlin-Samuelson approach, they conclude that the initial level of group endowments would be positively related to the level of protection awarded to the group.

Gardner (1987) develops an explicit political economy model using the Peltzman-Becker framework. Following Peltzman's viewpoint on regulation as a majority
generating function, or a political power function, and Becker's theory of competition among groups, he specifies the demand and cost (supply) of redistribution for U.S. farm commodity programs. He contends that farm commodity programs in the United States are primarily an attempt, given the political forces, to redistribute income efficiently. The results indicate that the intervention would narrow down substantially as the deadweight losses per dollar of the transfer increase. He further identifies an "optimal" size of the group seeking protection. Any deviations in either direction from this size are purported to lower the protection obtained. In a later attempt, Gardner (1989a) specifies a political preference function and concludes that people's political weight tends to increase as their incomes fall. However, as Lee (1989) points out, much of this work, and the political economy literature in general, lacks the "empirical analysis well grounded in theory with explicit connections between hypothesized behavior and actual outcomes" (p. 1173).

Miller (1991) also develops a model on the Peltzman-Becker framework where gains from the policy are expressed as a function of interest group political expenditure. Each group seeks to maximize its net income from the political involvement in a non-cooperative equilibrium. She points out that when farmers receive subsidies, the effect of the group size will be negative on the level of subsidies received. When farmers are taxed, larger groups should experience smaller price distortions. It is contended that the political influence associated with a given level of protection would be larger when output per farm is greater. However, without an increase in the level of political contribution, a higher political influence cannot be sustained.

Alston et al. (1989) analyze the causes and consequences of farm programs in the United States. They contend that the political economy literature usually focuses on farmer and consumer/taxpayer interactions, ignoring the role of agribusiness firms. The paper concludes that the instruments of farm policy are chosen in response to pressures from both agribusiness firms and farmers at the expense of consumers and taxpayers. Hallberg (1992) also analyzes the agricultural protection in the United States and points out that the U.S. farm policy over the past 60 years has been aimed at enhancing farmers' incomes. He argues that
an absolutely "free-market" solution for the U.S. agriculture may not be "workable". At the same time, he criticizes the present policies as being too expensive and may sometime work against the main aim of redistributing farm incomes.

II.2.2 Political Market Framework Models

Another approach to the study of political economy of protectionism focuses on the demand for and supply of protection within a political market framework. Breton (1974) combines and extends the essential arguments of the theory of public goods (Buchanan and Tullock) and the theory of democracy (Downs) to formulate a theory of decision-rules in order to explain the government behavior in democratic countries. His static theoretic model, based on a positive economics approach, provides the background for the governmental decision-making in a demand and supply framework. The demand for political action, in his model, depends upon the income and preferences of consumers as well as the participation costs for budgetary instruments. On the supply side of the public sector, it is concluded that, apart from the prices of public goods, the "dominant force in shaping the pattern of [government] policies ... is the relative power of politicians and bureaucrats."

Following Downs, Buchanan and Tullock, Breton, and Anderson and Baldwin (1987), the theory of political markets maintains that increased demand would be emanating from groups that expect greater per capita gains from protection. A more exhaustive articulation of this theory in context of agricultural protection is available in Anderson and Hayami (1986) where the demand for protection is linked to the stage of economic development of the country. Within a public choice framework, the book deals with the rise of protectionism in East Asian economies. The structural changes that occur during the course of economic development have been shown as instrumental in bringing about a switch in domestic agricultural policies from taxing to subsidizing the producers. Arguing that the relative strength of agriculture in the political market grows in the course of economic development, it is shown that the smaller the comparative advantage of agriculture, the earlier the switching takes place. Later that year, Honma and Hayami extended the analysis to the study of
structure of agricultural protection in industrialized countries. A more complete case of agricultural protection in Korea is provided in Anderson (1989) and Vincent (1989).

In an insightful article, Paarlberg (1989) disputes Anderson and Hayami's "uncritical embrace" of an extreme version of the public choice theory. He stresses that this approach rules out any possibility that the government will ever be able to act free from societal constraint. The Anderson and Hayami approach fails to explain why a significant portion of the benefits of farm programs in the United States goes to the least hurt farmers by the economic transformation process associated with structural change. Their approach is also inadequate in that it ignores external political and economic macro shocks. However, he forwards an alternative viewpoint that the government is more likely to respond to a static set of quasi-contractual obligations by the state towards the farmers. When production and land values become dependent upon protection, farmers will organize politically to resist any withdrawal. In response to Paarlberg's comments regarding the Honma and Hayami framework, David Lee points out that what is lacking in much of this work is the empirical support of the hypothesized behavior.

In another attempt, Anderson and Tyers (1989) conceptualize a general framework for examining the factors affecting the demand and supply curves for distortionary policies. Their approach to the agricultural protectionism is similar to that of Hayami and Honma. It is pointed out that some underlying patterns associated with structural changes that take place in a developing economy may include the decline in Engel coefficients and agricultural comparative advantage and prices. The marketable surplus of producers increases during this process. The features associated with the political market for protection are described in the case of a poor agrarian economy and an industrial economy, contending that the solution in the political market may not coincide with economic efficiency. The factors that they point out for weak demand for producer price supports in poor agrarian economies include the high cost of collective action by farmers, relative to potential benefits from lobbying, and the lack of other significant groups that argue for farm favor. On the supply side, the industrialists in poor countries emphasize a number of features which lower the political cost of supplying
assistance to manufacturing relative to agriculture. The demand for prices favoring agriculture expands as the economy grows since the benefits of price supports to farmers increase, the costs of collective action by farmers fall and a number of other groups with a vested interest in expanding agricultural output emerge.

In response to this paper, Honma contends that a more formal and empirically testable framework is needed to translate the subjective findings into objectively verifiable conclusions. Farm program interventions are associated with a high cost to consumers and taxpayers, as well as on foreign producers and consumers. However, the authors do not explicitly touch on this aspect. In addition, they have not analyzed the effect of foreign pressures on domestic agricultural polices and ignore the international linkages.

In yet another attempt, Anderson and Tyers (1991), and Tyers (1990) assess the potential effects of agricultural protection as well as of liberalizing agricultural trade in industrialized countries in a partial equilibrium framework. They use a simulation model of world agricultural markets for the years 1980-82, 1990 and 2000, for seven commodities or groups of commodities: rice, wheat, coarse grains, sugar, dairy, ruminant and non-ruminant meat. It is shown that liberalization of agricultural trade would negatively impact the producers' incomes but increase the overall net economic welfare.

Using the similar data base as well as commodity bundle, Tyers and Anderson (1992) have provided a more comprehensive version of their political market framework in their recent book *Disarray in World Food Markets*. They emphasize that the international food prices have been on a long-run downward trend, the trends in and direction of international trade has also changed markedly, and that agricultural protectionism has been growing in industrialized, newly industrialized and middle-income countries. Following Yujiro Hayami (1988), they provide an explicit model for the international political economy in a stochastic environment. They use nominal protection coefficients for approximating the protection rates. The existing food policies and associated cost structures are also analyzed. Overall, the book is fairly readable and is intuitively appealing in its methodology.
In a related approach, Balisacan and Roumasset (1987) extend Honma and Hayami's analysis. Employing an explicit public choice framework, they explain the correlation between economic development and agricultural protection. The reactions functions of opponents and proponents of agricultural protection are analyzed within the scope of neo-classical political economy, culminating in a non-cooperative equilibrium. While corroborating Olson's view on organizational difficulties faced by geographically dispersed farmers in developing countries, they conclude that since the farmers in developing countries have relatively low marketable surplus, their incomes are insensitive to the government's food price policy.

Johnson's much celebrated work, *World Agriculture in Disarray* (1973) presents a comprehensive analysis of the important effects of the farm and trade policies of industrialized countries. Johnson believes that agricultural protectionism in these countries has had little influence on increasing the productivity of labor in agriculture although it did increase the returns to land and capital. The domestic farm policies in the 1960s and 1970s are shown to have resulted in "enormous" costs to consumers and taxpayers. The major objectives of these policies included national self-sufficiency concerns as well as providing income support to farmers and supply insurance to consumers. However, he notes, the redistributive effects of these policies have transferred incomes away from consumers, many of whom were poor, to the farmers who were not really "poor". The real effects of these policies had contributed to the increase in agricultural production, under high-cost conditions, in these countries. The problems of lagging farm incomes were purportedly more due to the inadequate education and training rather than due to low farm prices which are the targets of such policies.

In the second edition of the book (1991), Johnson concludes that the disarray mentioned in the earlier version had in fact "deepened" in the intervening period rather than diminished. In this addition, he also focuses on the influence of exchange rate and interest rate distortions on the productivity and incomes in the agricultural sector. In addition, some newly industrialized and developing countries have also been included in his framework.
de Gorter and Tsur (1989, 1990 and 1991) adopt a model based on frameworks advanced by Downs and Breton, where politicians maximize their support from rural and urban groups. Both groups are assumed to share a homogeneous political support function. The protection afforded to each group is shown to be a function of relative income between the groups and redistributed income within the group. In their analysis, the equity motive is the focus of redistribution efforts. The explanatory variables used as proxies for endowment income differentials are per capita gross domestic products (GDP) in rural and urban sectors. However, contrary to the authors' contention, the facts suggest that in both an industrialized (for example, United States) and a developing country (India), the per capita GDP is higher in case of urban populations. Moreover, the assumption that rural people in developing countries have higher initial (or endowment) incomes, is contrary to the observed trends of rural-to-urban migration in these countries. The model loses generality due to the complexity of the comparative static analysis.

II.2.3 Empirical Evidence

There have recently been some studies analyzing the causes of agricultural protection levels within and across homogenous groups of countries. Studies analyzing these patterns across industrialized and developing countries and those providing theoretical background for their empirical work are relatively few. A sample of such studies along with their main features is provided in Table II.1.

The first and the best-known econometric analysis of cross-country agricultural protection by Honma and Hayami (1986) focuses on agricultural protection in ten industrialized countries for the period 1955-1980. Using the Nominal Protection Coefficients (NPC) for an aggregate commodity bundle, they conducted a multiple regression analysis in order to identify economic and political factors contributing to agricultural protectionism in these countries. The study identifies the comparative advantage in agriculture, its share in the economy, terms of trade between countries and other political factors as some of the major determinants. The ratio of labor productivity in agriculture to the labor productivity in
Table II.1: A sample of studies analyzing the causes of farm programs

<table>
<thead>
<tr>
<th>Reference</th>
<th>Country Groups</th>
<th>Commodities/Period Covered</th>
<th>Measure of Protection</th>
<th>Theoretical Approach</th>
<th>Group Focus</th>
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<tbody>
<tr>
<td>Honma and Hayami (1986)</td>
<td>10 Industrial Countries</td>
<td>Wt. Avg. of 13 Commodities; 1955-80</td>
<td>NPC</td>
<td>CHG</td>
<td>No Explicit Modeling</td>
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<td>Producers</td>
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<td>Honma and Hayami (1986)</td>
<td>15 Industrial and NIC Countries</td>
<td>Wt. Avg. of 12 Commodities; 1955-80</td>
<td>NPC</td>
<td>CHG</td>
<td>No Explicit Modeling</td>
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<tr>
<td>Balisacan and Roumasset (1987)</td>
<td>68 Market Economies</td>
<td>4 Commodities; 1979-81</td>
<td>NRP</td>
<td>CHG</td>
<td>Becker-Olson Framework</td>
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<td>Aggregate Commodity Bundle; 1975-79 and 1980-84</td>
<td>NRP</td>
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<td>Downs-Breton Framework</td>
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Table II.1: (contd.)

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<th>Reference</th>
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<th>Measure of Protection</th>
<th>PEAP Approach</th>
<th>Theoretical Modeling</th>
<th>Group Focus</th>
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<td>Rice; 1982-87</td>
<td>PSE</td>
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1 Period of coverage in most studies is divided in five-year periods.
2 NPC: Nominal Protection Coefficient; NRP: Nominal Rate of Protection.

industry and the ratio of agricultural land area per farm worker to average capital endowment per worker are used as proxy variables for comparative advantage of agriculture. Similarly, the share of agriculture in labor force and in total GDP were the two proxy variables used for the relative share of agriculture in the national economy along with some qualitative explanatory variables.

Honma and Hayami further extended this work in Anderson and Hayami (1986) by including five "exceptional" newly industrialized and industrialized countries to the above analysis. Using the same measure of protection for the same time period, the multiple regression analysis included some binary variables to account for European Community countries, non-militarily-aligned countries, and East Asia. The results of the OLS analysis indicated that agricultural protectionism in East Asia could be attributed mainly to the rapid increase in the comparative advantage in manufacturing rather than to a unique bias towards protecting agriculture. They conclude that the high costs of sectoral adjustment to farmers in some countries, along with the desire for maintaining political stability, necessitate
appeasement of farmers by the politicians, resulting in increased protection. Both of the above studies, however, lack any explicit theoretical modeling and are rather based upon *ad hoc* specifications. Moreover, they also suffer from the familiar problem of interdependencies present in such analyses. For example, while the declining comparative advantage in agriculture may result in price support, the price supports reduce international competitiveness of agriculture.

Balisacan and Roumasset (1987), on the other hand, empirically test the conclusions drawn by Honma and Hayami using nominal rates of protection for 68 industrialized and developing countries for a two-year period. They conclude that high proportion of food in urban consumer's budget generates intense pressure from consumers in developing countries. However, their empirical results indicate a less satisfactory explanation of the cross-country variation in protection levels when both developed and developing countries are included in the analysis. The connection between their empirical and theoretical analysis is also less explicit. As Gardner (1989a) points out, the studies in this area so far suffer from the lack of integrated development of theoretical and empirical analysis. Moreover, the choice of the dependent variable may be more suitable for comparisons across either industrialized countries or developing countries alone, not both. Direct payments to agricultural producers make these estimates biased downwards in case of industrialized countries. The taxation of producers in developing countries, on the other hand, would make these estimation biased upwards. Therefore, unlike the authors' contention, the results might be affected by the use of nominal rates of protection for the selected countries.

Using a pooled cross-country and time-series framework, Herrmann (1989) also presents an extension of Honma and Hayami's analysis by including a second independent variable (import-dependence) to the economic development measure. His empirical analysis of wheat protection levels for the period 1968-80 represents the "first such attempt" across 38 industrialized and developing countries. The study approximates the protection levels using the nominal protection coefficients. However, the "unsatisfactory" level of $R^2$ values, in case of developing and all countries, indicating omitted-variables problem, necessitated extending
the model to acknowledge the structural differences between countries and time periods. The major conclusions emerging from this analysis indicate that, apart from economic development and import dependence, the structural differences between countries is also an important determinant of the level of wheat price protection. Moreover, qualitative dependent variables can be successfully used to measure these structural differences. However, the empirical estimation in this paper is also based on ad hoc specifications.

In a series of comprehensive studies of the political economy of agricultural protection, Krueger analyzes market distortions in 18 developing countries (1989, 1992 and with Schiff and Valdès, 1991). The results of a World Bank research project are presented in five volumes. Volume 1 deals with studies of Latin American countries, Volume 2 with those in Asia and Volume 3 with African countries. Volumes 4 and 5 present a synthesis and comparative analysis of the findings of each country. Using a common analytical framework, the project was designed to systematically estimate the degrees of price discrimination against agriculture within individual countries. The dynamics of such policies over time as well as their effects on key variables such as agricultural output, income distribution and foreign exchange earnings, are also studied.

These volumes and other related papers by Krueger study the combined effects of direct pricing policies, and of "those more general economic policies that have an important but indirect impact upon agricultural returns", such as exchange rate distortions. A significant contribution of these studies is the calculation of direct, indirect and total nominal protection rates for a number of countries for the period 1960-85. The direct policies are reportedly designed to stabilize domestic prices. However, it is demonstrated that effects of indirect intervention policies dominate direct interventions in most cases. The results indicate that there is a strong tendency in developing countries to tax exportable agricultural commodities and to subsidize the importables.

She further contends that interventions in domestic pricing of agricultural commodities have their historical origins in four sets of circumstances:

(i) producers' activities to unite towards a common purpose or purposes,
(ii) governments' efforts to increase revenues,
(iii) efforts to keep food prices low for consumers, and
(iv) dynamic adjustments to external conditions.

Given these, it is pointed out that the protection of domestic consumers, price incentives to producers, self-sufficiency in food commodities and stabilization of prices are among the prime motives for government intervention in the agricultural sector in most of the countries studied. The individual country studies also reported, to varying degrees, the desire to promote food self-sufficiency as an overriding motive for agricultural intervention. The desire for inducing price stability was also mentioned as an important aspect of food pricing policies.

These and other factors such as foreign exchange earnings and controlling inflation were also assigned positive weights in the national agricultural policies. While these weights slowly shifted over time, none of the motives disappeared from the policy formulations. Moreover, the interrelationship among these variables suggests that the interventions designed to accomplish any one of these motives may soon encourage contests among various political and economic interest groups to tilt the outcome in their own favor. The country studies point out that, at times, government agencies were instructed simultaneously to try to guard the interests of different economic agents. It is also suggested that the determinants of protection awarded to different commodities differ sharply, depending upon the trade nature of the commodity, and whether it is a staple food commodity or not.

A single regression equation specified by de Gorter and Tsur (1991) to support their theoretical analysis uses the total nominal rates of protection estimates from Krueger et al. (1988) as a measure of protection for 18 developing countries. The analysis is done across a number of commodities covering averages for two periods (1975-79 and 1980-84). However, the transition from theoretical to econometric specification is somewhat unclear. The hypothesis advanced in the theoretical model claims that the pre-policy income gap is higher between rural and urban sectors of the industrialized countries. The analysis, however,
covers only developing countries and uses post-policy data. A number of other binary variables are used for which no theoretical interpretation is provided.

In his doctoral dissertation, de Gorter (1983) formulates a behavioral model of consumers, producers and politicians which outlines the supply and demand for government intervention in the United States dairy sector. The theoretical analysis indicates that the productivity of political pressures and resources, the inter- and intra-group reaction to protection levels awarded, the sensitivity of politicians to the pressures generated by various lobbying groups and the demand and supply elasticities are some of the major determinants of government intervention. On the other hand, the factors influencing the supply of government intervention include the level and sensitivity of political resource contributions and the usefulness of political resources in generating electoral votes. The comparative static analysis, however, lacks consistency and accuracy.

Using a similar World Bank data set (Krueger et al., 1988 and Valdés, 1991) of 18 developing countries, Fulginiti and Shogren (1992) perform an econometric analysis using the nominal protection coefficients to reflect relative strength of manufacturing and agriculture sectors. In the theoretical portion, they apply the economic theory of rent-seeking contests to these sectors. The manufacturing sector dominates agriculture in developing countries. As economic development follows, the weight of manufacturing decreases and both sectors become equally powerful. However, their econometric test for this conclusion does not yield significant results. It is concluded that there is a positive correlation between the exportable agricultural surplus and taxation of agriculture. "Food favoritism" as a reason for agricultural taxation in developing countries could not be validated empirically.

In another different yet related paper, Fulginiti (1992) uses the political market framework of supply of and demand for protection as articulated by Yujiro Hayami. The data set as well as the dependent and independent variables are similar as in the above paper. Using the same regression equations, it is implied that there is a strong correlation between economic development and agricultural protection. The same results are reported in this paper as above.
The econometric estimation in Gardner (1987) analyzes the farm programs in the United States for 17 commodities over 69 years. The protection levels are measured using a variation of nominal protection coefficient -- the price gains to agricultural producers as a percentage of observed market prices. Results from the pooled cross-section time-series regression estimated using Tobit maximum likelihood estimator indicate that the farm programs could partially be explained by, among other variables, supply or demand elasticity, number of producers, geographical concentration of producers, farmers' numbers and farm incomes. However, the analysis seems to suffer from the excluded variable problem since the coefficient of determination values obtained are significantly low.

Miller (1991) uses nominal protection coefficients as the dependent variable to approximate the level of protection in 34 countries for a sample of commodities. Some observations on the dependent variable correspond to the years of middle-to-late 1970s and some to early 1970s and early 1980s. The results from the Probit model, however, seem less satisfactory. In one of the regression models, none of the variables tested were significant and the coefficient of determination varied from 21 to 33 percent. Considerable bias may be present for treating output and consumption as exogenous variables to explain the protection levels.

A reduced form type model of U.S. producer price support in wheat, representing the supply-side approach to agricultural policy modeling, was empirically tested by von Witzke (1989). A criterion function is specified for the policy-maker which is defined over producers' income and budgetary expenditures. The target price for wheat in the U.S. is used as the dependent variable in the study which covers the period 1963-64 to 1983-84. It is concluded that shifts in farm price support in the U.S. are negatively influenced by the share of the U.S. in world wheat exports, budgetary expenditures of the farm policies and the U.S. presidential election years. However, as McCalla responds, it is unclear that the empirical equations estimated flow from the theoretical framework developed in the paper.

Causes of government intervention in Canadian agriculture have been studied by Carter et al. (1990) using a public choice framework. The conceptual approach as well as the
empirical model are similar to that of Gardner (1987), which, in turn, is based on the framework of Peltzman and Becker. The politicians are assumed to be passive and voters to be rationally ignorant. The focus in the empirical estimation is on the interest group variables for explaining protection. The empirical model uses a pooled cross-section time-series data for nine different grain and livestock commodities for the period 1965-87. The nominal protection coefficient is used as a dependent variable and the explanatory variables include commodity and interest group characteristics and 'national interest' variables. They do, however, realize that the nominal protection coefficient does not include effects of policies that do not have direct price effects and this variable "may be an imperfect proxy of the degree of protection ... and also does not reflect lagged effects."

Their results show higher levels of output growth to be associated with low levels of protection. The increased geographical variability of production is found to increase protection. However, casual observation reveals that the higher level of output implies higher level of income, which may, in turn, generate more political pressure and not less as suggested above. They also contend that the Peltzman-Becker model may be a useful tool in understanding agricultural policies in Canada but the redistribution in agriculture does not appear to be efficient. There also seems to be a bias present in the results since some of the explanatory variables may not necessarily be independent of the dependent variable, as is the problem with most empirical studies in this regard.

In a quantitative analysis Miller (1987) analyzes the political, institutional and economic complexities on the way to agricultural policy reform. Focusing on Japan, Canada, the European Community and the United States, he attributes the growth in farm programs in these countries to the slowdown in the rate of growth of demand and the recession of the early 1980s. Miller maintains that the world agricultural markets are in their worst state since the great depression of the 1930s (p. 7). He further contends that although the cost of farm programs has increased dramatically, the farmers in most countries face serious economic and financial hardships. He contends that quite apart from the cost of farm subsidies, farm programs adversely affect national income growth, domestic employment and income
distribution. The E.C. alone is estimated as having a net loss of one million jobs in manufacturing and services as a result of agricultural protection. Farm policies are aimed at similar objectives in all countries, such as farm income support, financial security, price stability and food-supply security. Reform of agricultural policy must be undertaken by many countries if the costs of liberalization are to be equitably distributed, he concludes.

The *World Development Report: 1986* highlights the dichotomy of the treatment of agricultural sectors across industrialized and developing countries. Small organized groups, such as organized labor and the middle class in developing countries, are shown to be politically more successful. On the other hand, large dispersed and unorganized groups, like small farmers and unskilled workers in developing countries, tend to be politically inarticulate. The report opines that "political decisionmaking tends to take over, so that prices are determined by the relative power of the interested parties."

Winters (1987) provides a descriptive analysis on a variety of themes related to the political economy of agricultural protection in industrialized countries. According to him, farm policies of industrial countries bring financial strain to their economic welfare. He argues that the problem results from the conflict between social attitudes which abhor change and an economic system and an agricultural technology which is constantly changing.

Within the boundaries defined by these forces, agricultural pressure groups, bureaucrats and politicians have considerable freedom to maneuver, and their interactions typically lead to increasing amounts and complexities of farm support. This outcome results not just from equilibrium in the political marketplace but also from the 'process' by which decisions on agriculture and other issues are taken.

Gautam et al. (1991) formulate a structural theoretical framework of the government intervention in agriculture across industrialized and developing countries. Producers maximize their profits by taking into account the political resource constraint which depends upon their contributions towards lobbying for political gains. A number of propositions are drawn from the comparative static analysis which are then tested empirically. The model uses a pooled cross-section time-series data for ten industrialized and developing countries to
explain the protection awarded to rice producers. Four different models, using a combination of proxies for explanatory variables, are specified to substantiate the results of the theoretical model. The coefficients are found to be highly significant and are able to explain up to 90 percent variation in protection levels across countries. It is established that as the production of the commodity rises relative to its consumption, the level of protection awarded may decrease. The group-size is also found to be an important variable that explains the protection awarded to rice producers. A corollary of the results is that as a country gets richer, it shifts from taxing to subsidizing its agricultural sector.

Lutz and Scandizzo (1980) attempt to analyze the extent of price distortion across seven developing countries in a partial equilibrium framework. The extent of distortions are studied on output, income, and government revenues using Marshallian surplus measures. Price distortions are measured by the nominal protection coefficients for a period of 1-2 years in the early- or mid-1970s. A brief review of supply and demand elasticities, along with the ranges of elasticities used in their analysis, is provided. They report that the agricultural sector is discriminated against in developing countries which also depresses domestic production. Domestic consumption, on the other hand, is subsidized in these countries which is stated to be one of the objectives of price intervention.

In the next year, using a similar partial equilibrium approach, Bale and Lutz analyze price policies pursued in nine developed and developing countries for the year 1976. They also quantify the impact of distortions as captured by the nominal protection coefficients on income, output, employment and efficiency, using the Marshallian surplus measures. They report that price distortions have altered rural employment in both developed and developing countries. Compared to the free-market scenario, distortions are shown to have resulted in higher unemployment rates and consumption, and lower production in developing countries. The opposite is found to be the case in developed countries. These incorrect price signals have also caused distortions in trade, making many importing countries self-sufficient and many potential exporting countries net importers.
Using a pooled cross-country and time-series framework, Herrmann (1989) concluded that wheat price protection is influenced by the levels of economic development and import dependence across countries. Due to unsatisfactory level of $R^2$ values in case of developing and all countries, he extends the model to acknowledge the structural differences among countries and time periods. This improved the results in that up to 60 per cent of the variation in the dependent variable was explained by some of the regression equations fitted. The major conclusions emerging from this analysis indicate that, apart from economic development and import dependence, the structural differences among countries are also an important determinant of the level of wheat price protection and that qualitative dependent variables can be successfully used to measure these structural differences. Nevertheless, the paper fails to outline broad theoretical framework to support the empirical analysis.

II.3 Food Security and Price Stabilization: A Motive for Intervention

A great deal has been written about food price stabilizing policies and the food security for consumers since the world food crisis of the 1973-74, when the prices doubled and, in some cases, tripled (Hopkins, 1986; and Thompson, 1983). A wide array of price stabilization and other policies are adopted in countries across the world in order to mitigate food shortages and to enhance accessibility to food for the poor consumers (Bigman, 1985). Various studies have highlighted the complex interaction among the domestic food price policy, food production policy and food security concerns in industrialized as well as developing countries. As Adelman and Berck (1991) point out, the food-security and associated problems are a serious concern of policy-making, especially in developing countries. Nevertheless, some of the policies adopted might be incompatible with each other and also with the long-run food security objectives (Krueger, 1992 and 1990; Tullis and Hollist, 1986).

Heckscher (1935) termed as provisionistic the trade and pricing policies that maintain domestic food prices below international levels. Such policies, as the following reviews demonstrate, are common in developing countries. As Tyers and Chisholm (982) point out,
poor consumers -- especially urban consumers -- in these countries are "an important political constituency" acting in rational self-interest. Policies to stabilize domestic markets to ensure consumer food security prevail in almost all countries trading in staple food products. However, the PEAP studies reviewed above have neglected the role of such concerns in the determination of domestic protectionistic policies.

Some relevant works on the consumer food security and its attainment through domestic price stabilization policies are reviewed below. This section stresses the need for an analysis which quantifies the linkages between food security, price stabilization and PEAP policies. The focus of this section is not on whether price stabilization policies, food aid or other development strategies are the best and most efficient instruments for achieving food security. Rather, the purpose here is to emphasize the point that there is a linkage between the food security perceptions of the general public and politicians and the determination of domestic food policies.

II.3.1 Consumer Food Security

Food security has generally been defined as availability of adequate supply of food for all the people at all the times and accessibility to food in terms of purchasing power of the people. According to the World Food Council (1988), food security may imply two things: availability of and accessibility to adequate food supplies for all people; and inter-temporal stability of food supplies. In this sense, first, adequate quantities of quality food should be available, accessible, and affordable -- when and where needed -- to ensure food security. Second, this state of affairs should be stable and expected to continue in the future. Busch and Lacy (1984) comment that food security has at least three dimensions: availability; accessibility; and adequacy of food supply for all people at all times. Bigman (1982 and 1985) measures food insecurity by not only the per capita consumption in different income groups, but also by the probability that, in a given year, their food consumption might fall below a certain critical level. A second element of risk may be introduced by the fluctuations in production.
A "less ambitious" concept of food security has been adopted by Chisholm and Tyers (1982) as the ability of a country to meet some target level of consumption. Food insecurity, in this sense, is ultimately a problem that affects the ability of people to command adequate food for consumption in the face of exorbitantly high prices. In this excellent collection of articles on food security, especially in Asian and Pacific Rim countries, they also report that many "low-income countries have subsidized and attempted to stabilize retail food prices to provide food security for urban consumers." They conclude that these programs have largely been successful but at the cost of rural population. Tyers and Chisholm report that governments in industrialized countries serve to increase their food self-sufficiency and to support agricultural income. They point out that policies adopted to ensure food self-sufficiency may entail some positive externalities such as "social sentiments favoring the maintenance of traditional rural life-styles."

Fafchamps (1992) argues that for developing countries, "food security is best assured by food self-sufficiency." He develops a crop portfolio choice model under multivariate risk. The absence of integrated food markets result in a high variance in food prices and a high covariance between individual and market supply. The combination of the staple nature of the commodity and low income elasticity of consumption and other factors lead to a situation in which food security at the household level is best achieved by a high degree of food self-sufficiency.

Sturgess (1992) similarly defines food security as "access by all people at all times to enough food for an active healthy life." He provides an operational definition of security as "the capacity to meet target levels of food consumption on a yearly basis." Self-sufficiency as a means of ensuring food security is the essence of his paper. He points out that self-sufficiency in food is seen as a safeguard against food shortages and hunger in the Western European countries. Although government intervention in agriculture is required to ensure stable food supplies, he argues that the agricultural interests have been crucial in defining agricultural price policies. Agricultural lobbies in these countries "seek to use vague public fears to buttress their protected positions" (p.316). He cites the following extracts
from an E.C. bulletin, *A Common Agricultural Policy for the 1990s*, that confirm the desire for ensuring food security through food self-sufficiency as being instrumental in E.C.'s agricultural policies:

Agricultural products are mainly intended for consumption as food, which is one of humanity's basic needs. Most civilizations have therefore placed great importance on developing and safeguarding agricultural production. In Europe on the other hand reliable food supplies are now taken for granted, largely thanks to a farm policy which has made it possible to expand agricultural production. Self-sufficiency in foodstuffs does not of course rule out trade with the rest of the world but such trade must be kept in balance and must not lead to one-sided and therefore potentially dangerous dependence on other countries (p. 9). ... [The] food shortages of early postwar years were still fresh memories and the increasing tensions of the Cold War made a stable supply base all the more desirable (p. 14). ... Critics of the CAP point out that world prices for agricultural products are low. They may well be at times, but the crux of the matter is to achieve long-term security of supply at reasonable and stable prices (p. 23).

As a result, the prices of agricultural products in Western Europe, especially cereals, have been highly stabilized and maintained at about 40 percent higher than the world price levels during the last decade. Although these policies have increased self-sufficiency, these have generally adversely affected social welfare. Sturgess feels that the fear of food shortages is one important element that generates willingness, among people in the Western Europe, to acquiesce to agricultural protection. Over the past half-century, the United Kingdom has, in its pursuit of self-sufficiency in food products, espoused agricultural policies that enhance production. However, as O'Hagan (1976) points out, food self-sufficiency has been an overt or covert objective of national development plans in almost every country, industrialized as well as developing, although with different policy instruments. The depressing effect of protective CAP policies on the world prices has also been studied by Saaris (1991).

Johnson (1991) reports that for the past century, food security has been an important objective of farm policies in most European and Asian countries. He questions the policy-makers' beliefs that food security can be enhanced by food self-sufficiency. He contends that food self-sufficiency does not assure food security, although the two are considered to be synonymous in many countries. Countries that pursue such policies, incur
huge costs in terms of reduced national incomes and increased tensions within their trading blocs. He points out that liberal trading system in international markets and peace are the essential conditions for food security.

Thompson (1983) contends that much of the literature on food security deals with a country's aggregate food security, ignoring it from the individual viewpoint. He comments that individual food insecurity can result from a drop in income or from a sharp increase in the price of food that reduces the purchasing power of that income and hence the amount of food it can buy. Aggregate food security, according to him, is achieved by ensuring adequate food supplies to feed the country's population at reasonable prices regardless of fluctuations in crop yields. Food insecurity at the most basic level, according to him, is not a problem of crop-failure but of poverty. "Only poor people go hungry." He further comments that international price risk is often cited as the rationale for developing countries' unwillingness to rely on food imports as a source of food security and for their desire to become self-sufficient in food.

Weber et al. (1988) define food insecurity from short-term and long-term perspectives. The short-term food insecurity arises out of immediate disasters such as crop-failures while long-term food insecurity comprises the chronic shortages of food supplies such as are encountered in many African countries. They contend that the problem of long-term food insecurity may be dealt with by increasing real incomes of food consumers. They argue that food prices play a dual role, especially in developing countries. They act as an incentive to agricultural producers but are a major detriment of the real incomes of the consumers. This price policy dilemma hinges on the question: who are net producer and net-consumers of food? Citing the example of some African countries, they show that the agricultural policies in these countries have erroneously kept food prices at higher level to increase the incomes of vast majority of rural people, aiming to increase long-term food security. However, the empirical evidence suggests that most of these countries have had lower than 50 percent of their population as net producers, with very little marketable surplus. This implicitly suggests that the appropriate policy would have been to keep food
prices low as is the case in many Asian countries. Moreover, they also point out that the supply response to higher food prices has been quite low, even negative in some cases, in developing countries. Citing evidence from elsewhere, they contend that "even with a hundred percent increase in cereal prices, the degree of self-sufficiency would only increase from 47 to 55 percent."

Two different dimensions of food security have been mentioned in the literature. Valdés (1983) distinguishes between the demand and supply side of food security. Warley (1983) separates short-term and long-term aspects of food security. Long-term food security implies assured availability of increasing per capita food supplies, while in the short-term, food security may be achieved by avoiding sharp reductions in consumption due to variations in incomes, food prices, supply and availability. Bale (1983) cites the problem of bias in policies towards attaining short-term food security while the long-term issues are seldom addressed and may be exacerbated by short-term measures. The problem is said to originate from the pressure on politicians to respond quickly to "short-run imperatives with a continual series of short-run policy palliatives."

Adelman and Berck (1991) acknowledge these divergent patterns in agricultural pricing policies across industrialized and developing countries, albeit with a common aim to ensure food security. They adopt the definition of food security as proposed by Reutlinger and Knapp (1980): *food security represents a condition in which the probability of a country's citizens falling below a minimum level of food consumption is quite low*. The results of their simulation models indicate that the adoption of different food security programs will depend upon the degrees of risk aversion of the society and upon the political influence of rural versus urban groups. They report that most developing country governments institute cheap-food policies mainly due to their high degree of risk aversion rather than any urban bias, though these two are not mutually exclusive factors. They admit that the pursuance of self-sufficiency to ensure food security results in higher food prices than would be the case in specializing according to comparative advantage or importing. Most developing country governments that are concerned with poverty tend to subsidize the
price of grains to consumers. But this policy benefits the poor less than the rich in absolute terms and also in proportion to their incomes.

Roumasset (1982) develops a conceptual model of short-run and long-run food security. A less obvious cost of stabilization is the reduction in domestic production. He suggests that without costly producer subsidies, stabilization policies that put a ceiling on consumer prices will also lower producer prices. Bouis and Herdt (1982) share Roumasset's view of the trade-off between short- and long-run food security. They report that the short-run government objective is often to keep the staple food prices low as is the case in many Asian countries. Such a short-term policy "runs counter to the long-run goal [and represents] a classic trade-off in the distribution of income between consumers and producers." They further report that long-range policy issues are often accorded second priority in government policy formulation to the short-run issues.

Phillips and Taylor (1990) contend that the food security literature so far has failed to appreciate the cross-sectional and inter-temporal distinctions in the concept of food security. Food insecurity, defined by Reutlinger and others as a 'temporary decline in households' access to enough food,' is too restrictive according to them. They assert that the problem of assuring food security for the masses is prevalent in industrialized economies as well, although not as visible as in developing countries. They comment that "although vast majority of hungry people live in countries with very low average per capita incomes, food insecurity is not restricted to these countries alone." For example, approximately 20 million people in the United States did not have access to sufficient food in 1990. They also recognize the link between food security and domestic agricultural price stabilization policies. Defining food insecurity as the current state of food insecurity plus anticipated deviations from this state, they develop an elaborate conceptual framework with an optimal control problem that may form the basis for future quantitative efforts in this area. The conceptual model acknowledges the risks imposed by the excessively high food prices and the concept of food insecurity insurance at micro (household) as well as macro (national) levels.
Staatz, Agostino and Sundberg (1990) also recognize the distinction between the national and household concepts of food security. They point out that the problem of food insecurity may no longer be viewed as a transitory one but as a chronic problem arising out of inaccessibility to adequate quantities of food. Moreover, the relationship between higher household incomes and good nutrition may itself be too weak in some instances, as they show in case of Mali. The insecurity is not as much due to the shortage in supplies as it is due to inequitable distribution of these supplies. Moreover, they point out that the factors ensuring food security at the national level may do nothing to alleviate the problem of food insecurity at the household level. Therefore, they contend, the commonly used indicators of food security at national level may at best be "poor guides to interventions to help the hungry," and hence the need to develop indicators for food security at the micro levels.

The relationship between household incomes and individual food security is also the focus of Schiff and Valdés (1990). Like Staatz et al., they contend that increasing incomes may not improve the nutritional intake of individuals. They argue that the focus in developing countries on industrial development and providing cheap food to urban consumers through price interventions has resulted in severe underdevelopment of their agricultural sectors. This has adversely affected their long-term food security. In a comment on this paper, von Braun (1990) suggests that one of the emerging issues in this regard is the problem of food security for the urban poor in low-income countries. He commends the paper's appropriate stress on the linkages between food security and the role of public interventions for nutritional improvement. In an earlier attempt (1988), he cautions against risks of food subsidy policies followed by developing countries. He contends that in all of the developing countries studies, the consumer prices of agricultural products are kept below the international prices.

Sanderson's (1990) compilation of papers on agricultural protectionism provides a comprehensive evaluation of farm policies in industrialized countries. He points out that food security is often cited as a justification for protecting agriculture in the European Community and in the United States, which produce much more than their domestic
requirements. The argument seems more plausible in the case of Japan which has pleaded for exempting basic foods from GATT negotiations on the grounds of food security. He contends that agricultural fundamentalist and food security considerations still hold powerful sway over attitudes in many countries. A similar collection of articles on PEAP literature is available in Burger et al. (1991). Koester, in the same volume, highlights the cost of farm programs on consumers and taxpayers in E.C., Canada, Japan and Australia.

Gardner (1990b) also cites promoting food security as one of the five main reasons for farm policies in the United States. He hypothesizes that non-farmers acquiesce to farm programs as they consider that these programs guarantee food availability at reasonable prices. Farm programs may constitute a form of insurance for risk averse consumers and producers. He contends that price instability is generally viewed as a market failure and that farm programs are corrective and benefit the economy as a whole although this may not be supported by factual evidence.

Sanderson and Mehra (1990) opine that food security concerns become more important than concern about food prices, the more affluent the consumer gets and the support for agricultural protection increases (p.323). They further contend that wars and embargoes, with their attendant food shortages, leave an enduring legacy of anxiety about food security. Similar sentiments are also expressed by Josling, Sanderson and Warley (1990), George and Saxon (1986), and Anderson and Tyers (1989). Assuring food security at stable and equitable food prices, "keeping people on the land" slogans, and supporting a simpler and healthier rural life style may be some important vote-getters in industrialized countries. Koester and Tangermann (1990) also mention assuring adequate food supply at reasonable prices as one of the four main determinants of food policies in the European Community.

Hayami (1990) and Kobayashi (1989) cite achieving food security as one of the Japanese government's most important responsibility. George and Saxon (1986) corroborate Hayami's contention by pointing out that "many Japanese consider that the present cost of agricultural protection is not too much to pay for the food security it is perceived to provide."
The Japanese obsession with food security is believed to have deep historic roots in the memories of periodic famines and food shortages over past several centuries. Moreover, Japan's location and extremely high ratio of population to agricultural land also make it appear vulnerable to external threats to its food supply. They further point out that the value Japanese people place on these functions of the farm sector has given rise to an ideology of support that is built into Japan's agricultural legislation. Hayami (1986) also adduces the threat of war with North Korea as an underlying factor in South Korea's protectionistic policies aimed at maintaining adequate food security.


Falcon et al. (1987) discuss long-run and short-run food security and the dilemmas associated with policies addressing these issues. Short-run consumption oriented food security can be obtained in part by pricing policies that benefit the poor and the malnourished. The difficulty is that such price policies may be in direct conflict with longer term food security objectives, such as increased food production or certain food trade policy. The same conflicts are also reported by Reutlinger (1987) and Pinstrup-Andersen (1987).

Miller (1987) states that important among the goals pursued by farm programs in food importing countries are those of security and quality of food supplies. The importance of these genuine national concerns have been heightened by war time and other famines and by grain export embargoes. Both Japan and the E.C. have sought to pursue food self-sufficiency. On a calorie basis, Japanese food self-sufficiency has declined to now stand at around 59 percent. In Japan, the basic approach to achieve food security has been to encourage domestic self-sufficiency and consumer prices of food are over 60 percent higher than they would otherwise have been. The Common Agricultural Policy (CAP) of the EC guarantees regular food supplies and ensures reasonable prices to consumers. European
consumers pay prices for agricultural commodities that are considerably higher than world prices. The objective of guaranteeing regular supplies to consumers in EC have been met but at a high cost to consumers and taxpayers. However, the objective of consumers paying "reasonable" prices have not been met, since E.C. consumers pay prices much higher than would be the case if a free flow of world agricultural commodities were allowed into the Community.

Variyam, Jordan and Epperson (1990) estimate the determinants of U.S. citizens' preferences regarding government involvement in agriculture. The results from the survey indicate that roughly 75 percent of the respondents favor the idea that the family farm must be preserved since it is a vital part of their heritage. However, when the questions were worded differently to take into account the consumers' willingness to pay for farm programs, only 35 percent supported the idea of increasing the food prices to help pay for these programs. The results also indicated that as incomes and education increase, the support to protect the family farms as well as the government intervention generally declines. The negative correlation between incomes and preference for farm programs is contrary to Anderson, Honma and Hayami's argument that as consumers' incomes increase and their Engel coefficients decline, the resistance to farm programs also declines. It may be noted that these differences in preferences may be due primarily to the micro and macro level of investigation in these studies. Overall, about 82 percent of respondents felt that government should be involved in the agricultural sector. Their results indicate that individual preferences exhibit rational self-interest in deciding government policy towards agriculture, as contrary to the economic arguments suggesting altruistic motives as a cause of redistributionary farm policies. The results are contrary to Pope (1986) who suggests that people feel altruistic towards farm families and are willing to support income transfers to the agricultural sector. However, the survey lacked direct questions on consumer food security issues such as maintaining stable and surplus food production and reasonable prices.

Mellor (1988) stresses the structural imbalance in global food production and consumption. Developed countries produce surplus food whereas in developing countries,
the demand outstrips domestic production. He offers opportunities to increase food security from this imbalance in the short-run as well as in the long-run. Improving food security requires both increasing the purchasing power of the poor and boosting overall food production. Security of food consumption cannot be separated from production stability programs. He contends that the domestic food price policy, food import policy, and food production policy represent a complex interaction from the food security perspective. Cheap food policies may also be implemented for reasons of maintaining political stability in the face of little income growth.

FAO (1988) states that the major objectives of agricultural policies in industrialized countries also include attaining food self-sufficiency and supporting domestic consumers. The food self-sufficiency has been a major goal of domestic farm policies in many countries, in part due to the uncertainty, real or perceived, of imported food supplies. In industrialized countries, with a history of substantial exports of major food commodities, food prices paid by consumers tend to be closer to international prices. In importing countries with a substantial measure of protection to domestic producers, consumer food prices tend to be high in line with producer support prices. As a consequence of such policies, consumers in industrialized countries have been guaranteed regular food supplies and have often been unaffected by fluctuations in the world market. The direct link between trade and food security of developing countries is also stressed, highlighting the interdependence between agricultural sectors of industrialized and developing countries. FAO (1987) specifies consumer food price stabilization and food security as important objective of price policies in developing countries (p. 34). The World Bank's *World Development Report: 1986* also reports that "most developing countries pronounce self-sufficiency as an important objective but follow policies that tax farmers, subsidize consumers, and increase dependence on imported food." Consumer subsidies help the poor but they also end up reducing the incomes of farmers who are much poorer than many of the urban consumers.

Tullis and Hollist (1986) report that governments in many industrialized and newly industrializing countries suddenly found a pressing need to reduce their food insecurity. It
has generally been accomplished by further protecting and subsidizing domestic food production, even when the costs of these programs exceeded those manifest in international market prices. "Some governments found that cheap food seemed less desirable than secure food and the political tranquillity that such security implied" (p. viii, italics added).

Hayami (1986) argues that consumers' acceptance of agricultural protection policies in Newly Industrialized Countries may be a necessary reason for food security. It has been argued that protectionist policies are essential to the maintenance of adequate food security, especially in Korea. Anderson and Hayami (1986) point out that the food-security objective has usually been perceived as requiring farm prices to be raised to ensure self-sufficiency. Hillman and Rothenberg (1988) trace out the Japanese concern for food security, which, they argue, "has been predicted on, if not fully identified with, self-sufficiency" (p.40).

Developing countries usually support cheap-food policies to the benefit of consumers of agricultural products over farmers (Peterson, 1979). State controls through the marketing boards set prices of food products below the levels that would be determined by the competitive free-markets, thus ensuring short-term food security to poor consumers. Other policies designed to lower domestic prices may include the imposition of export taxes and overvaluation of currencies. On the other hand, prices received by farmers in industrialized countries were about four to five times greater than those received by farmers in low-income countries. Using the data from 28 developing countries, he concludes that unfavorable farm prices have resulted in a 40-60 percent decrease in the agricultural output in these countries, thus adversely affecting their long-run food security. Similar conclusions are also reported in Kerr (1985). In a related work, Bale and Lutz (1981) also conclude that such pricing policies have provided more food to the non-agricultural population in developing countries. These studies seem to suggest that short-term food security is the primary focus of agricultural policies in low-income countries than long-term food security.

Byerlee and Sain (1986) evaluate the differences between domestic producer and consumer, and world prices of wheat for 31 developing countries for a period of 1980-82. They comment that there is an ample evidence to suggest that governments in developing
countries consistently try to provide low price wheat to urban consumers. However, the policy of favoring consumers has not always been at the direct expense of domestic producers. The lowest wheat prices were reported where wheat is a staple food and where most of the wheat is produced domestically (about 90 percent self-sufficiency). Consumer subsidies were high in countries which are relatively less dependent upon agriculture for income and taxation. It is also suggested that higher levels of wheat imports were generally associated with high producer prices. They conclude that the discrimination against agriculture as well as the producer-consumer conflict in policy formulation may not be as wide spread as reported in earlier studies.

Lutz (1988) provides a bibliography of protectionism in which the common theme expressed is that countries create berriers to food imports because of food and national security. The reasons pointed out for domestic protection include national security of food supplies and a quick government response to shptides. He further asserts that many industrialized countries also protect their farmers for reasons of food security.

II.3.2 Price Stabilization to Ensure Food Security

Consumer benefits from price stabilization policies were the focus of initial works by Waugh (1944), Oi (1961) and Massell (1969). Waugh's famous theorem on consumer benefits of price stability states that, under some specific assumptions, consumers are harmed by price stability while variable prices benefit consumers. This result stems from the downward sloping nature of the demand curve. However, symmetrical fluctuations in prices may raise consumer welfare while welfare declines from asymmetrical price fluctuations. This is because a price decline increases welfare by more than a price increase of equal magnitude decreases it.

His methodology was later challenged by many economists including Massell (1969) and Samuelson (1972). Massell demonstrated that while price stabilization increases welfare to society, its effect on individual groups depends crucially on the source of instability. Consumers gain from price stabilization if price fluctuations arise from demand disturbances
and lose if these arise from the supply side. The opposite is true in case of producers. Although his analysis is based on some special assumptions such as linear supply and demand curves and risk-neutrality of agents, the simplicity of his results nevertheless has had great appeal (Wong, 1989). Samuelson demonstrated that Waugh's results could only be verified under certain very restrictive and unrealistic assumptions and "can never feasibly apply". Samuelson theorizes that in a closed economy, price stabilization must result in a lower mean than the unstabilized base scenario. In a final statement, he concludes that "price stability is, other things equal, in itself a virtue."

These pioneering works have been the basis of a flood of subsequent theoretical research. Much of the earlier work in price stabilization was based on some special assumptions including perfect competition and risk neutral agents. A substantial body of literature has since been developed and the models have become increasingly sophisticated incorporating more realistic assumptions about uncertain market conditions, distortionary interventions and risk attitudes of agents. For example, works by Newberry and Stiglitz (1981), Turnovsky (1976), Samuelson (1972), Bigman and Reutlinger (1979), Bigman (1982 & 1985), Zwart and Blandford (1989), Wong (1989), Wright and Williams (1989), Sicular (1989), and Konandreas et al. (1978) relax some of the earlier assumptions.

The study by Newbery and Stiglitz offers a different analytical approach. Their comprehensive analysis incorporates a number of realistic assumptions and does not suffer from the weaknesses of Waugh-Oi-Massell framework (Ch. 9). They identify errors in the models using the conventional Marshallian consumer surplus measures to evaluate the benefits of price stabilization. One of the errors of the earlier literature is in assuming that it is possible to stabilize prices at the mean. The correct price around which to stabilize is the price at which average supply equals average demand. Evaluating the effects of price stabilization, they demonstrate that risk-averse consumers benefit from price stabilization in a stochastic environment. They contend that the consumer would be willing to pay a fraction of their incomes to have the price stabilization introduced. This fraction would depend upon their relative risk aversion, variance of prices, income and price elasticities, and their
expenditures on the commodity in question. They conclude that consumers would prefer stable prices when they are averse to income risk and their demand is relatively inelastic.

Newberry and Stiglitz's framework has been applied in Tyers and Anderson (1992, Ch. 3 and Appendix 4) to account for short-run disturbances originating in domestic production and in the international market for rice. Assuming linear demand and supply schedules they introduce an element of risk through random disturbance in production and border price. Domestic demand is divided between rural and urban households. They opine that both producers and consumers prefer more rather than less stable prices and highlight a public interest case for insulation of food markets in both rich and poor countries. Moreover, since relatively more influential pressure groups are expected to be the main beneficiaries of such programs, government intervention is thus supplemented by aggressive lobbying by these groups. The supply of intervention is relatively less costly for the politicians since no group of agents in the domestic economy would appear to lose significantly. If economic agents are risk-averse, they conclude, then a public interest case for price stabilization exists if instability in prices threatens their welfare.

Using a simple conceptual framework, Foster and Rausser (1992) attempt to explain why consumers and taxpayers acquiesce to seemingly inefficient wealth transfers to a relatively small number of producers. They disagree with the proposition advanced by political economists that consumers and taxpayers suffer too little in the rent-seeking game to bear the cost of opposing the aggressive political influence of producers. They contend instead that consumers in fact benefit from this transfer. Their model assumes two interest groups, each of whom has a veto power over a change from the status quo. They believe that farm policies are part of a larger portfolio of policies and that these price distorting redistributory transfers are the cheapest means of securing public interest policies. They conclude that producers as a group might actually be losers from such transfers when the implementation of the larger portfolio is accounted for. Their framework demonstrates "how a seemingly inefficient policy that appears to harm consumers could, in fact, be a rational
component of a larger portfolio of policies ultimately benefiting consumers at the expense of producers."

Adelman and Berck (1991) highlight the link between price stabilization and food security. They contend that price stabilization policies have been used to ensure food security in both industrialized and developing countries, albeit with contrasting results. Price stabilization policies of industrialized countries are useful in reducing the likelihood of food shortages. Many groups would be willing to pay for such a policy, but it may have virtually no effect on decreasing the percentage of malnourished or the food-deficit on the average. Other food security policies impoverish domestic farmers and reduce their production incentives, as those pursued in developing countries. They report that urban groups, except marginal workers, would be willing to pay 0.21 to 1.5 percent of their incomes for price stabilization introduced. If the cost of price stabilization programs were to be passed on to the households in the form of increased taxes, it would amount to four-tenths of a percent of their incomes and these groups would be willing to pay this insurance cost.

Bigman (1985) also examines the link between food policies and food security under instability and develops a behavioral model of farmers' production and consumption decision in response to stabilization policies. One of the objectives in his work is to highlight the trade-offs between short-term food needs and long-term production goals. He discusses the policy analysis in an open and closed economy case amid price uncertainty and under various scenarios, incorporating food security risk in the analysis. In one of his earlier attempts (1982), Bigman also examines the methodological framework under the welfare economic analysis that seeks to assess the desirability of stabilization policies. He also provides a review of the policy being used in many developing countries to cope with specific food problems and to secure price stability. Gardner (1981 and 1990a) also proposes a hypothesis that unregulated markets cannot cope adequately with instability.

Stabilizing agricultural prices or reducing fluctuations of some high priority commodities is an important objective of agricultural price policies in developing countries (Reca, 1983). Johnson (1991) points out that in the E.C. and Japan, stable prices and assured
supply at those prices are the primary benefits that consumers obtain for their acceptance of farm subsidies and price supports. He points out that consumers find it difficult to respond to prices that vary significantly from one period to another. This, he contends, may explain why consumers benefit from price stabilization, although it may still be questionable. He argues that measurement of consumer benefits from price stabilization should rather focus on an aggregate price index, such as the consumer price index.

The *World Development Report: 1986* states that price stabilization in case of staples is a major concern in many developing countries, where the poor spent a large proportion of their incomes on these foods. It also points out that the price stabilization schemes that protect farmers from large price falls and consumers from large price increases may be explained by the variability of agricultural commodity prices. For example, the Food Corporation of India runs one of the greatest food distribution systems in the world. The system has been successful in providing greater price stability for consumers than would have existed otherwise. Stabilizing and increasing farmers' incomes and containing the migration of people out of the farming sector are contended to be the primary objectives of agricultural policies in industrialized countries. Underlying these objectives, it is claimed, are the social and political aims of stable food prices and self-sufficiency in production. The Report maintains that though self-sufficiency is supposed to contribute to food security, stabilize food prices and make prices reasonable, cheaper means may exist to accomplish these objectives.

Kerr (1985) analyzes the trends in agricultural price protection for a sample of 37 developing countries during the period 1967-83, using nominal protection coefficients. The major emphasis is on checking whether a significantly different pattern of price protection existed for major staple food commodities. The results show that governments in these countries have placed more importance on stabilizing the price of these commodities, particularly that of cereals. He further points out that "stabilization of food crop prices is not in the interest of farmers but rather in the interest of stabilizing and maintaining retail food prices at low levels for urban consumers." Less than 20 percent of the price increases
associated with the world food crisis of early 1970s were passed on to the cereals farmers whereas non-food export crop prices reflected almost double that amount. Nevertheless, these policies have resulted in increasing scarcity of food products in these countries.

Hazel, Jaramillo and Williamson (1990) use the post-War data to examine the trends in world price stability and its impact on the prices received by agricultural producers in developing countries. They conclude that while world prices of most commodities have been quite variable with an upward trend in variation, the domestic marketing arrangements as well as government interventions have prevented the variability from being transferred to producer prices in developing countries. The impact of such marketing boards and other price stabilization schemes in Canada are studied by Spriggs and Van Kooten (1988). They contend that price stabilization schemes may even have negative impacts on stability of farm incomes, and thereby on consumption and overall welfare. Therefore, they suggest removal of commodity-based stabilization programs which, they claim, are essentially a means by which "a select group in society can successfully pursue rent-seeking activities."

Welfare impacts of domestic and international price stabilization policies are also analyzed by Wong (1989). He comments that earlier studies on welfare effects of price stabilization have assumed a perfectly competitive framework. Following Massell's framework, with apparent modifications, he develops a two country model to draw the distinction between the effects of these two types of price stabilization. Chisholm and Tyers and others also conclude that the world price stability is adversely affected by the domestic price stabilization programs.

In industrialized countries, such as the European Community, Canada and the United States, government intervention is usually designed to keep producer prices at a level above their nonintervention levels. The welfare effects of domestic and world price stabilization policies are also analyzed by many authors (Spriggs and Van Kooten, Bullock, 1992; Devadoss, 1992; Choi and Johnson, 1992; Thompson, 1983; Evenson, 1983; Schultz, 1978; de Janvry, 1983). Devadoss concludes that domestic distortionary policies themselves may contribute to the world price instability and that world price stabilization programs would
result in gains to agricultural producers. Similar conclusions were also reported by Zwart and Meilke (1979).  

In short, then, food security concerns seem to be relevant for consumers across both developing and industrialized countries. These concerns may also influence domestic protectionistic policies. However, the patterns of intervention aimed to achieve food security seem to differ across these countries. Although long-term food security is ensured through increasing domestic production, the immediate government objective is often primarily concerned with keeping food prices low in countries with large number of poor consumers (Bouis and Herdt, 1982). The food security literature, thus, suggests an unambiguous link between the food security concerns of consumers, price stabilization policies and government intervention in the agricultural sector. Food programs and food price stabilization policies, therefore, also seem responsive, in part, to consumers' attitudes towards food security risk. Some significant influences on the direction and magnitude of distortionary intervention may include, among others, the relative strengths of economic pressure groups, the relative size and incomes of different groups. The preferences of rational self-interested political leadership may also bear importantly in the political market equilibrium.

The next chapter provides an analytical overview of the protectionistic patterns across industrialized and developing countries.

\footnote{Literature in this area is extensive. However, in keeping with the focus of the present thesis, these studies are not reviewed here.}
CHAPTER III
AN ANALYTICAL OVERVIEW OF AGRICULTURAL PROTECTION

The variation in protection awarded to agricultural commodities indicates some general patterns of protection across industrialized and developing countries. The observed patterns exhibit a positive relationship of the level of protection with the per capita incomes and negative relationship with the number of farmers and the share of agriculture in the national economy (see Gautam, 1992). A predominant pattern of agricultural protectionism across countries is that while farmers in industrialized countries receive subsidies through income enhancing and price support programs, their counterparts in developing countries are generally taxed (USDA, 1993; OECD, 1992). The producer support programs in industrialized countries invariably result in higher food prices for consumers while developing countries adopt cheap food policies to improve accessibility to food for poor urban consumers (Schultz, 1978; Miller, 1986; Byerlee and Sain, 1986).

This chapter begins by providing a simple political market framework of agricultural protection in order to explain the factors that lead to such divergent policy outcomes across industrialized and developing countries. The idea is to analyze the interactions among producers and consumers of agricultural commodities as well as the politicians, and examine other factors that affect the demand for and supply of agricultural protection. The first section, therefore, highlights these interactions within a theoretical framework, along with supporting factual evidence. An accurate measurement of the actual level of intervention is a prerequisite for the effectiveness of the analysis. Therefore, a comprehensive comparative analysis of various measurement concepts and their policy coverage is provided in Section II.2. The choice of a measurement concept is also highlighted along with its merits and limitations. The analysis is followed by a display of the comparative results with a graphical exposition of the food commodity market distortions in the cases of small and large countries. The case of price discrimination, where foreign markets are competitive and domestic market is monopolized, is also discussed at the end of the chapter.
III.1 A Political Market Framework of Agricultural Protection

In analyzing the divergent outcomes of agricultural protectionistic policies across industrialized and developing countries, one plausible starting point may be to employ the traditional theory of demand and supply to the market for political intervention. The theoretical frameworks developed by Downs (1957), Buchanan and Tullock (1968), and Breton (1974) and further advanced by Honma and Hayami (1986), Anderson and Hayami (1986), Hayami (1988) and Tyers and Anderson (1992), conceptualize a political market where the demand for a particular policy emanates from the potential beneficiaries while the political leadership is the supplier (Figure III.1). The political process is assumed to consist of three groups: agricultural producer interest group, agricultural consumer interest group, and the political leadership. The groups whose incomes are positively associated with the prices of agricultural commodities are included in the producer subset. The non-farm population, broadly mentioned as consumers who are net purchasers of agricultural commodities, would comprise of groups whose incomes are negatively associated with these

![Figure III.1: The political market for government intervention in agriculture](image)

The frameworks advanced do not require the political leadership to be democratic. For example, farm protection was introduced in South Korea while it was still under dictatorial rule. However, it is generally assumed that the leadership is contestable (Tyers and Anderson, 1992). The explicit graphical exposition of the political market concept was provided by Hayami (1988, p. 130), and later by Tyers and Anderson (1992, p. 85). In addition, the slopes of the political supply and demand curves are also influenced by the political characteristics of different interest groups.
prices. Any distortionary policy designed to benefit a specific group would invariably harm the other group in the society. The political support from the group opposed to the policy would, therefore, decrease, constituting a cost to the policy makers. The higher the level of protection, the higher the political cost of each additional increase in the level of support. This would produce an upward sloping supply curve, reflecting the marginal cost of the policy, as shown in the figure. On the other hand, the marginal gains to the beneficiaries of a policy would be lower at higher levels of protection, thus giving a negatively sloped demand curve, reflecting marginal benefit. Therefore, the policy maker, realizing this trade-off, balances the marginal cost of a distortionary policy to its marginal benefits, with the equilibrium level of protection awarded being decided at the intersection of the political supply and demand curves.

Given this simple political market framework, the next step would be to analyze the factors that affect these demand and supply curves in such a way that diametrically opposite agricultural protection policies result in industrialized and developing countries. Inter-temporal dynamics of agricultural protection within a given country can also be analyzed using this framework.

III.1.1 The Political Market in Developing Countries

In developing agrarian economies, the demand for agricultural protection is generally weak primarily due to high cost of collective action by farmers relative to potential benefits from lobbying (Olson, 1965 and 1988; Anderson and Tyers, 1989). The large number of geographically dispersed farmers in these countries are faced with poor communication and transportation infrastructures and evident free-riding problems. Therefore, they find it hard to organize themselves for political lobbying. The per capita gains from lobbying for higher prices of their products are relatively less worthwhile for small farmers with little marketable

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6 Groups interested in agricultural policy include farmers, consumers, taxpayers, bureaucrats, foreigners, input suppliers and other agribusiness firms. There might also be numerous subgroups within these broad categories. For example, within the producer group, livestock producers and corn producers may represent different interests. Moreover, interests of low-income farmers may be represented in both producer and consumer groups or some of them can be net consumers. However, to keep the exposition comprehensible, all interests have been confined to either of the three groups.
surplus. Moreover, the absence of farm-support groups like fertilizer, pesticide and credit corporations and related lobbies also makes it formidable for farmers in developing countries to successfully lobby the political leadership. These factors tend to keep the demand curve for agricultural producer protection, $D_p$, relatively weak (Figure III.2).

![Figure III.2: The protection levels for agricultural producers and consumers in low income countries](image)

On the other hand, the relatively strong demand for agricultural consumer assistance policies in developing countries, $D_c$, emanates from their relatively small number and large Engel coefficient. The relatively easier organization in case of urban consumers and industrialists and their close proximity to the political leadership assists in obtaining political gains. The industrialists also favor cheap food policy in order to keep the wages of their workers at lower levels. Food price fluctuations tend to increase the expenditure risk of agricultural consumers and the profit risk of industrialists. The fluctuations in prices and quantities supplied of some essential food commodities may induce an element of uncertainty in the consumption patterns of poor consumers who are trying to meet a minimal target level
of consumption. These problems are even more accentuated for consumers who spend a large portion of their incomes on food. Under such circumstances, consumers may prefer government intervention in the agricultural sector to have price stabilization introduced. According to Tyers and Anderson (1992), people seem to "prefer prices of (especially necessary) products to be more rather than less stable over time" (p. 99). The consumers' concerns regarding food security and food prices seem to be overriding (Webb et al., 1990, p. 85). This premise is explored in some depth in the theoretical model of consumers of food products developed in the next chapter.

The relative size of consumer subsidies may also be contingent upon the risk aversion position of the country (Adelman and Berck, 1991). A highly risk averse country may opt to pursue policies of higher subsidization for consumers in order to ensure accessibility to adequate food supplies. This subsidization is often carried out by keeping the domestic food prices at levels lower than the international prices, which, in turn, also depresses the prices received by agricultural producers. Therefore, the demand for consumer protection in developing countries generally lies to the right of that of the producers.

On the supply side, the cost to other sectors of providing subsidy to the large agricultural sector becomes prohibitive due to their small size and high per capita tax burdens associated with even a small amount of agricultural subsidy. Such subsidies, which generally result in increased food prices, are, therefore, resisted by the urban consumers and industrialists. High and volatile food commodity prices may also result in political instability for the leadership. In addition, the high costs of tax collection from the consumer interest group in developing economies, in terms of leakages and corruption, make consumer taxation less worthy. Moreover, the relatively small size of the consumer group in these countries would bring forth lower absolute tax revenues. The lost support from the disadvantaged groups would, thus, make the cost of assisting a particular group inversely proportional to the size of that group (Anderson and Tyers, 1989).

7 It seems appropriate that if a country is risk-averse, then low producer prices to ensure cheap food to consumers would increase the risk of food shortfalls and not reduce it. This is the dilemma faced by developing countries which strive to ensure short-run food security to their consumers while such policies often run counter to the long-term food security. This apparent trade-off between the short- and long-term food security is discussed in detail in Section II.3.
Therefore, in developing countries, there is generally a high political cost to the leadership in supplying protection to the agricultural producers. The assistance provided to the consumer group by keeping food prices low, would usually entail lower political cost. Most developing countries accomplish this objective of cheap-food through a host of government agencies which, in some cases, monopolize both buying and selling of staple food commodities. The Food Corporation of India, the National Food Authority of Philippines and the National Logistics Agency of Indonesia, are some examples of state controls aimed at maintaining stability in agricultural supplies and prices. In addition, some other social and fiscal characteristics also tend to favor the consumer interest groups. The bias in favor of industrialization as a tool of modernization in government policies may also put adverse pressure on the agricultural sector. Some nationalistic perceptions also work to reinforce the continuing exploitation of the agricultural sector in favor of the urbanized consumer group.

Thus, the resultant supply curve for the producer political support, $S_p$, is generally to the left of that of the consumer interest group, $S_c$, as shown in the figure. This reflects that the per unit cost of supplying protection to the consumer group relative to the producers is much lower. For example, supplying $\tau$ units of protection to consumers costs $OC$ per unit, while per unit cost of the same level of protection to producers costs the political leadership $OA$. On the demand side, the marginal benefits of obtaining one unit of protection is higher for consumers ($Ob$) as compared to producers ($Od$). Overall, the interaction of political supply and demand for agricultural producer and consumer protection in developing countries invariably results in taxation of the former ($Ep$) and subsidization of the latter ($Ec$). Thus, food price policies in these low-income countries generally favor consumers and discriminate against agricultural producers.\(^8\)

Table III.1 substantiates the above political market explanation of agricultural protection by providing information on costs and benefits of seeking protection to the

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\(^8\) However, the extent of discrimination against producers would depend upon their relative size and level of effective organization. In countries where producer groups are relatively more effective, the level of taxation will correspondingly be lower (Miller, 1981, p. 499). Such groups may also receive explicit input subsidies but the taxation in these countries is normally indirect and is not explicit to the producers.
producer and the consumer groups. The matrix depicts that per capita benefits to the successful group happen to be much higher than the cost to the disfavored group. In case of China, the per capita benefits to consumers (non-farm population) of protection equal $119.65 while the cost to each farmer (farm population) is $36.21 only. If the same benefits were distributed among the farm population, these would have provided a per capita benefit of $42.04 and, if the same costs were borne by the consumers, each consumer would have had to pay $103.05. Thus, eliminating the protection would harm consumers more than it would benefit the farmers. In short, these characteristics of poor agrarian economies increase the demand for and supply of protection to agricultural consumers. The reverse is true in case of industrialized countries, as discussed below.

Table III.1: Cost-benefit matrix of agricultural protection
(1990)

<table>
<thead>
<tr>
<th>Country</th>
<th>Benefits</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Producers</td>
<td>Consumers</td>
</tr>
<tr>
<td></td>
<td>Per Capita: $6,939.4</td>
<td>Per Capita: -$80.07</td>
</tr>
<tr>
<td>United States</td>
<td>Total: $34,697 million</td>
<td>Total: -$19,616 million</td>
</tr>
<tr>
<td>China1</td>
<td>Producers</td>
<td>Consumers</td>
</tr>
<tr>
<td></td>
<td>Per Capita: $119.65</td>
<td>Per Capita: -$36.21</td>
</tr>
<tr>
<td></td>
<td>Total: $33,619 million</td>
<td>Total: -$28,954 million</td>
</tr>
</tbody>
</table>

1 The data for China correspond to the year 1987.

Note: The total benefits and costs are calculated for each country by adding the gross PSEs (or CSEs) for the commodities for which data were available. The per capita benefits (costs) are derived by dividing the total benefits (costs) received by the group by total number of members in that group.

III.1.2 The Political Market in Industrialized Countries

In industrialized countries, the per capita benefits to the agricultural producers of engaging in political lobbying are relatively higher due to their small numbers and high marketable surpluses. The costs of organization and collective action are relatively small because of improved communication infrastructure, better education and less free-rider problems (Olson, 1965). Relatively wealthier farmers in these countries find increased means and motivation to demand higher protection in the face of decreasing importance of agriculture in the national economy (Paarlberg, 1989). The demand for agricultural producer protection may also rise as the farmers in industrialized countries see their incomes lag behind those of non-farm sectors (Sanderson and Mehra, 1990). Even in some industrialized countries with relatively large number of farmers, the problems of free-riders are minimal due to several factors, such as increased awareness and better communication. In addition, other agribusiness groups, such as fertilizer and pesticide lobbies, also have a vested interest in expanding agricultural output and, therefore, support output enhancing policies such as price subsidies. Moreover, the government bureaucracy also often provides political support to the farm lobbies. The high costs of moving off the farm, both economically and emotionally, also step up the demand for protection by the farmers.

The demand for protection from the consumer interest group is, however, relatively weak in these countries due to factors such as high costs of collective action, geographically dispersion, increased free-riding problem and small Engel coefficients. These factors reduce per capita benefits of seeking protection. The resulting demand curve for producer support, $D_p$, therefore, lies to the right of the demand for consumer support, $D_c$ (Figure III.3). The society is reported to have an income elastic demand for assisting farmers. The resistance to increasing food prices by non-farming groups in industrialized countries dissipates as their incomes increase and the overall share of food in the household budget declines (Anderson and Tyers, 1989). In addition, the increase in per capita incomes also reduces the price

---

9 For these farmers, it might be worth it to spend most of their farming subsidies on political resource contribution towards increasing these subsidies in the following years. As The Economist (December 12, 1992) exclaims, "The Swiss farmer who earns 80% of his income from subsidies would do well to spend 80% of his time farming the government."
elasticity of demand for food commodities (Sanderson and Mehra, 1990).

The supply of political support in industrial countries tends to favor the producer group (OECD, 1985). The relatively lower share of agriculture in the national income also lowers the cost to the political leadership of supplying protection to the agricultural producers. Certain other factors, such as food security considerations, fondness of non-farm population towards preserving the farming lifestyles, and self-sufficiency in food commodities, work to abate the opposition to the supply of protection to this group. In addition, food shortages associated with wars and famines may also instill anxiety about food security. Agriculturist fundamentalist and food security considerations have been reported to still hold a powerful sway over attitudes about agriculture in many industrialized countries (Josling, Sanderson and Warley, 1990).

Moreover, as Gardner (1990b) points out, there seems to be a perception that an economically sound agriculture becomes a kind of food insurance for risk-averse consumers who prefer stability in the supplies of food products. These concerns add to the support for **Figure III.3: The protection levels for agricultural producers and consumers in industrialized countries**

Anderson and Tyers (1989) argue that any given price distortion policy results in deadweight welfare loss (as a percentage of the gross national product) that is roughly proportional to the share of that sector in the country's total gross domestic product (p.183).
increasing agricultural production through subsidizing producers. The food security concerns, therefore, may become overriding compared to the concerns about food prices as the consumers' incomes rise (Tyers and Anderson, 1992; Sanderson and Mehra, 1990; Anderson and Tyers, 1989). More about food security and benefits of price stabilization to the consumers is discussed in the development of theoretical framework of consumers.

The supply curve for the producer group, $S_p$, therefore, would generally be to the right of that of consumers, $S_c$, as shown in the figure, reflecting lower marginal cost to the political leadership. The marginal cost of supplying protection to the large consumer group as opposed to the small farming group may be formidably higher. The political leadership would have less to lose politically by hurting the interests of the large and unorganized consumer group. In short, a number of features lower the political cost of assisting agricultural producers and raise the political demand for benefiting this group, thus resulting in subsidization of the producer group ($E_p$). On the consumer side, the weak demand, associated with high cost of political support, result in taxation of consumer groups ($E_c$) in industrialized countries.\footnote{In industrialized countries where consumer organizations are relatively vocal, consumer support may take forms other than price support. For example, the public funding for product quality inspections, medical research on dietary habits, and other publicly subsidized research costs may be more significant than programs encouraging lower staple prices.}

These conclusions may also be supported from the data for the United States presented in Table III.1 above. The table shows that in 1990, the per capita benefits to agricultural producers (per capita of the farm population) were $6,939.40 in the United States whereas the per capita cost to the disfavored group (consumers) was relatively small ($80.07). These protection levels amount to even greater benefits when calculated on a per farmer basis rather than the per capita of farm population basis. For example, the subsidy equivalents per farmer during the same period in the United States amounted to $22,000 (OECD, 1992). Similar estimates for other industrialized countries were also comparable. Japan and E.C. farmers, for example, got relatively lower but significant benefits ($16,000 and $13,000, respectively). On the other hand, per hectare subsidy equivalents were significantly higher in Japan ($8,422) as compared to other nations (OECD, 1992).
III.1.3 A Comparative Analysis of Patterns of Agricultural Protection Across Countries

Figure III.4 explains the outcome of divergent protectionistic policies across countries on a single graph showing subsidies to farmers in industrialized countries and taxation of farmers in low-income developing countries. In terms of the figure, $\tau$, representing the units of protection, generally appears on the left side of the origin in low-income developing countries while it falls in the positive quadrant (subsidy) in the case of industrialized countries. The patterns of consumer protection policies, on the other hand, would represent the opposite of this outcome across developing and industrialized countries. Figure III.5 also corroborates this political market framework by providing factual evidence for 1991 on producer and consumer protection levels, as approximated by the producer and consumer subsidy equivalents, respectively. For example, producers in industrialized countries such as Australia, Canada, E.C. Japan, United States, etc. are subsidized while the low-income countries such as China, Pakistan, India, Turkey, Bangladesh, Argentina, etc. tax the farmers. On the consumer side, these low-income countries subsidize their agricultural consumers while they are taxed in high-income countries. Some middle-income countries, like S. Africa and Mexico, subsidize both the agricultural producers and consumers. The source of protection in such cases invariably comes from the taxation of the non-agricultural sector. Although the demand for protection has increased from the producer group, yet the relatively high proportion of food in private household consumption expenditures (for example, 35% in case of Mexico), limits the government's options to start taxing the agricultural consumers.

Therefore, among the factors that influence the level of producer assistance across countries, the effect of the share of food in total household consumption expenditures, or the Engel coefficient, is of particular interest. Engel coefficients are one of the primary determinants of benefits to consumers of seeking food assistance or opposing agricultural producer protection (Balisacan and Roumasset, 1987; Honma and Hayami, 1986). These coefficients may not only affect the demand for protection from poor consumers in developing countries, these may also subdue the protests to increasing producer protection in industrialized countries. These patterns are analyzed in Figures III.6 and III.7, which show
Figure III.4: The divergent outcomes of agricultural producer protection policies in industrialized and developing countries

Note: 1. The consumer subsidy equivalents for Australia are zero. The data on consumer subsidy equivalents for Argentina, Brazil, Chile, Egypt and Turkey were not available.
2. The data for Australia, Canada, United States, E.C., Japan and Taiwan correspond to the year 1991. The data for Austria, Finland, Norway, Sweden and Switzerland pertain to the year 1990. The data for Argentina, Bangladesh, Brazil, China, Egypt, India, Mexico, Pakistan, S. Africa, Turkey and U.S.S.R. correspond to the year 1985.


Figure III.5: Producer and consumer protection levels across industrialized and developing countries for wheat
Engel Coefficient (%)

Note: 1. The data for consumer protection, approximated by CSEs, represent averages for a number of commodities for 1982-87.
2. Engel Coefficients represent the average (percent) private household expenditure on food for the period 1982-87.

Figure III.6: Decreasing food expenditure and its influence on the demand for consumer protection

PSE (%)

Note: 1. The data for producer protection, approximated by PSEs, represent averages for a number of commodities for 1982-87. In case of Bangladesh, the PSE-Wheat is used.
2. Engel Coefficients represent the average (percent) private household expenditure on food for the period 1982-87.

Figure III.7: Decreasing consumer resistance to agricultural producer support
the relationship of Engel coefficients to the consumer and producer protection levels, respectively, across industrialized and developing countries. Figure III.6 shows that consumer protection tends to be higher where food expenditures amount to a greater percentage of the total. The consumers in low-income countries with low purchasing power are highly vulnerable to fluctuations in food supplies and prices. Thus, the political market outcome in developing countries favors consumers at the cost of producers, as shown in thenext figure. Engel coefficient is, thus, shown to be positively related to the consumer protection levels, giving rise to the S-shaped area in the figure.

As the percentage expenditure on food declines, the importance of food prices diminishes for urban consumers in industrialized countries and the resistance against producer protection declines. The diagonal reverse S-shaped area in Figure III.7 shows that Engel coefficients are negatively related to the producer protection levels. The higher the Engel coefficient, the more the farmers are taxed and vice versa. An important corollary of this observation is that as the proportion of household budget spent on food declines further to a certain level, the effective taxation of the consumer groups may begin.

Other important determinants of agricultural protectionistic policies may include the import-dependence or self-sufficiency in the commodity concerned. Countries like E.C. and Japan have raised their food-security and self-sufficiency in some food commodities and have decreased dependence upon imported food (Gardner, 1990b). The E.C., a food importing country in the early 1960s has become a major food exporter. Japan's pleas for exception of staple foods from multilateral trade negotiations have been linked to the reasons of food security (Sanderson, 1990). Such policies in these countries have invariably been associated with heavy taxation of consumers. Concerns about food security are more important in case of developing countries where food prices are kept low to ensure immediate food security,

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11 The countries like Mexico and Argentina may be considered as the outliers in this figure although the policies in most middle-income countries tend to favor both producer and consumers simultaneously.

12 Food self-sufficiency is generally defined as the domestic production as a percentage of consumption. In most industrialized countries, food production has outstripped consumption, thereby increasing their food self-sufficiency and making them major exporters of these commodities. See for example, Sanderson and Mehra (1990), p. 355.
which has invariably depressed production and has made them net food importers.

The relative size of the consumer and producer groups also has significant impact on
the protection awarded to the group. Politically successful groups tend to be small relative to
the size of the groups taxed to pay their subsidies, as discussed in the earlier section. Figure
III.8 plots the share of agriculture in labor force against the wheat producer protection levels
in a cross-country framework. The countries where agriculture accounts for a relatively
lower (higher) proportion of the total labor force, generally subsidize (tax) their farmers.
Most of the countries with share of agriculture in labor force between the range of
approximately 18-38 percent (the shaded area in the figure) in the given sample, are
middle-income countries which have relatively recently started subsidizing their farmers.

Noticeable contrasting patterns in agricultural protection and their magnitudes can
also be observed when policy outlays are compared across industrialized and developing
countries (Table III.2). An obvious dichotomy in policies may be observed through the
market price support mechanism. Industrialized countries tend to keep their domestic
producer market prices above the border price levels. Developing countries, on the other
hand, tend to keep the domestic producer price below the border level, depressing domestic
production incentives.

Among the selected industrialized countries, the least distortionary policies are being
followed in wheat market by the Australian government. While domestic producers are paid
input and other assistance, the domestic producer prices are kept at the same level as the
border prices. The levels of market price support ($7086.11 million) as well as the overall
expenditure outlays ($8408.23 million) in case of wheat farmers are the highest in the
European Community. Similarly in Japan, about 78 percent of the support to farmers comes
through market price support measures. In these countries, where market price support
policies are the main mechanism of support to domestic farmers, the majority of the burden
of such policies is borne by the domestic consumers. For example, the incidence of producer
support on the consumers in the European Community and Japan accounted for about 58.7
percent and 78.4 percent, respectively, in 1991. By contrast, in countries where direct
Note: Wheat producer protection levels are approximated by PSE Wheat. The Labor Force (Agriculture) data have been arranged in an ascending order to facilitate comparison.


**Figure III.8:** Farm group size and variation in protection levels: Wheat, 1982-1987
Table III.2: The magnitude of intervention in wheat markets: Cross-country comparisons of policy outlays

<table>
<thead>
<tr>
<th>Country</th>
<th>Market Price Support</th>
<th>Direct Payments</th>
<th>Input Assistance</th>
<th>Other Assistance</th>
<th>Total Policy Outlays</th>
<th>NRP (%)</th>
<th>PSE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Australia</td>
<td>Canada</td>
<td>E.C.</td>
<td>Japan</td>
<td>U.S.A.</td>
<td>Argentina</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>915.17</td>
<td>7086.11</td>
<td>842.54</td>
<td>1149</td>
<td>-65.52</td>
</tr>
<tr>
<td>Industrialized Countries</td>
<td></td>
<td>0</td>
<td>292.2</td>
<td>218.2</td>
<td>82.87</td>
<td>2403</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>52.27</td>
<td>1035</td>
<td>55.25</td>
<td>270</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>132.63</td>
<td>249.36</td>
<td>96.69</td>
<td>350</td>
<td>90</td>
<td>31.54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(66)</td>
<td>(100)</td>
<td>(100)</td>
<td>(8)</td>
<td>(31)</td>
<td>(100)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200.5</td>
<td>1509</td>
<td>8408.23</td>
<td>1077.35</td>
<td>4120</td>
<td>-33.98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100)</td>
<td>(100)</td>
<td>(100)</td>
<td>(100)</td>
<td>(100)</td>
<td>(-10)</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses represent percentage of total. The percentage figures in case of developing countries indicate how much of the total does each policy account for, had all these policies been favorable to the producers.

Developing Countries:

Argentina

Bangladesh

China

India

Nigeria

payments are the mainstay of agricultural policies, such as in the United States, the main burden falls on the taxpayers. The market price supports in the United States accounted for only about 28 percent of the total outlays, whereas the direct assistance policies accounted for about 58 percent of the same.

The average transfers per head of population in the E.C. amounted to $409 while the same figure for the United States was $318 in 1991. Such transfers were highest among the Scandinavian countries such as Finland ($1,173), Norway ($987) and Sweden ($416) as well as in Switzerland ($925). The producer support levels per farmer (PSEs) were about $22,000 in both Canada and the United States while E.C. farmers received $13,000 per head in the same period. Although the transfers per farmer in Japan were $17,000, the per hectare transfers in case of Japan were the highest ($8,422). In the Japanese dairy sector as well, the transfers to dairy farmers amounted to $3,472.8 per cow, which were the highest among the industrialized countries.

In case of developing countries, the market price support was generally negative. The domestic prices relative to the border prices were lowest in case of India resulting in highest taxation of farmers among the selected countries (Table III.2). None of the developing countries make any direct payments to farmers as is the case in industrialized countries. However, providing input assistance to farmers in developing countries is not unusual.

The measurement concepts aimed at gauging the level of intervention by the wedge between the domestic and border prices only, such as the nominal rate of protection (NRP), would show no government intervention in case of policies such as those followed by Australia. Some other measures, such as the producer subsidy equivalents (PSEs), would account for the input and other assistance policies and show a more accurate positive level of intervention. The comparative efficiency of these and other measurement concepts is discussed in detail in the next section.
III.2 Comparative Analysis of Protection Measurement Concepts

The government intervention in agriculture affects the market prices and producer incentives through a myriad of distortionary policies. The policy transfers to agricultural producers may be occasioned by means of price and non-price supports. While some policy instruments may affect these variables directly with relatively transparent effects that are easily calculable, some other policies designed to affect the agricultural sector as a whole or the entire economy may also have substantial influence on the market conditions for individual commodities. The product-specific effects of such indirect policies may not, at times, be easily discerned. One of the underlying elements of the policy analysis, therefore, is to determine the magnitude of the influence of such divergent policy instruments on the market incentives (Josling and Tangermann, 1989).

The number of different policies as well as the ambiguity of the effects of certain policies require that the measurement concept used to gauge the actual level of intervention must be capable of identifying the product-specific and aggregate effects of a wide range of diverse policies. The recent focus in international trade policy forums, such as GATT, on using estimates of the extent of protection has espoused a variety of measurement concepts, each with its own specific coverage of given policies. The studies on the extent of government intervention and the trade distortion impacts of the market price support and other policies have emphasized the measurement of the gaps generated between the domestic and border prices. The various concepts developed to determine the market distortions are related to one another representing modifications, extensions or derivatives of the measurements of this gap (Cahill and Legg, 1990).

This section provides a comprehensive analysis of these measures of estimation and their policy coverage. Various measures of protection have been defined in the next subsection along with a comparative analysis of the policy effects captured by these measures. The analysis is then used to determine the appropriateness of the measure employed in the empirical part of the study.
III.2.1 Alternative Measurement Concepts of Agricultural Protection

Studies on agricultural protection have employed alternative measurement concepts which differ in their meanings and in terms of their uses and degree of complexity. One of the most common concepts to measure the extent of government intervention is to determine the price wedge, the difference between the domestic and the border prices, for a specific commodity, as used by Bela Balassa (1965). The most simple and widely used measurement of the price wedge is the nominal rate of protection (NRP) and the nominal protection coefficient (NPC) (for example, Tyers and Anderson, 1992; de Gorter and Tsur, 1991; Krueger, Schiff and Valdés, 1991; Miller, 1991; Balisacan and Roumasset, 1987; Anderson and Hayami, 1986; Honma and Hayami, 1986; and Bigman, 1985). However, where the effects of government policies are not directly translated into domestic prices, these measures would provide only a partial indication of the extent of government intervention. While some concepts are restricted to the measurement of the price wedge alone, some other aggregative measures have also included in their scope the effects of a wide range of other interventionary policies. Some other measures have, therefore, been developed over time that try to capture the distortionary effects of a number of policies.

Table III.3 lists the mathematical formulas for 14 different measures of the levels of agricultural producer and consumer protection. The NPC is defined as the ratio of domestic to border prices, expressed in a common currency. The NRP estimates the price wedge, measured in the domestic currency, in percentage terms. These estimates indicate the responsiveness of domestic prices to government policies. The consumer counterpart of NRP, the nominal rate of protection for consumers (NRPC), similarly measures the wedge between domestic consumer price and the border price of a given commodity. The novelty of these measures is the relative ease with which these estimates can be calculated provided that reliable statistics on domestic and border prices are available. However, these measures fail to take into account the effects of any policies that do not affect producer prices (Schwartz and Parker, 1988).
An extension of the NRP concept is provided by the nominal rate of assistance (NRA) which takes into account the aggregate returns to producers - the output produced times the domestic price plus other subsidies or taxes - and expresses it as a percentage of the world prices (Cahill and Legg, 1990). Subsidies like deficiency payments that are not captured by NPC or NRP are included in the NRA estimates. The higher the level of such payments, the greater would be the difference between the estimate provided by NRP and NRA. Nonetheless, the NRA and NRP measures do not capture the effects of distortions in the input markets.

Since input pricing policies effectively distort the producer incentives, it is imperative to account for policies that affect both input and output markets. The effective rate of protection (ERP) provides a better measure of the level of protection since it considers the joint effects of input and output policies on the value added (Corden, 1971 and 1987; Josling and Tangermann, 1989). The ERP is calculated as the percentage difference in the unit value added at domestic and border prices, expressed in a common currency. Thus ERP would capture the effects of a subsidy on an intermediate input that might distort the supply and prices of the final commodity. In case of agricultural outputs that use the outputs of other sectors as an intermediary input, such as grain-fed livestock, the estimates of overall distortion provided by the ERP measure would be superior to those provided by the NRP or NRA. The ERP, therefore, may provide better indication of the resource misallocation among various sectors of an economy (Corden, 1971).

A number of policies, such as investment subsidy for agriculture, that do not affect the value added are not incorporated in ERP calculations. Thus, ERP may not provide a complete picture of all policy-induced output distortions (Cahill and Legg, 1990). Moreover, information requirements for calculating ERP are quite stringent since ERP calculations involve estimating NRP for the final commodity, NPRCs for all intermediate inputs, and technical information on input-output coefficients, which are relatively difficult to obtain (Schwartz and Parker, 1988).
### Table III.3: Comparison of alternative agricultural protection measurement concepts

<table>
<thead>
<tr>
<th>Measurement Concept</th>
<th>Acronym</th>
<th>Definition $^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Protection Coefficient</td>
<td>NPC</td>
<td>$P_d / P_w$</td>
</tr>
<tr>
<td>Nominal Rate of Protection</td>
<td>NRP</td>
<td>$(Q (P_d - P_w) / Q \cdot P_w)$</td>
</tr>
<tr>
<td>Nominal Rate of Protection for Consumers</td>
<td>NRPC</td>
<td>$- Q_c (P_c - P_j) / Q \cdot P_w$</td>
</tr>
<tr>
<td>Nominal Rate of Assistance</td>
<td>NRA</td>
<td>$Q ((P_j + \omega) - P_j) / Q \cdot P_w$</td>
</tr>
<tr>
<td>Effective Rate of Protection</td>
<td>ERP</td>
<td>$(VA_d - VA_w) / VA_w$</td>
</tr>
<tr>
<td>Effective Rate of Assistance</td>
<td>ERA</td>
<td>$((VA_d + \delta) - VA_w) / VA_w$</td>
</tr>
<tr>
<td>Direct Nominal Protection Rate</td>
<td>NPRD</td>
<td>$\left( (P_d - C) - (P_w - C') \right) / (P_w - C')$</td>
</tr>
<tr>
<td>Indirect Nominal Protection Rate</td>
<td>NPRI</td>
<td>$\left( (P_d - C) - (P_w - C') \right) / (P_w - C')$</td>
</tr>
<tr>
<td>Total Nominal Protection Rate</td>
<td>NPT</td>
<td>$\left( (P_d - C) - (P_w - C') \right) / (P_w - C')$</td>
</tr>
<tr>
<td>Producer Subsidy Equivalent</td>
<td>PSE</td>
<td>$(Q(P_d - P_w) + D + I - L) / (Q - P_d + D - L)$</td>
</tr>
<tr>
<td>Producer Subsidy Equivalent, Trade Distortion Variant</td>
<td>PSEm</td>
<td>$(Q(P_d - P_w) + D + I - L) / (Q - P_d + D - L)$</td>
</tr>
<tr>
<td>Consumer Subsidy Equivalents</td>
<td>CSE</td>
<td>$- (Q(P_d - P_w) + D_z) / (Q \cdot P_w)$</td>
</tr>
<tr>
<td>Trade Distortion by Support</td>
<td>TDS</td>
<td>$Q \cdot \epsilon \cdot S_a - Q_d \cdot \epsilon \cdot S_a + Q \cdot \epsilon \cdot S_d - Q_d \cdot \epsilon \cdot S_d + Q \cdot \epsilon \cdot S_a - SSO$</td>
</tr>
<tr>
<td>Aggregate Measure of Support, GATT</td>
<td>AMSG</td>
<td>$Q \cdot (P_w \cdot P_{w,rq})$</td>
</tr>
</tbody>
</table>

1 The measurement concepts refer to the protection levels for a single agricultural commodity. However, these can easily be aggregated to reflect overall protection to the agricultural sector. Percentage values can be derived by multiplying each measure by 100, except the TDS and AMS.

2 The variables used are defined as: $P_d$: Domestic Producer Price; $P_w$: World price (measured in domestic currency); $Q$: Domestic production; $\omega$: Set of other subsidies/tax on output (including deficiency payments); $C$: Adjustment for differences in quality, storage, transportation, handling costs and other margins; $\delta$: Adjustment for differences in quality, storage, transportation, handling costs and other margins measured under competitive conditions; $P_{w,q}$: Price index of non-agricultural sector; $P_{w,q}^*$: Price index of non-agricultural sector in the absence of trade distortions; $E$: Nominal official exchange rate; $E^*$: Equilibrium exchange rate in the absence of intervention; $VA_d$: Value Added per unit of output at domestic prices; $VA_w$: Value Added per unit of output at world prices (measured in domestic currency); $\delta$: Assistance on all outputs and inputs; $D$: Direct transfers to agricultural producers; $I$: Indirect transfers (budgetary-financed support) to agricultural producers; $L$: Agricultural producer levies; $P_d$: The "Policy", "Incentive" or "Shadow" price of the commodity that would keep the output the same as the current policies if all policies were removed; $\epsilon$: Own-price supply and demand (negative) elasticities, respectively; $S_a$: Market support ratio; $S_d$: Direct income support rates for producers and consumers, respectively; $Q$: Quantity consumed; $SSO$: Set-aside offset resulting from direct payments to producers; $Q_d$: Output produced in time period $t$; $P_{w,rq}$: Fixed reference price based on the years 1986-88, generally the average f.o.b. unit value for the commodity in a net exporting country and the average c.i.f. unit value for the commodity in a net importing country in the base period, measured in domestic currency; $P_w$: The consumer price of the commodity; and $D_z$: Budgetary-financed assistance to consumers.

Sources:
The effective rate of assistance, ERA, like the NRA, extends the ERP concept to include all other assistance to output and inputs, represented by $\delta$ in Table III.3. The difference between the value added at border and domestic prices, then, is expressed as a percentage wedge, measuring the assistance to the production activity rather than to the product itself. The consideration of policy effects on the overall activity in the given commodity provides a clearer indication of the extent to which it would attract resources from other sectors. Since policies such as investment subsidy for agriculture do not affect the value added, these are not reflected in the calculations of ERP or ERA.\(^{14}\)

Some other variants of NRP, the nominal rates of protection due to direct and indirect policies ($NPR_D$ and $NPR_I$) were recently proposed in a comprehensive manner in a World Bank investigation by Krueger, Schiff and Valdés (1991). These measures recognize the essential differences between the policies that affect the agricultural prices (of both inputs and outputs) directly and those more general macroeconomic policies that affect producer returns indirectly but in a significant way (Krueger, 1989).\(^{15}\) The $NPR_D$ adjusts the domestic and border prices for differences in transportation and storage costs and other quality differentials while the $NPR_I$ also considers the effects of the economy-wide policies, such as exchange rate distortions and protection awarded to non-agricultural sector, on the agricultural producer incentives. The total nominal protection rate includes both direct and indirect components discussed above. The $NPR_I$, thus, considers the agricultural protection in a general equilibrium framework. Since the general equilibrium effects may be rather significant in countries where agriculture constitutes a high proportion of labor force and the gross domestic product, $NPR_I$ may be a useful measure. However, the exclusion of income support policies limit the usefulness of these measures, especially in case of industrialized countries.

\(^{14}\) However, the ERP measure would include the deficiency payments if these distort the output price (see Table III.3).

\(^{15}\) Krueger also emphasizes that indirect interventions in agriculture seem to be much more important than the direct support policies. Discrimination against agricultural commodities in policies external to agricultural has a greater impact on agricultural incentives than do policies aimed directly at agriculture. This is mainly true in case of developing economies of the Third World.
An alternative producer protection measurement concept, the producer subsidy equivalents (PSEs), was first used in Australia in the mid-1960s. The PSEs, and their consumer counterpart, the consumer subsidy equivalents (CSEs), were later formally advanced by Tim Josling of the Food and Agricultural Organization (FAO) of the United Nations, in the early 1970s (FAO, 1973 and 1975). The PSE concept has been further refined, extended and used in various forms and several versions of these measures exist. For example, the FAO, the OECD, the USDA and IIASA (International Institute for Applied Systems Analysis) have developed their own estimates of PSEs and CSEs of selected countries (Gardner, 1991). The OECD uses these measures to monitor the level of government intervention in member countries while the USDA calculates the PSE and CSE estimates for a number of industrialized and developing countries. The usefulness of PSE and CSE estimates is manifest in their ability to summarize the effects of a multiple policy interactions into a single monetary estimate that can be readily used for comparison of protection levels across commodities and countries (Bray et al., 1992). The flexibility of these measures to include or exclude any number of policies affords them a further added usefulness in that these can be tailored to meet the different objectives of any specific investigation.

A PSE is defined as the level of subsidy that would be necessary to compensate the agricultural producers if all farm policies were removed. Similarly, a CSE is defined as the amount of compensation to be given to the consumers to keep their incomes unchanged after removing all agricultural programs. Unlike the measures discussed earlier, the PSE and CSE concepts focus on income transfers to producers and consumers from the government programs. The estimation of PSEs includes the effects of a number of diverse agricultural policies that directly and indirectly affect the producer incentives. As is evident from Table III.4, the policy coverage under PSEs extends to direct payments to farmers, input market distortions, marketing assistance and economy-wide policies. The government outlays to assist agricultural production in the long-run, such as expenditures on research and extension,
Table III.4: Policy effects captured by alternative protection measurement concepts

<table>
<thead>
<tr>
<th>Policy measure</th>
<th>Producer</th>
<th>Consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NPC</td>
<td>NRP</td>
</tr>
<tr>
<td>Market Price Support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Border Measures</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Domestic Price Support</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Market Board &amp; State Trading</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Other Output Price Policies</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Direct Payments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deficiency Payments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disaster Payments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop Insurance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Producer Levies</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Income Stabilization Funds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Assistance Policies</td>
<td></td>
<td></td>
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<tr>
<td>Primary Input Policies</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Intermediate Input Policies</td>
<td></td>
<td></td>
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<tr>
<td>Marketing Assistance</td>
<td></td>
<td></td>
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<tr>
<td>Advisory and Inspection</td>
<td></td>
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<tr>
<td>Transportation</td>
<td></td>
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<tr>
<td>Infrastructure Assistance</td>
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<tr>
<td>Research and Extension</td>
<td></td>
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<tr>
<td>Land Improvement</td>
<td></td>
<td></td>
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<tr>
<td>Irrigation</td>
<td></td>
<td></td>
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<tr>
<td>Economy-wide Policies</td>
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<tr>
<td>State and National Policies</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Taxation and Other Policies</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Consumer Assistance Policies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer Price Policies</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Consumer Food Donations</td>
<td></td>
<td></td>
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<tr>
<td>Other Consumer Subsidies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Border Measures also include the effects of tariffs, quotas, variable levies, export subsidies. Other output policies may include price premium, two-tiered pricing systems and price stabilization schemes. Primary inputs may include purchased inputs such as fuel, fertilizer, chemicals and disease control measures. Examples of an intermediate input subsidies would include feed subsidies on meat production. The estimates of CSEs as calculated by OECD (1991) have explicitly assumed the equivalence of producer and consumer prices and have used the farmgate or producer prices in their calculations of CSEs. However, since it is observed that, at times, the producer and consumer prices may differ significantly, it is more appropriate to recognize the differences in the two and use the observed consumer prices in the estimation of CSEs. Other consumer subsidies include both direct and indirect transfers to consumers. It may be noted that USDA, ERS calculations of CSEs (1990) do not make any distinctions between these direct and indirect transfers.

2 The ERP calculations include the deficiency payments in case where such payments directly affect the input prices or the production of output.

3 State and national policies include programs administered by state, provincial or national governments which tax or subsidize agricultural producers, such as state programs in the U.S., provincial programs in Canada and national programs in the U.E. The USDA (1990) calculations of FSEs include the effects of these policies in case of the U.S. and Canada only.

4 Other economy-wide policies such as taxation and exchange rate policies have an important but indirect impact on agricultural returns.
land improvement, conservation programs, development of irrigation facilities, etc., are also a part of the PSE calculations. The USDA estimates of PSEs also incorporate the indirect effects of exchange rate distortions, so prevalent in developing countries. The PSEs account for non-border policy measures which are not included in the NRP and ERP calculations. Thus, the policy coverage of NRA is wider than that of NPC and NRP, but shorter than ERP and ERA (not shown in Table III.4) which, in turn, include the effects of a lesser number of policies than covered by the PSEs. In short, the calculations of NRP and ERP measures require similar amounts of information as do PSEs whereas the estimates provided by NRP and ERP measures are neither as complete nor as flexible as those provided by the PSEs (Tangermann et al., 1987).16

Among the measures discussed above, NPC, NRP, NRA, NPRC, NPRP, NPRP, ERP and ERA, aptly capture the effects of border measures (such as tariffs, quotas, variables levies and export subsidies), domestic price support policies and distortions created by the national marketing board activities and state trading operations as well as the effects of other policies that distort domestic producer and consumer prices (Table III.4). The NRA includes the effects of more policies (such as deficiency payments and producer levies) than the NRP and NPC measures. But the NRA falls short of the NPRP concept in terms of policy coverage which also includes effects of economy-wide policies. However, these measures would underestimate the overall protection levels where policies such as direct payments, input assistance (besides ERP and ERA), marketing and infrastructure assistance, which do not affect the domestic prices directly, are an integral part of the national protectionistic policies.

Figure III.9 provides policy-wise producer protection expenditures captured by

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16 However, although the NRP measures partially make up for the shortcomings by virtue of the ease of their calculations, the ERP measure is neither complete nor easy to calculate. The ERP calculations are quite stringent since they involve estimating NRP for the final commodity, NPC for all intermediate inputs, and technical information on input-output coefficients, which are notoriously difficult to obtain on a representative basis (Schwartz and Parker, 1988).
The Market Price Support policies define the wedge between the domestic producer price and the world reference price. These policies may include trade distorting measures such as tariffs and quotas and other domestic price supports. Direct Payments include deficiency payments, disaster payments, diversion payments, etc. General Services include services such as transportation subsidies, and other services provided to the domestic wheat producers. Other policy measures may include assistance to long-term production, such as conservation programs, research and extension and structural programs.


Figure III.9: Policy-wise producer protection expenditures captured by alternative measures of support for United States: All commodities, 1979-90
alternative measures of support for the United States for the agricultural sector for the period 1979-90. The figure also illustrates an appealing visual comparison of the extent of the policy coverage in case of NRP, ERP and PSE. While all three measures account for the market price support component of the overall policy intervention, the NRP excludes the input subsidies, direct payments, general services, sub-national policy programs, besides other miscellaneous policies. The ERP, on the other hand, includes input subsidies but fails to account for the effects of the rest of the policies. The PSE concept, therefore, is more comprehensive in its policy coverage as compared to the alternative measures of protection. The estimates provided by consumer subsidy equivalents are superior to those provided by the NPRC measure since CSE calculations also incorporate direct and indirect consumer assistance policies. However, the protection measures discussed thus far ignore the effects of supply-control policies. The above variant of PSEs concentrates only on the producer income transfers to gauge the extent of government intervention and ignores the trade distortionary output effects of the policies.

The relatively recent contributions in the measurement of producer protection levels have been the introduction of aggregate measures of support being considered in the GATT (AMS) to account for the trade distortionary effects of agricultural policies. The ongoing GATT negotiations have favored another variant of PSE, the AMS concept, in order to define a base level of protection for each country on which to define the future protection reduction targets. The AMS expresses the price wedge as the difference between the domestic "policy" price of a commodity for 1986 and the average world reference price of that commodity for the years 1986-88. The AMS concept mainly focuses on the supply-control policies by evaluating the level of distortion by maintaining the current output levels in the absence of current farm support programs.

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17 ERP calculations, at times, may include direct payments such as deficiency payments that translate directly into output price effects.

18 The USDA, ERS calculations, however, make no distinction between the direct and indirect assistance to the consumers, as is evident from Table III.3.

19 Since trade distortionary implications of agricultural policies are not indicated by the PSEs, Roningen and Dixit (1991) have proposed the "trade distorted by support" measure (TDS) to "measure the change in the volume of net trade from existing levels if a country completely eliminates all support to the commodity."
The next subsection further elaborates trade distortionary effects of domestic policies. It provides a comparative analysis of two variants of PSEs, one that accounts for the income transfers to domestic producers, thus gauging the extent of government intervention, and the other that measures the trade distortionary effects of agricultural policies. The section also highlights the choice of PSE as the dependent variables for the empirical part of this study.

III.2.2 Choice of a measurement concept

The discussion in the previous section highlights the distinction in the meaning and policy coverage of various measurement concepts used in the studies aimed at determining the extent of government intervention or the trade distortionary impacts of intervention. The analysis suggests that the producer subsidy equivalents, with the widest coverage of agricultural policies, are the most comprehensive and flexible means of gauging the effects of government intervention in agricultural markets. The present study, therefore, uses PSEs as an approximation of producer protection levels across selected countries.

PSEs have been quoted as having the attraction of pragmatism (MacLaren, 1991) while Cahill and Legg (1990) singled out PSEs on the basis of their practicality over a number of other measurements. The flexibility of the PSE approach is manifest in its ability to include or exclude any 'desirable' policies, in its potential to handle supply-control policies (through a modified version), and in its additivity property that allows aggregation across commodities to arrive upon a comprehensive protection index for the overall agricultural sector (Tangermann et al., 1987). The data needs for calculating PSEs are also manageable (Josling and Tangermann, 1989). The PSEs have been widely used by organizations such as OECD and USDA and this approach has also found favor with GATT's Uruguay Round negotiations since it summarizes the effects of a number of agricultural policies into a single monetary or percentage unit that can be readily used to make comparisons across commodities and countries (Bray et al., 1992).20

20 The PSEs may be expressed either as a percentage of the value to producers, in monetary units per ton, or in total monetary value of transfers.
Gardner (1990a) cites various problems in using NPCs and NRP's as a measurement of protection levels. First, since the overvaluation of currencies is common in developing countries, the conversion of domestic and world prices into a common currency tends to underestimate the actual level of taxation. Second, since input subsidies are also common in some developing countries, the actual level of taxation would be lower than the NPC and NRP estimates. Third, in case of a large country, the internal prices of a commodity may also influence the world prices. Finally, the measurements regarding the world price are not based upon the price that would have existed in the international market in the absence of farm policies. However, all of the alternative measures are equally vulnerable to the choice of world price (Tangermann et al. 1987).

The main assumptions underlying the calculations of PSE and CSE concepts include: partial-equilibrium framework; homogeneous goods with no substitution possible in production or consumption; prices of non-traded goods and other sectors held constant; domestic and foreign goods considered to be perfect substitutes; and a small country case. These concepts do not account for social costs and benefits. Nevertheless, as MacLaren (1991) points out, "one of the practical reasons why the methodology [of PSE and CSE] has been used in the Uruguay Round is that it is a partial-equilibrium approach that can be used on a commodity-by-commodity and country-by-country basis on price, quantity and trade data which are readily available." He further contends that "while these assumptions are not satisfactory from a theoretical point of view, they do allow consistently calculated values of transfers to be placed before negotiators."

Regarding the partial equilibrium framework employed in the PSE concept, it is noted in Josling and Tangermann (1989) that "general-equilibrium-adjusted rate of protection in agriculture is probably only marginally different from the rate of protection measured in the traditional partial approach" (p. 345). They further opine that the rate of protection based on general equilibrium framework tends to be less than that estimated using the partial

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*Some adjustments in this case are suggested by Josling and Tangermann (1989) that would mostly benefit in the framework of studies of trade models dealing with the effects of liberalization rather than the studies on the extent and reasons of government intervention.*
equilibrium approach. One other assumption in the calculation of PSE is the notion that a dollar in government expenditures results in a dollar increase in producers' income.

In short, the benefits of using subsidy equivalents for measurement of protection levels include being simple and flexible; a wider policy coverage; and enabling cross-country and cross-commodity comparisons on individual and aggregate basis - the additivity property (Ballenger, 1988). Overall, the extent of distortions captured by PSEs and CSEs can be up to 30 percent more than captured by other alternative measures (Schwartz and Parker, p. 1143). However, all of the measures of protection discussed above suffer from two problems: ignoring general equilibrium effects; and being based on small country assumption.

The basic definition of PSEs, with its emphasis on income transfers to agricultural producers, is more suitable for gauging the extent of government intervention. This measure aptly suits the purpose of an investigation where the focus is on analyzing the income redistribution effects and determinants of government intervention in agriculture across countries. However, where the focus is on measuring trade distortions and effects of liberalization by looking into how much the output of a sector is influenced by a policy, this measure seems to be less satisfactory (Hathaway, 1987). For example, a country can switch to a policy that further distorts producer incentives without changing the actual transfers to producers. As originally proposed, the PSE approach was designed to capture income transfer effects and not the distortions to production caused by domestic farm policies. This inability has resulted in the development of a variant of the PSE, the 'trade distortion producer subsidy equivalent (PSE$_{TD}$), that focuses primarily on the output distorting effects of policies. The advocates of PSEs in multilateral trade negotiations have favored using the PSE$_{TD}$ which would capture the effects of a policy switch that distorts output. The original version of the PSE in this case would stay the same since income transfers remain unchanged. These two variants of PSEs, as well as NRP measure, are compared below under a small country case (i) where the producer incentives are influenced through indirect government outlays, and (ii) where producer incentives are influenced without involving budgetary expenditures.
Consider the case of a closed small country where supply of the commodity in question is represented by the curve $S$ and the domestic demand by $D$, as shown in Figure III.10, panel A. Suppose that the domestic price is maintained at $P_d^*$ to support the domestic farmers, which is above the world price $P_w$. The output produced is $OQ$. If the government supports the agricultural sector by subsidizing research and extension activities, this would shift the supply curve in the long run to $S'$, with the new output level $OQ'$. The gross total value of the NRP measure, in this case, is $OP_d b Q - OP_w a Q = P_d^*P_d b a$. The similar estimate of PSE is $OP_d b Q - OP_w a Q$ plus the indirect government expenditures on research and extension, given by the area $P_d^*P_r cb$. In order to compare these estimates with the absolute trade distortion effects captured by the $PSE_{TD}$, the policy incentive price needs to be identified that would elicit the same amount of output ($OQ_2$) in the absence of the indirect subsidy. The incentive price that would support $OQ_2$ level of output at the old supply curve would be $P_r$. The trade distortionary effects captured by this measure extend the price wedge to $OP_d c Q - OP_w a Q = P_r c a$.

In this case, it is apparent that the NRP and PSE capture the same extent of the market price support but the PSE also incorporates the government outlay on research and extension in its calculations. Therefore, the distortionary effects captured by the PSE are higher than those captured by the NRP measure. The overall estimates of the distortion provided by the trade-distortion and the government-intervention variants of PSE are similar in this case although the market price support measured by the $PSE_{TD}$ is relatively higher than the PSE by the area $P_r P_r cb$, which is also the amount of government expenditures.

However, in the case where the policies that influence output but do not involve government expenditures, the similarity of the estimates provided by the two PSE measures would cease to exist. In other words, the policies that result in a shift of the supply curve but do not enter the regular calculations of PSE, the estimates of the distortion provided by the two PSE measures would no longer be identical. For example, Bray et al. (1992) show that in case of supply restraint programs like the flex acres in case of the U.S., the resulting estimates of the trade distortion and government intervention PSEs would be different.
Consider initially that the world price, \( P_w \), is allowed to prevail in the domestic market and the total output produced is \( OQ_1 \). Further, consider a case where the government policies result in a disincentive for producers that shifts the supply curve back from \( S \) to \( S' \) (Figure III.10, panel B). The shift due to the disincentive policy reduces the domestic output to \( OQ_2 \) at the world price. In this case, the policy incentive price that would restrict the output to \( OQ_2 \) without the policy, will be \( P_p \). Here, the \( NRP \) and \( PSE \) measures would show zero distortions since the price wedge is nonexistent and there are no government outlays. The \( PSE_{TD} \) however, would capture the negative trade distortionary effects of this policy on the producers and would be equal to the area \( OP_p Q_2 - OP_w Q_2 = - P_p P_w bc \).

In contrast, now consider the case where the government maintains the domestic price at higher than the world price level at \( P_d \), resulting in the domestic output \( OQ_3 \) along the supply curve \( S \) (Figure III.10, panel B). The shift in the supply curve to \( S' \) due to the policy discussed above would, in this case, decrease the domestic output to \( OQ_1 \). Here, the effects

\[ \text{Figure III.10: Comparative analysis of policy effects captured by PSE and PSE}_{TD} \]

\[ \text{In order to qualify for assistance under the U.S. government's set-aside program (which is aimed at restricting production acreage under the grain support program), a certain percentage of a producer's base acreage must be left fallow. The normal flex acreage is about 15 percent of the base, with an additional 10 percent under optional flex acres. Producers do not receive deficiency payments on these flex acres although alternative crops may be planted on this land. For a detailed discussion, see Note 3 in Bray et al.} \]
of this policy would provide different estimates of the three measures of support. The numerator of \( NRP \) as well as \( PSE \) estimates would be \( P_r P_{d} d a \) which represents the market price support or the wedge between the domestic and the border price. The policy incentive price that would maintain the output at \( OQ_t \) without the policy, would be the same as the world price \( P_w \). The trade distortion measuring definition of \( PSE \) - the \( PSE_{TD} \) - would in this case be zero. The effects of a decoupled payment, a payment that is unrelated to the output, would also be similar.

These examples appropriately illustrate the differences in the policy coverage between \( NRP \) and the two variants of producer subsidy equivalents. The \( PSE \) focuses on the income transfers to the producers while the \( PSE_{TD} \) captures how the output of the commodity is influenced by the distortionary policy, highlighting the trade distortionary effects of the policies. Therefore, the above discussion suggests that for studies aimed at measuring the extent of government involvement in a given sector and its effect on the producers' income, the appropriate measure would be the \( PSE \). On the other hand, in the case where the interest is to analyze the effects of policies on the trade distortions in the commodity markets, as is the case in the current GATT negotiations, the \( PSE_{TD} \) would provide more consistent estimates.

In international trade forums, the main focus is on how the government policies distort the incentives for domestic production and on the adverse effects of the distorted supply on the trading partners of a country. In such negotiations, the extent of government outlays and the transfers to the domestic producers seem to be much less of a concern. In case where negotiations are based upon the estimations of the distortion provided by the producer subsidy equivalent measures, the trade distortionary version of this measure would provide more meaningful information. The use of \( PSE_{TD} \) has recently received considerable support in trade negotiations (Bray, et al. 1992; Meilke and Warley, 1989; Rossmiller and Elliott, 1989; Tangermann, 1989; Tangermann, et al., 1987). The measures proposed earlier by the Canadian government (trade distortion equivalent, \( TDE \)) and the E.C. (the support
measurement unit, SMU) also represent the constant output version of the producer subsidy equivalents (FAPRI, 1992; Colman, 1991; IATRC, 1990).

The emphasis of aggregate measure of support (AMS) is on finding a commonly agreeable definition of the measurement concept and, later, on gradual reduction in the support levels as measured by this concept. The AMS is calculated on a product-specific basis for each product that receives the market price support and other specified assistance while the non-product-specific support is combined into a single composite monetary estimate. The AMS calculates the market price incentives by using the wedge between the hypothetical policy price (or the applied administered price) for the commodity for 1986 and the average of the fixed external reference price for the years 1986-88. The wedge is multiplied by the quantity of output eligible to receive the policy price in that period to obtain the resulting base for future negotiations on trade liberalization and reductions in government support. Since the focus here is on trade distortion and not on domestic expenditures on farm programs, unlike PSE, the budgetary outlays made to maintain this gap, such as buying or storage costs, are not considered in the AMS calculations.

As the focus of this study is to theoretically and empirically identify and analyze the determinants of government intervention across industrialized and developing countries, the obvious choice of a measure rests with the original concept of PSEs which measures income transfers.

The empirical analysis in the present study uses the estimates of producer subsidy equivalents as developed by USDA (1990) and OECD (1991). Although there are some differences between the estimates calculated by these two organizations, they are broadly comparable (Blandford, 1990). The following discussion highlights the compatibility of using these two data sets in the empirical analysis in this study since both account for similar policies and provide similar estimates of the extent of government intervention.

Table III.5 highlights the policies covered under the two data sets. Generally, the USDA and OECD calculations of support to domestic producers can be summarized into six similar broad categories: market price support, direct income enhancing policies, programs
Table III.5: Policies covered under PSE calculations by OECD and USDA

<table>
<thead>
<tr>
<th>Policies</th>
<th>USDA</th>
<th>OECD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Price Support</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Direct Income Support</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Research and Extension</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Producer Levies</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Primary Input Policies</td>
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<td>x</td>
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<td>Intermediary Input Policies</td>
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<tr>
<td>Infrastructure Support</td>
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<td>Exchange Rate Controls¹</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Marketing Assistance²</td>
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<td>x</td>
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<tr>
<td>Sub-National Policies³</td>
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<td>Administrative Costs</td>
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<td>Subsidies to Agribusiness Sector</td>
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<tr>
<td>General Income Tax Policies</td>
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</tr>
<tr>
<td>Voluntary Export Restraints⁴</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 The effects of exchange rate distortions are captured primarily in the estimates of PSEs in case of developing countries only where substantial differences exist between the official and unofficial exchange rates. Moreover, the relatively large size of the agrarian sector in these countries implies that exchange rate distortions would translate into greater impacts on the overall agricultural sector than would be the case in industrialized countries.

2 The OECD calculations aggregate all other support that does not directly related to producer income but constitutes budgetary expenditures into a composite "general services" category.

3 The sub-national policies in case of USDA calculations include such policies for only two countries, namely, the United States and Canada.

4 Voluntary export restriants agreements can be interpreted as implicitly included in their effects on border measures.

assisting variable costs of production, marketing assistance services, programs affecting long-term agricultural production and controlled exchange rate distortions (also, see Table III.4). Market price support policies include border measures and price stabilization schemes designed to raise (or lower, in case of some developing countries) domestic producer prices. Since the higher prices are untenable to be sustained in an open economy, the border measures also follow restriction on competition in domestic markets by applying trade restrictions. The direct payments to producers, or producer levies which have negative effects on production, are also included in the PSE calculations, as mentioned earlier. Input and marketing assistance policies, such as transportation subsidies, also lower producer costs although their effect on producer revenues are ambiguous. These policies are included as indirect protection policies in both USDA and OECD calculations.

Long-term production assistance policies included in the calculations cause fewer trade distortions in the short-run than do market price support policies. However, certain long-term and other policies may fall under different categories in these data sets due to their effect on current output. For example, the electricity subsidy to Indian farmers is counted in the USDA calculations as an input subsidy rather than under the infrastructure support, as mentioned in the government outlays.

The USDA calculations, in addition to the OECD classification, also include the effects of exchange rate distortions in case of developing countries but accounts for the effects of sub-national policies in case of United States and Canada only. None of these calculations include the cross-commodity effects of protection awarded to an agricultural commodity. Nor are the effects on producer incentives of subsidies to the agribusiness sector (the food processing industries, for example) included in these estimates. The administrative costs as well as the social security benefits and general economy-wide taxation policies are also excluded. The reduction in incomes due to policies that control supplies such as uncompensated acreage reduction programs in the United States (as discussed in the case illustrated earlier) and the dairy production quotas in E.C. and Canada, are also not included in these estimates. The overall product-specific as well as aggregate estimates of producer
and consumer protection levels provided by these organizations are similar to a great extent as is shown in Figure III.11. Therefore, the estimates from these sources can be merged to enhance the coverage of countries and commodities in the present study. The USDA data are shown only for the period 1982-87.

There have been relatively few quantitative studies on the determination of government intervention in agriculture in a product-specific framework. Majority of these studies have adopted an aggregative approach to analyzing agricultural protection. Since most protectionistic policies are based upon individual commodities and vary significantly across commodities, aggregating the effects of policies designed to influence different commodities individually would obscure the significance of the results. For example, the Indian government provides subsidies to oilseeds while it taxes the cereal producers. Table III.6 shows the commodity-wise protection awarded as well as the effect of aggregating the protection level for all these commodities. The table shows that while individual commodities may be rather heavily taxed or subsidized, the aggregate agricultural protection levels, as are used in most earlier studies, reflect only mild interventions in such cases. For example, the aggregate PSEs for 1984 show zero level of government support while there was substantial taxation (corn, cotton-long, sorghum, soybean and wheat) or subsidization (cotton-medium, peanuts, rapeseed and rice) of individual commodities in that year. Therefore, the aggregate estimates may lead one to believe falsely that the government intervention is rather less pervasive in some cases while the opposite might be the case. The aggregation across commodities, thus, obscures these differences (Herrmann, 1989). This certainly poses a problem in cases where governments subsidize certain commodities, while, at the same time, tax others. Such policies are widespread in developing economies for reasons such as food security for poor consumers or national concerns, among others. Results of studies that include developing countries in their analysis of cross-country agricultural protection using the aggregate protection levels may be adversely influenced by this problem. Therefore, the present analysis would adopt a product-specific approach to the

---

23 See Table II.1.
PSE (%)  

- USDA  
- OECD  


Figure III.11: Comparison of wheat PSEs of United States as estimated by OECD and USDA

Table III.6: Standard deviations of product-specific and aggregate PSEs for India  
(in percent)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>-12</td>
<td>-7</td>
<td>-38</td>
<td>-56</td>
<td>-10</td>
<td>4</td>
<td>59.08</td>
</tr>
<tr>
<td>Cotton, Long</td>
<td>-2</td>
<td>-23</td>
<td>-19</td>
<td>-5</td>
<td>23</td>
<td>-36</td>
<td>53.7</td>
</tr>
<tr>
<td>Cotton, Medium</td>
<td>22</td>
<td>-15</td>
<td>2</td>
<td>2</td>
<td>23</td>
<td>-11</td>
<td>50.31</td>
</tr>
<tr>
<td>Peanuts</td>
<td>6</td>
<td>28</td>
<td>25</td>
<td>18</td>
<td>-3</td>
<td>-29</td>
<td>59.29</td>
</tr>
<tr>
<td>Rapeseed</td>
<td>28</td>
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<td>23</td>
<td>1</td>
<td>24</td>
<td>57</td>
<td>80.65</td>
</tr>
<tr>
<td>Rice</td>
<td>-20</td>
<td>2</td>
<td>5</td>
<td>-8</td>
<td>10</td>
<td>4</td>
<td>12.29</td>
</tr>
<tr>
<td>Sorghum</td>
<td>-39</td>
<td>-31</td>
<td>-32</td>
<td>-40</td>
<td>-23</td>
<td>-10</td>
<td>50.3</td>
</tr>
<tr>
<td>Soybeans</td>
<td>-14</td>
<td>-12</td>
<td>-45</td>
<td>-36</td>
<td>-25</td>
<td>11</td>
<td>61.54</td>
</tr>
<tr>
<td>Wheat</td>
<td>-6</td>
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<td>-7</td>
<td>-19</td>
<td>-1</td>
<td>7</td>
<td>12.25</td>
</tr>
<tr>
<td>All Commodities</td>
<td>-11</td>
<td>2</td>
<td>0</td>
<td>-12</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

1 The standard deviation of PSEs of various commodities represent deviations across the years in individual PSEs from the weighted average in that year.

study of the extent of government intervention in the agricultural sector. A graphical comparison of the ability of selected measures to capture the market distortions is presented below under different policy scenarios in a trade theoretic framework.

III.3 Comparative Graphical Analysis of Measurement Concepts

This subsection provides a comparative analysis of selected measurement concepts within a theoretical framework. The analysis compares the Marshallian producer surplus measure with NRP and PSE estimates for small and large country cases under a variety of policy scenarios. The commodity in question is assumed to be staple food commodity (normal good).

III.3.1 Measuring Market Distortions in Case of a Small Country

Consider a small country with supply and demand of a staple agricultural commodity shown by $S$ and $D$, respectively (Figure III.12). The assumption here is that the country's share of the world market for that commodity is too small to influence the world market prices. In addition, this particular commodity constitutes an insignificant part of the domestic economy to have any effects on the foreign exchange rate. In the absence of any distortionary policy, the world price, $P_w$, prevails in the domestic market. At this price, domestic production is $OQ_1$ and domestic consumption is $OC_1$ and the $Q_1C_1$ quantity is imported. Here the gross returns to the producers are $OQ_1P_w$, which, after taking into account the variable production costs, result in the producer surplus equivalent to the area $aP_2b$.

Now suppose that the government decides to increase the producers' income by providing them a direct subsidy per unit of production such that the market price still stays at $P_w$. Farmers are promised the difference $P_p - P_w$ as deficiency payments per unit. The domestic production increases to $OQ_2$ and, since consumption remains at the same level, imports drop to $Q_2C_1$. Farmers' gross income now is $OP_dQ_2$ and the producer surplus is

---

24 Assuming that this policy does not shift the supply curve but rather results in increase in the quantity supplied.
This involves the cost to the government equal to the area \( P_w P_d d j \) which clearly is higher than the gains to the domestic producers by the area \( b dj \).

In order to determine the extent of market distortions captured by the NRP and PSE measures of protection, the estimates provided by these measures can be compared with the change in producer surplus. To facilitate such comparisons, the change in producer surplus may be converted into the percentage change (\( \% \Delta PS \)) at (i) border value, using the base of the nominal protection rate; and (ii) market value, using the base of producer subsidy equivalent.

\[
NPR = \frac{Q_{P_d} - Q_{P_w}}{Q_{P_w}} = \frac{OP_w Q_2 - OP_w Q_1}{OP_w Q_2} = 0,
\]

\[
\% \Delta PS \Big|_{\text{border price}} = \frac{P_w P_{d b}}{OP_w Q_2}.
\]

The NRP measure is not capable of capturing the market distortions that do not affect domestic prices. Here, while producers evidently gain due to this direct transfer, the NRP fails to capture this gain. Therefore, in this case, NRP underestimates the actual market distortions.
On the other hand, \( PSE \) does consider the transfers to producers such as deficiency payments as:

\[
PSE = \frac{Q P_d - Q P_w + (D + I) Q}{Q P_d + D - Q} = \frac{OP_w Q_2 - OP_w Q_1 + P w P d j}{OP_w Q_2 + P w P d j} = \frac{P w P d j}{OP_d Q_2},
\]

whereas,

\[
\%\Delta PS|_{\text{Market Prices}} = \frac{P w P d b}{OP_d Q_2}.
\]

Clearly, \( PSE \) overestimates the gains to producers by the area \( bdj \) which represents extra cost associated with producing quantity \( Q_1 Q_2 \) domestically rather than importing it. This brings forth the weakness associated with the calculating the extent of distortion using the \( PSE \). The \( PSE \) measures the effects of some government programs by the level of government expenditure, which may bear little relationship to its effect on market distortion (Schwartz and Parker, 1988). Comparing these three measures, it is evident that,

\[
PSE > \%\Delta PS|_{\text{Border Prices}} > \%\Delta PS|_{\text{Market Prices}} > NRP.
\]

Now, suppose that the government provides a price subsidy which raises the producer price to \( P_p \) rather than providing a direct income transfer to the farmers as in the previous case. Here, the estimates of \( NRP \) and comparative producer surplus would be:

\[
NPR = \frac{OP_p d Q_2 - OP_w d Q_2}{OP_w d Q_2} = \frac{P w P d j}{OP_w d Q_2},
\]

\[
\%\Delta PS|_{\text{Border Price}} = \frac{P w P d b}{OP_w d Q_2}.
\]

\( NRP \) overestimates the percent change in producer surplus at border price by the area \( bdj \). The \( PSE \) measure also overestimates the percentage change in producer surplus at market prices but underestimates the same at border prices:

\[
PSE = \frac{OP_p d Q_2 - OP_w d Q_2}{OP_p d Q_2} = \frac{P w P d j}{OP_p d Q_2}.
\]
\[
\% \Delta PS_{\text{Market Price}} = \frac{P_w P_d b}{OP_d Q_2}.
\]

Therefore,

\[
NRP > \% \Delta PS_{\text{Border Prices}} > PSE > \% \Delta PS_{\text{Market Prices}}.
\]

Clearly, in case of price induced producer subsidy, \(NRP\) overestimates the distortion by a larger amount as compared to the \(PSE\), which is contrary to the assertions made in Schwartz and Parker (1988) that "For ... the price induced producer subsidy, the \(PSE\) is identical to the \(NRP\)." \(^{25}\)

Now consider a case where the government institutes a tariff on the imports of the commodity that raises the domestic price to \(P^t\) from \(P\). The government uses all of the tariff revenue, \(\sigma e n k\), to further assist the domestic producers by providing a price subsidy of \(P_r P_s\). These trade distortions cause changes in real economic variables. Consumption now is \(OC_2\) down from \(OC_1\), domestic production is \(OQ_3\), and imports drop to \(Q_4 C_2\), representing restrictions on market access. The policy also results in price-induced income effects. Consumer surplus decreases by the area \(P_c P_s C_2\) whereas producer surplus now is equal to \(a P_f f\). This revenue-neutral tariff plus the producer subsidy policy results in net economic loss to the domestic economy equal to the triangles \(b f k\) (which represents the additional cost associated with producing quantity \(Q/Q_1\), domestically rather than importing it) and \(n e c\) (since consumers buy \(C_1\) less in quantity and pay higher per unit price for it).

In this case, the comparison among the \(NRP\), \(PSE\) and percentage changes in producer surplus at border and market prices yields:

\[
NPR = \frac{P_w P_d k}{OP_w Q_2} > \% \Delta PS_{\text{Border price}} = \frac{P_w P_d b}{OP_w Q_2} > PSE = \frac{P_w P_d k}{OP_d Q_2} > \% \Delta PS_{\text{Market price}} = \frac{P_w P_d b}{OP_d Q_2}.
\]

It may be stated, therefore, that the market distortion captured by the \(NRP\) and \(PSE\) measures would provide identical estimates of the level of distortion both in the case of a price subsidy or import tariffs. Nonetheless, it should be noted that the absolute differences in the two

\(^{25}\) Although the absolute measures of \(PSE\) and \(NRP\) would provide identical estimates in this case, converting them into percentages, the two measures yield different results. Since in most of the studies, the \(PSEs\) and \(NPRs\) are used in percentage terms, the above conclusion seems more meaningful.
estimates would be contingent upon the size of the direct payments since the direct payments enter both the numerator and the denominator of the PSE. This aspect is discussed further at the end of this subsection.

Since these distortions also affect the domestic consumer prices, their effects on domestic consumers can be approximated using the NPRC and CSE measures which can further be compared with the respective percentage change in the consumer surplus:

\[ NPRC = \frac{-[OP_{pe}C_2 - OP_{wn}C_2]}{OP_{wn}C_2} = \frac{-P_wP_{pen}}{OP_{wn}C_2}, \]

and

\[ \%\Delta CS_{\text{border price}} = \frac{-P_wP_{pen}}{OP_{wn}C_2}. \]

Here, NPRC underestimates the (absolute) amount of market distortion affecting consumers. CSE, on the other hand, also underestimates the percentage change in consumer surplus at market prices:

\[ CSE = \frac{-[OP_{pe}C_2 - OP_{wn}C_2]}{OP_{pe}C_2} = \frac{-P_wP_{pen}}{OP_{pe}C_2}, \]

and

\[ \%\Delta CS_{\text{market price}} = \frac{-P_wP_{pen}}{OP_{pe}C_2}. \]

Comparing both the results together, it is obvious that,

\[ \%\Delta CS_{\text{border price}} > \%\Delta CS_{\text{market price}} > NPRC > CSE, \]

if the area \( P_wP_{pen} < enc \). If the area \( P_wP_{pen} > enc \), then

\[ \%\Delta CS_{\text{border price}} > NRP > \%\Delta CS_{\text{market price}} > CSE. \]

NPRC thus seems to overestimate the market distortions as compared to the CSE measure although NPRC underestimates the distortion as compared to the consumer surplus at border prices.

All of the above cases implicitly assumed the case of industrialized countries where domestic prices are usually kept at levels higher than the international prices so as to support
the domestic producers. Such policies adversely affect consumer welfare as is depicted by the negative values obtained in the case of the above measures.

Next, assume the case of a small poor agrarian economy where the aim of the government is to provide consumers with cheap food and, therefore, they institute policies that keep the food prices at levels below the international market. The earlier assumptions regarding the ineffectiveness of the country to influence the border prices or of the particular commodity to influence the foreign exchange rates are still in effect.

Let $P_w$ be the price of the commodity in the world markets (Figure III.13). At this price, assuming no distortionary policies in the domestic economy, output $OQ_1$ is produced, of which the quantity $OC_1$ is consumed domestically and the remainder, $C_1Q_1$ is exported. The international price is higher than what would ensure the domestic consumer sufficient consumption of the commodity. Therefore, the government imposes an export tax equivalent to the amount $P_dP_a$ per unit of output which decreases the domestic consumer and producer price to $P_d$.

The export tax thus induces changes in real variables. Domestic production decreases to $OQ_2$, domestic consumption increases to $OC_2$ and exports are now $C_2Q_2$. The price-induced income effects of this policy would result in the loss in producer surplus equal to the amount $P_dP_a$, per unit of output which decreases the domestic consumer and producer price to $P_d$.

The estimation of the market distortion from the producers' point of view may be approximated using the $NRP$, $PSE$, and producer surpluses at border and market prices:

$$NPR = \frac{OP_{deQ2} - OP_{wgQ2}}{OP_{deQ2}} = \frac{-P_dP_wg}{OP_{wgQ2}},$$

$$\%\Delta PSE_{\text{border price}} = \frac{-P_dP_wg}{OP_{wgQ2}},$$

$$PSE = \frac{OP_{deQ2} - OP_{wgQ2}}{OP_{deQ2}} = \frac{-P_dP_wg}{OP_{deQ2}},$$

and
Both NRP and PSE are smaller than the percent change in producer surplus at border and market price, respectively, by the area $egc$. However, although the absolute estimates of NRP and PSE are identical, in percentage terms, the NRP estimates underestimate the distortionary effects by less than the PSE:

$\%\Delta PS_{Market\ price} > \%\Delta PS_{Border\ price} > NRP > PSE.$

Evaluating the distortionary effects of the export tax on the consumers using NPRC, CSE and consumer surplus measures yield the following:

$$NPRC = \frac{-\left[OPdwC2 - OPwjC2\right]}{OPwC2} \quad = \frac{PdPwfb}{OPwC2},$$

$$%\Delta CSI_{Border\ price} = \frac{PdPwfb}{OPwjC2},$$

$$CSE = \frac{-\left[OPdwC2 - OPwjC2\right]}{OPdC2} \quad = \frac{PdPwfb}{OPdC2},$$

and

$$%\Delta CSI_{Market\ price} = \frac{PdPwbd}{OPdC2}.$$

Figure III.13: Measuring distortions in a small developing country case
NPRC overestimates percent change in consumer surplus at border price by the area $hfd$.

Similarly, CSE also overestimates the percent change in consumer surplus at market price by the area $hfd$. However, the estimate for CSE for this policy is greater than that for NPRC. In short, for the case of an export tax, CSE and NPRC provide identical absolute estimates yet differ in percentage terms:

$$CSE > \%\Delta CS |_{\text{Market price}} > NPRC > \%\Delta CS |_{\text{Border price}}.$$  

It should be noted that the market distortion captured by the NPRC and CSE measures may also provide identical estimates of the level of distortion in case of any policy instruments that affect domestic prices only. However, any policy that does not affect consumer prices would result in different estimates of these measures. In that case, CSE would approximate the distortion levels more precisely than NPRC which would fail to account for income transfer measures, like food stamps, as is explained below.

Further assume that the government redistributes some part or all of its export tax revenues to provide an income support to the poor consumers, which shifts the demand curve out to the right to $D_j$ (Figure III.13). Consumer and producer prices remain below the international prices at $P_d$. Consumption now increases to $OC_3$ while output remains at $OQ_2$ and, therefore, exports decrease to $C_3Q_2$. Consumer surplus is now $P_dhj$ while the producer surplus remains unchanged at $nP_{d,e}$.

In this case, on the producer side, since there is no further change in producer price and output, the earlier results for the PSE, NPR, and producer surpluses at border and market prices would remain unchanged. The direct income transfer to the consumer would, however, change the estimates of protectionary effects on the consumer side, since:

$$\text{NPRC} = \frac{- [OP_{d}C_3 - OP_{w}C_3]}{OP_{w}C_3} = \frac{P_d P_{w,j}}{OP_{w}C_3},$$

$$\%\Delta CS |_{\text{Border price}} = \frac{ahljd}{OP_{w}C_3},$$
CSE = \frac{(Q_cP_e - Q_cP_w) + (Q_e + I_e)Q_c}{Q_cP_e + D_eQ_c} = \frac{-[OP_d/C_3 - OP_w/C_3] + df_{ij}}{OP_d/C_3 + df_{ij}} = \frac{P_dP_w + df_{ij}}{OP_d/C_3 + df_{ij}},

\text{and}

\%\Delta CS|_{\text{market price}} = \frac{ahjd}{OP_d/C_3 + df_{ij}}.

Here CSE estimates are higher than those provided by the NPRC because NPRC fails to capture the income transfer subsidy to consumers. Since NPRC accounts for only the wedge between the domestic and border prices but not the direct transfers to consumers, CSE provides a better measure of how government policies influence incentives for consumers. This finding is also consistent with the earlier studies. The comparisons among the NRP and CSE with consumer surpluses at border and market prices yield ambiguous results:

\begin{align*}
\text{NRP} & > \%\Delta CS|_{\text{border price}} \iff \text{area } P_d^aP_d^d > ahmb; \\
\text{CSE} & > \%\Delta CS|_{\text{market price}} \iff \text{area } P_dP_{dij} > ahmb; \\
\text{NRP} & > \%\Delta CS|_{\text{border price}} \iff \text{area } P_dP_{wh} > ahmb.
\end{align*}

Tables III.7 through III.9 provide calculations of NRP, PSE, NRPC and CSE to support the above analysis in case of small country. The small wheat importing industrialized countries like Norway and Switzerland have market price support (MPS) greater than zero with different levels of direct and indirect producer support. In case of absolute measurements (considering only the numerator of NRP and PSE), the existence of direct or indirect payment would result in higher estimates of PSE. But where the percentage addition to numerator is smaller than the denominator, the PSE estimates would be lower than the NRP. For example, in Table III.7, the NRP estimates for Norway for the year 1980 are smaller than those provided by the PSE measure, while the reverse is true for the year 1990. In case of developing countries, like Nigeria and India, where MPS and direct payments are zero, NRP would be zero. Here, PSE would provide more accurate measures of distortion since it would capture any positive or negative indirect support, and thus would be significantly different from the NRP estimates.

\footnote{See, for example, Josling and Tangermann (1989), Schwartz and Parker (1988), and Gardner (1989b).}
Table III.7: Extent of distortions captured by NRP and PSE:
Small importing countries

<table>
<thead>
<tr>
<th>Year</th>
<th>World Reference Price</th>
<th>Domestic Producer Price</th>
<th>Domestic Production</th>
<th>Direct Payments</th>
<th>Indirect Payments</th>
<th>NRP (Percent)</th>
<th>PSE (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(P_w)</td>
<td>(P_d)</td>
<td>(Q)</td>
<td>(D)</td>
<td>(I)</td>
<td>Q(P_d - P_w)/P_wQ</td>
<td>Q(P_d - P_w)+D+I/P_dQ+D</td>
</tr>
<tr>
<td>Norway (Wheat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>963.7</td>
<td>1086</td>
<td>63</td>
<td>28</td>
<td>20</td>
<td>63 (1086-963.7) = 13</td>
<td>0.063 (1086-963.7)+28+20 = 88</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>(63x963.7)</td>
<td>(0.063x1086)+28</td>
</tr>
<tr>
<td>1990</td>
<td>802.9</td>
<td>3189</td>
<td>224</td>
<td>46</td>
<td>24</td>
<td>224 (3189-802.9) = 297</td>
<td>0.224 (3189-802.9)+46+24 = 79</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>(224x3189)</td>
<td>(0.224x3189)+46</td>
</tr>
<tr>
<td>Switzerland (Common Wheat)</td>
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<td></td>
</tr>
<tr>
<td>1980</td>
<td>392.1</td>
<td>966</td>
<td>372</td>
<td>12</td>
<td>30</td>
<td>372 (966-392.1) = 146</td>
<td>0.372 (966-392.1)+12+30 = 69</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>(372x392.1)</td>
<td>(0.372x966)+12</td>
</tr>
<tr>
<td>1990</td>
<td>277.9</td>
<td>1029</td>
<td>530</td>
<td>-33</td>
<td>51</td>
<td>530 (1029-277.9) = 270</td>
<td>0.530 (1029-277.9)+33+51 = 81</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(530x277.9)</td>
<td>(0.530x1029)-33</td>
</tr>
<tr>
<td>Nigeria (Wheat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1982</td>
<td>280</td>
<td>280</td>
<td>26</td>
<td>0</td>
<td>-0.91</td>
<td>0.026 (280-280) = 0</td>
<td>0.026 (280-280)+ 0-0.91 = -12.5</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>(0.026x280)</td>
<td>(0.026x280)+ 0</td>
</tr>
<tr>
<td>1986</td>
<td>520</td>
<td>520</td>
<td>15</td>
<td>0</td>
<td>1.95</td>
<td>0.015 (520-520) = 0</td>
<td>0.015 (520-520)+0+1.95 = 25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.015x520)</td>
<td>(0.015x520)+0</td>
</tr>
<tr>
<td>India (Wheat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>1565</td>
<td>1565</td>
<td>36,000</td>
<td>0</td>
<td>-17580</td>
<td>36 (1565-1565) = 0</td>
<td>36 (1565-1565)+0-17580 = -31.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(36x1565)</td>
<td>(36x1565)+0</td>
</tr>
<tr>
<td>1986</td>
<td>1744</td>
<td>1744</td>
<td>44,000</td>
<td>0</td>
<td>-24360</td>
<td>44 (1744-1744) = 0</td>
<td>44 (1744-1744)+0-24360 = -31.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(44x1744)</td>
<td>(44x1744)+0</td>
</tr>
</tbody>
</table>

1 World reference price is in domestic currency per ton, after adjustment for transportation costs.
2 Producer price is in domestic currency per ton.
3 Domestic production is in 1000 tons.
4 Direct Payments are in millions of domestic currency. The direct payments may include deficiency or disaster payments, area and hedge payments, diversions, levies/fees, and double harvest promotions, among others.
5 Indirect Payments are also in millions of domestic currency. The indirect payments may include assistance through input subsidies, and general agricultural services like credit and rural electrification, in case of developing countries.
6 The formula used above has been modified by multiplying and dividing it by the domestic production, Q, to facilitate graphical comparisons with the graphical analysis of PSE estimates.
7 The world reference prices in case of Nigeria and India have been extrapolated from the USDA (1990) data set.

### Table III.8: Extent of distortions captured by NRP and PSE:
Small exporting countries

<table>
<thead>
<tr>
<th>Year</th>
<th>World Reference Price(^1) (P(_w))</th>
<th>Domestic Producer Price(^2) (P(_d))</th>
<th>Domestic Production(^1) (Q)</th>
<th>Direct Payments(^3) (D)</th>
<th>Indirect Payments(^4) (I)</th>
<th>NRP(^5) (Percent)</th>
<th>PSE(^6) (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria (Wheat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>2731.5</td>
<td>3362</td>
<td>1201</td>
<td>-127</td>
<td>286</td>
<td>( \frac{(286-2731.5)}{2731.5} \times 100 )% = 23</td>
<td>( \frac{(3362-2731.5)}{2731.5} \times 100 )% = 23</td>
</tr>
<tr>
<td>1990</td>
<td>1519.8</td>
<td>3623</td>
<td>1404</td>
<td>-241</td>
<td>134</td>
<td>( \frac{(1404-1519.8)}{1519.8} \times 100 )% = 81</td>
<td>( \frac{(3623-1519.8)}{1519.8} \times 100 )% = 134</td>
</tr>
<tr>
<td>Sweden (Wheat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>810</td>
<td>963</td>
<td>1193</td>
<td>11</td>
<td>48</td>
<td>( \frac{(1193-963)}{963} \times 100 )% = 21</td>
<td>( \frac{(1193-963)}{963} \times 100 )% = 21</td>
</tr>
<tr>
<td>1990</td>
<td>400</td>
<td>1361</td>
<td>2165</td>
<td>402</td>
<td>-38</td>
<td>( \frac{(2165-1361)}{1361} \times 100 )% = 60</td>
<td>( \frac{(1361-400)}{400} \times 100 )% = 20</td>
</tr>
<tr>
<td>South Africa (Wheat)(^8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>286</td>
<td>286</td>
<td>2420</td>
<td>0</td>
<td>80.6</td>
<td>( \frac{(2420-286)}{286} \times 100 )% = 70</td>
<td>( \frac{(2420-286)}{286} \times 100 )% = 70</td>
</tr>
<tr>
<td>1986</td>
<td>360</td>
<td>360</td>
<td>2285</td>
<td>0</td>
<td>205.6</td>
<td>( \frac{(2285-360)}{360} \times 100 )% = 50</td>
<td>( \frac{(2285-360)}{360} \times 100 )% = 50</td>
</tr>
<tr>
<td>India (Rice)(^8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>2619</td>
<td>2090</td>
<td>53248</td>
<td>0</td>
<td>22,267</td>
<td>( \frac{(53248-2090)}{2090} \times 100 )% = 20</td>
<td>( \frac{(53248-2090)}{2090} \times 100 )% = 20</td>
</tr>
</tbody>
</table>

1. World reference price is in domestic currency per ton, after adjustment for transportation costs.
2. Producer price is in domestic currency per ton.
3. Domestic production is in 1000 tons.
4. Direct Payments are in millions of domestic currency. The direct payments may include deficiency or disaster payments, area and hedge payments, diversions, and levies/fees, among others.
5. Indirect Payments are also in millions of domestic currency. The indirect payments may include assistance through input subsidies, and general agricultural services.
6. The formula used above has been modified by multiplying and dividing it by the domestic production, Q, to facilitate graphical comparisons with the graphical analysis of PSE estimates. These estimates have been calculated using the data given in the table.
7. The PSE estimates are calculated using the data set and in some cases may not necessarily match those provided in OECD (1991).
8. The world reference prices in case of South Africa and India have been extrapolated from the USDA (1990) data set.

### Table III.9: Extent of consumer market distortions captured by NRPC and CSE: Case of small importing countries

<table>
<thead>
<tr>
<th>Year</th>
<th>World Reference Price</th>
<th>Domestic Consumer Price</th>
<th>Domestic Consumption</th>
<th>Direct Payments</th>
<th>Indirect Payments</th>
<th>NRPC</th>
<th>CSE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Pd)</td>
<td>(Pc)</td>
<td>(Qc)</td>
<td>(Dc)</td>
<td>(Ic)</td>
<td>(Percent)</td>
<td>(Percent)</td>
</tr>
<tr>
<td>1987</td>
<td>16499</td>
<td>6573</td>
<td>8538</td>
<td>0</td>
<td>84746</td>
<td>-151</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(8538x16499)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(8538x6573)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>2152</td>
<td>1932</td>
<td>43719</td>
<td>0</td>
<td>33009</td>
<td>-111</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(43719x2152)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(43719x1932)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: USDA, ERS calculations do not distinguish between direct and indirect payments to consumers.
1 World reference price is in domestic currency per ton, after adjustment for transportation costs.
2 Consumer price is in domestic currency per ton.
3 Domestic consumption is in 1000 tons.
4 Direct Payments are in millions of domestic currency. The direct payments may include food stamps, among others.
5 Indirect Payments are also in millions of domestic currency.
6 The formula for NRPC has been modified by multiplying and dividing by the domestic consumption level to facilitate comparisons with the CSE estimates.

The greater the level of direct and indirect transfers, the more significant would be the difference in the estimates provided by these measures (Table III.8). In Sweden, for example, the NRP for 1990 is 240 percent while the PSE is only 73 percent. In case where MPS is not zero but there are no direct payments, such as in case of India, the absolute NRP estimates would exceed those of PSE. The differences among the estimates provided by consumer protection measurement concepts are similarly different (Table III.9). If domestic consumer price is less than the border price and there are some direct or indirect payments, the CSE would always be larger than NPRC.

It may be useful to further analyze the case where the staple food commodity commands a large percentage of consumers' budget. In that case, the change in prices will have real income effects. This is particularly true in case of poor developing economies. This case may be studied using the compensated demand analysis instead of the standard Marshallian demand curves.

III.3.2 Measuring Distortions in Case of A Large Country

Large industrialized exporting countries in wheat (the United States, the European Community, Australia and Canada) have also relied, besides other measures, upon export subsidies to safeguard the interests of their domestic producers. The European Community has become a net exporter of most commodities, from being a net importer during the 1960s, by the extensive use of variable levies and export subsidies. Export subsidies alone accounted for about 30 percent of the total support provided to grain farmers. The Community provided its wheat growers $7,086.5 million through its trade measures designed to protect the domestic producers from world price fluctuations (OECD, 1991). The Australian Wheat Board, on the other hand, manages the marketing of 80 percent of total Australian wheat production, which is sold in international markets. Domestic prices of wheat have exceeded export prices, resulting in an assistance of about $7 per ton to the domestic producers (USDA, 1987). The recent policy trend in the case of United States is to rely more on export subsidies and deficiency payments (Gardner, 1990a). The Canadian dairy
industry is characterized by extreme political involvement and protection and the Canadian
dairy farmers received about $1782 million in 1990 in market price supports including
export subsidies (OECD, 1991). The following case analyzes the distortions caused by such
subsidies in large exporting countries which face an upward sloping excess demand curve
(ED) by the rest of the world (Figure III.14).

Let the world price be \( P_w \), at which the domestic production is \( OQ_1 \) and domestic
consumption is \( OC_1 \). The quantity \( C_1Q_1 \) is exported which equals \( OX_1 \) in panel (B).
Domestic producers lobby for higher output prices and the government agrees to provide an
export subsidy of \( P_dP_w \) per unit of output. This raises the domestic price to \( P_d \) and also
induces changes in real variables. Domestic consumption decreases to \( OC_2 \) and domestic
production increases by \( Q_1Q_2 \). Exports are now \( C_2Q_2 \), which is equal to \( OX_2 \). The consumer surplus
decreases by the area \( PJP_1da \) whereas the producer surplus increases by \( P_dP_ehb \), resulting in
a net gain of \( adcb \), which is equal to the area \( ghP,P_2 \) in panel (B).

The increase in exports shifts the excess supply in the world market to \( ES_1 \), thereby
decreasing the world price to \( P_{w1} \). The cost to the government of exporting country is given
by the amount of exports times the difference between the domestic price and the new world
price. Hence the cost of the policy is \( kdcm \), which is equivalent to the area \( jhP_jP_{w1} \) in panel
(B). Of this cost, the producers' gain is \( adcb \) (or \( ghP_jP_{w} \)). The lower prices in the world
markets increase the consumer surplus of the importing countries by the area \( jgP_jP_{w} \),
leaving the net economic loss to the world of \( jhg \). Of this loss, the exporting country bears
the portion \( ihg \), which equals the sum of the two triangles \( eda \) and \( bef \) in panel (A), while the
rest, area \( jig \), is borne by the rest of the world.

The distortions in the exporting country's economy caused by the export subsidy can
be approximated by \( NRP \) and \( PSE \) and compared with the distortion estimates provided by
the Marshallian producer surplus measures. In absolute values, the \( NRP \) and \( PSE \) estimates
would be identical and would overestimate the distortion. However, in percentage terms, the
estimates of distortion obtained using the \( NRP \) would be higher than those obtained from
Moreover, both these estimates would exceed the producer surplus estimates by the area $P \times bcm$. Overall, the NRP would overestimate the distortion by a larger amount as compared to the PSE, which would overestimate the distortion at market prices but would underestimate it at the border prices.

The analysis reveals that the large exporting country loses by maintaining domestic prices above the world price levels and the domestic economy witnesses the redistribution of income from consumers and taxpayers to the domestic producers and foreign importers. Compared to a small country case, when a large country raises its domestic prices above international prices, it depresses the international prices and the cost to the domestic economy is much higher than reflected in the gains to the domestic producers. The level of the distortion due to the export subsidy in case of large exporting country, as measured by the NRP and PSE, reveals that both these measures clearly overstate the actual extent of distortion.

The differences in the estimates provided by these measures are also substantiated in Tables III.10 through III.12. As discussed earlier, in case where MPS is zero but producers are given positive direct payments, the PSE estimates would always be greater than NRP.

Figure III.14: Measuring distortions in a large exporting country case
since $NRP$ would be zero, as is the case of United States (wheat) for the year 1990 (Table III.10). On the contrary, when $MPS$ is positive but there are no direct or indirect payments, the $PSE$ estimates would be smaller than those of $NRP$ because in these countries, domestic prices are maintained above the world prices. In low-income countries like Argentina which tax domestic farmers and provide no direct payments but provide positive indirect subsidies, the numerator of $PSE$ would be smaller resulting in different estimates.

Likewise, in case of large importing countries with significant positive price wedge, the $NRP$ estimates would far exceed those of $PSE$ (Table III.11). The $NRPC$ and $CSE$ estimates would be negative in case of large industrialized countries that maintain higher consumer prices as compared to the world prices (Table III.12). The higher this wedge, the smaller would be the $CSE$ as compared to the $NRPC$.

III.4 Measurement of Protection Levels Under Price Discrimination

In many countries, the governments set up agencies that have monopoly control in important foodgrains and manage domestic supply and international trade in order to influence domestic prices (Anderson and Tyers, 1992). For example, the Japan's Food Agency, Canadian Wheat Board (CWB), and the Australian Wheat Board (AWB) are engaged in such efforts. The Australian Wheat Board (AWB) has had a monopoly on marketing of wheat overseas and domestically. The board has long been administering domestic wheat prices above the international levels. Although the domestic wheat marketing has almost been deregulated since 1989, the AWB still exercises monopoly power over the marketing of wheat exports, which constitute about 80 percent of the total production (Edwards, 1990). In the case of many developing countries, government agencies, such as Food Corporation of India and National Logistics Agency of Indonesia, also hold monopoly power to maintain control over domestic prices and engage in international trade. These agencies, however, maintain domestic prices below the international prices in order to ensure accessibility to cheap food for poor people.

Although some studies have analyzed price discrimination, the following discussion represents the first systematic demonstration of price discrimination in the context of extent of distortion captured by alternative measures of protection.
Table III.10: Extent of distortions captured by NRP and PSE: Large exporting country

<table>
<thead>
<tr>
<th>Year</th>
<th>World Reference Price</th>
<th>Domestic Producer Price</th>
<th>Domestic Production</th>
<th>Direct Payments</th>
<th>Indirect Payments</th>
<th>NRP² (Percent)</th>
<th>PSE (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.A. (Wheat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>144</td>
<td>144</td>
<td>64.6</td>
<td>596</td>
<td>767</td>
<td>Q(P_d-P_w)/P_w-Q</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>64.6(144-144)</td>
<td>596+767</td>
</tr>
<tr>
<td>1990</td>
<td>80.6</td>
<td>96</td>
<td>74.7</td>
<td>2403</td>
<td>620</td>
<td>Q(P_d-P_w)/P_w-Q</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>74.7(96-80.6)</td>
<td>2403+620</td>
</tr>
<tr>
<td>E.C. (Common Wheat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>125.7</td>
<td>164</td>
<td>50.2</td>
<td>0</td>
<td>0</td>
<td>Q(P_d-P_w)/P_w-Q</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50.2(164-125.7)</td>
<td>0+0</td>
</tr>
<tr>
<td>1990</td>
<td>107.1</td>
<td>171</td>
<td>72.8</td>
<td>-244</td>
<td>793</td>
<td>Q(P_d-P_w)/P_w-Q</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>72.8(171-107.1)</td>
<td>-244+793</td>
</tr>
<tr>
<td>Canada (Milk)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>161.7</td>
<td>282</td>
<td>7.95</td>
<td>149</td>
<td>207</td>
<td>Q(P_d-P_w)/P_w-Q</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.95(282-161.7)</td>
<td>149+207</td>
</tr>
<tr>
<td>1990</td>
<td>158.8</td>
<td>418</td>
<td>8.02</td>
<td>121</td>
<td>566</td>
<td>Q(P_d-P_w)/P_w-Q</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.02(418-158.8)</td>
<td>121+566</td>
</tr>
<tr>
<td>Argentina (Wheat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>0.3</td>
<td>0.24</td>
<td>8.3</td>
<td>0</td>
<td>0.18</td>
<td>Q(P_d-P_w)/P_w-Q</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.3(0.24-0.30)</td>
<td>0+0.18</td>
</tr>
<tr>
<td>1985</td>
<td>54.18</td>
<td>37.4</td>
<td>13.2</td>
<td>0</td>
<td>77.17</td>
<td>Q(P_d-P_w)/P_w-Q</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13.2(37.4-54.18)</td>
<td>0+77.17</td>
</tr>
</tbody>
</table>

1 World reference price is in domestic currency per ton, after adjustment for transportation costs.
2 Producer price is in domestic currency per ton.
3 Domestic production is in million tons.
4 Direct Payments are in millions of domestic currency. The direct payments may include deficiency or disaster payments, area and hedge payments, diversions, levies/fees, and double harvest promotions, among others.
5 Indirect Payments are also in millions of domestic currency. The indirect payments may include assistance through input subsidies, marketing subsidies and general agricultural services like research advisory etc.
6 The formula for NRP has been modified by multiplying and dividing it by the domestic production, Q, to facilitate graphical comparisons with the graphical analysis of PSE estimates.
7 The world reference price for 1980 was extrapolated from the OECD (1991) data set.
8 The world reference price for Argentina was extrapolated from the USDA (1990) data set, considering trade policy transfers as the wedge between the domestic and world reference prices.

Table III.11: Extent of distortions captured by NRP and PSE:
Large importing country

<table>
<thead>
<tr>
<th>Year</th>
<th>World Reference Price</th>
<th>Domestic Producer Price</th>
<th>Domestic Production</th>
<th>Direct Payments</th>
<th>Indirect Payments</th>
<th>NRP $\text{'} (Percent)</th>
<th>PSE $\text{'} (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(P$_n$)</td>
<td>(P$_d$)</td>
<td>(Q)</td>
<td>(D)</td>
<td>(I)</td>
<td>Q(P$_d$ - P$_n$)/P$_n$Q</td>
<td>Q(P$_d$ - P$_n$) + D + IP$_d$Q + D</td>
</tr>
<tr>
<td>Japan, (Wheat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>47</td>
<td>178</td>
<td>583</td>
<td>24</td>
<td>22</td>
<td>583(178-47) = 279</td>
<td>583(178-47) + 24000 + 22000 = 96</td>
</tr>
<tr>
<td>1990</td>
<td>24.8</td>
<td>154</td>
<td>946</td>
<td>12</td>
<td>22</td>
<td>946(154-24.8) = 521</td>
<td>946(154-24.8) + 12000 + 22000 = 99</td>
</tr>
<tr>
<td>Japan, (Rice)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>128.8</td>
<td>295</td>
<td>9751</td>
<td>322</td>
<td>314</td>
<td>9751(295-128.8) = 129</td>
<td>9.751(295-128.8) + 322 + 314 = 71</td>
</tr>
<tr>
<td>1990</td>
<td>61.4</td>
<td>275</td>
<td>10350</td>
<td>234</td>
<td>238</td>
<td>10350(275-61.4) = 348</td>
<td>10.35(275-61.4) + 234 + 238 = 87</td>
</tr>
<tr>
<td>Japan, (Beef)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>304.6</td>
<td>1565</td>
<td>418</td>
<td>0</td>
<td>72</td>
<td>418(1565-304.6) = 414</td>
<td>418(1565-304.6) + 0 + 72 = 92</td>
</tr>
<tr>
<td>1990</td>
<td>236</td>
<td>1526</td>
<td>551</td>
<td>0</td>
<td>37</td>
<td>551(1526-236) = 547</td>
<td>551(1526-236) + 0 + 37 = 85</td>
</tr>
</tbody>
</table>

1 World reference price is in thousands of yen per ton, after adjustment for transportation costs.
2 Producer price is in thousands of yen per ton.
3 Domestic production is in 1000 tons.
4 Direct Payments are in billions of yen. The direct payments may include deficiency or disaster payments, area and hedge payments, diversions, levies/taxes, and double harvest promotions, among others.
5 Indirect Payments are also in millions of domestic currency. The indirect payments may include assistance through input subsidies, and general agricultural services.
6 The formula used for NRP has been modified by multiplying and dividing it by the domestic production, Q, to facilitate graphical comparisons with the graphical analysis of PSE estimates.
7 The PSE estimates are calculated using both the data set and in some cases may not necessarily match those provided in OECD (1991).

Table III.12: Extent of consumer market distortions captured by NRPC and CSE

<table>
<thead>
<tr>
<th>Year</th>
<th>World Price</th>
<th>Domestic Consumer Price</th>
<th>Domestic Consumption</th>
<th>Direct Payments</th>
<th>Indirect Payments</th>
<th>NRPC&lt;sup&gt;6&lt;/sup&gt; (Percent)</th>
<th>CSE (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(P&lt;sub&gt;W&lt;/sub&gt;)</td>
<td>(P&lt;sub&gt;C&lt;/sub&gt;)</td>
<td>(Q&lt;sub&gt;C&lt;/sub&gt;)</td>
<td>(D&lt;sub&gt;C&lt;/sub&gt;)</td>
<td>(I&lt;sub&gt;C&lt;/sub&gt;)</td>
<td>(Q&lt;sub&gt;C&lt;/sub&gt;(P&lt;sub&gt;C&lt;/sub&gt;−P&lt;sub&gt;W&lt;/sub&gt;)/P&lt;sub&gt;W&lt;/sub&gt;)</td>
<td>(Q&lt;sub&gt;C&lt;/sub&gt;(P&lt;sub&gt;C&lt;/sub&gt;−P&lt;sub&gt;W&lt;/sub&gt;)+D&lt;sub&gt;C&lt;/sub&gt;+I&lt;sub&gt;C&lt;/sub&gt;) / P&lt;sub&gt;C&lt;/sub&gt;Q&lt;sub&gt;C&lt;/sub&gt;)</td>
</tr>
<tr>
<td>U.S.A. (Wheat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 1987 | 70 | 109 | 29507 | 0 | 0 | -\[
\frac{29507(109-70)}{29507}\]
\(-.36\) | -\[
\frac{29507(109-70)}{29507}\]
\(-.36\) |
| E.C. (Sugar) | | | | | | |
| 1987 | 148 | 896 | 9540 | 0 | 0 | -\[
\frac{9540(896-148)}{9540}\]
\(-.83\) | -\[
\frac{9540(896-148)}{9540}\]
\(-.83\) |
| Japan (Beef and Veal) | | | | | | |
| 1987 | 381500 | 2209420 | 880 | 0 | -838190 | -\[
\frac{880(2209420-381500)}{880}\]
\(-479\) | -\[
\frac{880(2209420-381500)}{880}\]
\(-479\) |

Note: USDA, ERS calculations do not distinguish between direct and indirect payments to consumers.

1 World reference price is in domestic currency per ton, after adjustment for transportation costs.
2 Consumer price is in domestic currency per ton.
3 Domestic consumption is in 1000 tons.
4 Direct Payments are in millions of domestic currency. The direct payments may include food stamps, among others.
5 Indirect Payments are also in millions of domestic currency.
6 The formula for NRPC has been modified by dividing and multiplying it by the domestic consumption in order to facilitate graphical comparisons with the CSE estimates.

In the case of industrialized countries where domestic prices are usually maintained above the world price level, these agencies may engage in price discrimination. Assuming that the world market price of an agricultural commodity is determined competitively, it becomes important to analyze the effects of the distortions caused by the actions of these agencies. It is of further interest whether such policies may result in biased estimates of protection levels using the NRP and PSE measures.

Consider the case where the monopolist is facing a perfectly elastic demand in the world markets but a downward sloping demand in the home market (Figure III.15). First, assume that the world market price, $P_{w1}$, which is also the competitive marginal revenue, is such that domestic marginal revenue curve, $MR$, is everywhere below $P_{w1}$. The total output produced at this price is $OQ_1$ but, since no domestic buying occurs, all of this output is exported. In this case, the total revenues for the monopolist are $OP_{w1}aQ_1$. Of this area, $OfaQ1$ represents the total variable costs and the Marshallian producer surplus is given by the area $fP_{w1}a$. Moreover, since no domestic price exists at which any buying may occur, the NRP and PSE may not be defined.

Now assume that the world market price drops to $P_{w2}$ and, thus, it becomes feasible for the monopolistic agency to engage in price discrimination. The total output produced in this case would be $OQ_2$ at point c where the foreign marginal revenue curve intersects the marginal cost curve, $MC$. Of this total output, the monopolist will be able to sell $OQ_3$ in the domestic market at price $P_{d1}$, which is higher than the world price. The remaining output, $Q_1Q_3$, will be exported. The producer surplus is $fP_{d1}bdc$, which is equivalent to the areas $fP_{w2}c + P_{w2}P_{d1}bd$. As $P_{d1} > P_{w2}$, the producer receives an increase in revenue equivalent to $P_{w2}P_{d1}bd$ due to price discrimination. These estimates of producer surplus in the commodity market can now be compared with the estimates of distortion provided by the NRP and PSE.

Here, two scenarios can be analyzed. First, the case where trade is ignored and only domestic

---

18 Price discrimination is generally defined as the situation where any product produced under single control is sold at different prices to different buyers (Robinson, 1938).

29 It is being assumed here that both markets are separable with no arbitrage possibilities, different price elasticities exist, and in cases discussed below, that the domestic government bars imports from impinging upon the monopolized domestic market with no similar restrictions by other countries that might affect this country's exports.
consumption is considered, and, second, where both domestic consumption and exports are considered. In the first case, the estimates of \( NRP \) and \( PSE \) would be:

\[
NRP = \frac{OP_{d1} bQ_3 - OP_{w2} dQ_3}{OP_{w2} dQ_3} = \frac{P_{w2} P_{d1} bd}{OP_{w2} dQ_3}.
\]

\[
PSE = \frac{OP_{d1} bQ_3 - OP_{w2} dQ_3}{OP_{d1} bQ_3} = \frac{P_{w2} P_{d1} bd}{OP_{d1} bQ_3}.
\]

The total producer surplus, considering total output, \( OQ_2 \), is equal to the area \( fP_{d1} bdc \). Here, the \( NRP \) and \( PSE \) estimates clearly understate the total producer surplus at border and market price, respectively, by the area \( fP_{w2} c \). Nevertheless, the \( NRP \) estimate is consistent with the change in the producer surplus at border price due to price discrimination by the monopolist, which creates the wedge \( P_{w2} P_{d1} \) and the change in producer surplus is \( P_{w2} P_{d1} bd \). The estimate for \( PSE \) would compare similarly with the change in producer surplus at the market price.

Figure III.15  Comparison of measures of protection under price discrimination
Next, when trade is considered, the \( NRP \) and \( PSE \) measures would overestimate the above change in producer surplus by the area \( bdhc \):

\[
NPR = \frac{\text{OPT}_2 - \text{OPT}_1}{\text{OPT}_2} = \frac{\text{OPT}_2}{\text{OPT}_1},
\]

\[
PSE = \frac{\text{OPT}_3 - \text{OPT}_1}{\text{OPT}_3} = \frac{\text{OPT}_3}{\text{OPT}_1}.
\]

However, the overestimation is less in case of \( PSE \) as compared to the \( NRP \) estimates when trade is considered. If, due to increased competition in the international market, the world price falls down to somewhere between \( P_{w2} \) and \( f \), the domestic consumer welfare would increase. The increase in consumer surplus would clearly be much higher in the case where no price discrimination occurs. The \( PSE \) and \( NRP \) estimates would still be biased upwards. The monopolist would lose due to falling world prices. The monopolist would be able to recover some of the loss by exercising price discrimination in the domestic market as compared to the case where world price was allowed to prevail in the domestic market.

Next, suppose that the world market price is too low, say at \( P_{w3} \), such that \( P_{w3} \) is less than the monopolist's average total cost at all levels of output. In this case, the domestic monopoly situation prevails and no trade occurs. The monopolist would operate at \( g \) where monopolist's marginal cost and marginal revenue curves intersect and would charge the maximum price that the consumers are willing and able to pay \( (P_{d3}) \) for the output \( Q_3 \).

The producer surplus will then be \( fP_{d3}e_g \) and both \( NRP \) and \( PSE \) would overestimate the distortion in domestic markets by the area \( P_{w3}fg \). The percent \( PSE \) would, however, overestimate the distortion by less amount than the percent \( NRP \) estimate:

\[
NPR = \frac{\text{OPT}_4 - \text{OPT}_3}{\text{OPT}_4} = \frac{\text{OPT}_4}{\text{OPT}_3},
\]

\[
PSE = \frac{\text{OPT}_5 e_4 - \text{OPT}_3}{\text{OPT}_5} = \frac{\text{OPT}_5}{\text{OPT}_3}.
\]

---

\(^{30}\) It may be noted that the world price may decrease further with no change in the domestic price and output.

\(^{31}\) However, it must be noted that the foreign price component in this case is arbitrary and could be anything.
Although the example above illustrates an extreme case, it is not far from the situation in some industrialized countries where domestic producers face very low international prices yet manage to get a higher price domestically for their output. In some cases, the controlling agencies may also establish export subsidies which compensate the producers for overproduction which is then exported at the international prices. The cases where such subsidies are provided are relatively complicated to analyze. However, two such cases are discussed below where domestic consumers and producers are subsidized by way of direct payments.

Consider first the case of a direct consumer subsidy. The world price is $P_w$ and domestic production is $OQ_1$, of which $OQ_2$ is consumed domestically at price $P_d$, and the rest, $Q_3Q_1$, is exported (Figure III.16). A per unit subsidy equivalent to $nh$ would shift up the curve $AR$, to $AR'$ and $MR$, to $MR'$, as shown in the figure.\(^{32}\) The total domestic production remains unchanged at $OQ_1$ since the monopolist’s $MC$ curve and the foreign $MR$ curve do not change. However, due to increased demand in domestic market, it becomes profitable for the price discriminating monopolist to sell more output in the domestic market at a higher price, $P_d'$. Since the domestic sales increase to $OQ_2$, exports drop to $Q_3Q_1$. At the total output produced, the $PSE$ (and $NRP$) overestimate the distortions by the area $bhgc$. Note, however, that without the subsidy, the $PSE$ overestimate was equivalent to the area $aijc$. Whether the overestimation is less or more now, depends on whether the area $aikb$ is more or less than the area $khgf$. It may be further noted that the demand and $MR$ curves may shift in such a way as to leave the domestic price unchanged after the subsidy. In that case, the $PSE$ estimates would be less biased by the area $aikb$ as compared to the case without the subsidy.

Since $PSE$ is the summation of two types of government policies, the wedge between the border and domestic prices, and the direct and indirect transfers to agricultural producers, the absolute estimates of $PSE$ and $NRP$ do not differ in the case where income transfers are made to consumers only. The $CSE$, on the other hand, would capture these budgetary transfers from the government to consumers, and would, therefore, provide relatively

---

\(^{32}\) It may be noted here that an ad valorem subsidy would alter the slopes of the $AR$ and $MR$ curves between the pre- and post-subsidy scenarios. The overall policy effects in this case can be shown analogous to the per unit subsidy case analyzed below and are not discussed separately.
accurate estimates as compared to the \( NPRC \):

\[
NPRC = \frac{OP_{d_2} hQ_3 - OP_w bQ_3}{OP_w bQ_3} = \frac{P_w P_{d_2} h b}{OP_w bQ_3},
\]

\[
CSE = \frac{OP_{d_2} hQ_3 - OP_w bQ_3 + mP_{d_2} h n}{OP_{d_2} hQ_3} = \frac{P_w P_{d_2} h b + mP_{d_2} h n}{OP_{d_2} bQ_3}.
\]

The \( NPRC \) measure fails to capture the direct consumer transfers. Therefore, the \( NPRC \) underestimates the distortion compared to \( CSE \) by the amount of government expenditures. The consumers now consume higher quantities but also the domestic price has risen from \( P_{d_1} \) to \( P_{d_2} \). Therefore, the consumers gain the area \( stlx \), but lose the area \( P_{d_1} P_{d_2} xi \). Therefore, the overall effect on consumers is ambiguous. Moreover, the comparison of \( CSE \) and \( NPRC \) with the consumer surplus at border and market prices, respectively, is also inconclusive.

Now, assume that instead of consumer subsidy, the government provides specific input subsidy to farmers which shifts the marginal cost curve down to \( MC \) (Figure III.17). The output increases to \( OQ_2 \). However, since domestic demand remains unchanged, the

![Figure III.16: Comparison of measures of protection under price discrimination with consumer subsidies](image-url)
domestic component of price discrimination is unaffected and the consumers still consume at $OC_1$. Exports increase to $C_2Q_2$ from $C_1Q_1$. The producer surplus increases by the area $fdbg$ to $fP_a eag$. The numerator of $NRP$ measures the area $P_aP_d kg$. Whether the area $P_aP_d kg$ is greater or less than the area $fdbg$ would depend upon the elasticities and the extent of the shift. Compared with the no input subsidy case, the overestimation by $NRP$ here would increase by the area $bhkg$. The $PSE$, which would also include the amount of government expenditures, $nP_a gm$, would provide even more inflated estimates of the distortion. The comparison of these measures with the respective percent change in producer surplus would still be ambiguous.

Figure III.17: Measures of market distortion under price discrimination with input subsidy
In short, the graphical analysis in this section examines how different interventionary policies distort producer and consumer incentives. Under highly simplistic assumptions, the analysis compares and contrasts the level of distortion captured by different methods of measurement. It is revealed that the market distortion captured by the NRP and PSE and NRPC and CSE measures would provide identical estimates of the level of distortion where the market distortion is translated into the wedge between the border and domestic prices. There are certain policies that result in distortions that do not affect the wedge. In that case, PSE or CSE estimates would be closer to the actual effects whereas the NRP and NRPC would fail to account for them. There are certain policies whose effects and the direction of change would not possibly be captured by any of these measures. In such cases, empirical examination of the effects becomes desirable.

The purpose of this chapter has been to provide an analytical overview of the political economy market of agricultural protection. A political market framework has been advanced along with some contrasting patterns of protectionistic policies across industrialized and developing countries highlighting several determinants of agricultural protection. A comprehensive comparative analysis of different measurement concepts and their respective policy coverage is discussed. Finally, a graphical exposition of the policy effects captured by some selected measurement concepts is provided under many different scenarios and market conditions. The choice of the measurement concept to be used in the empirical analysis that emerges from the analysis apparently favors the producer subsidy equivalent on the basis of its comprehensive and wider coverage of different policies and its suitability to analyze the extent of government intervention.
CHAPTER IV
THEORETICAL FRAMEWORK

The theoretical models developed in this chapter incorporate two analytical viewpoints. The self-interest of individuals seeking personal benefits is combined with the larger societal goals representing altruistic motives. The self-interest elements are the mainstay of the producer model. The consumers seeking government intervention in the agricultural sector to reduce the risk of food insecurity are viewed from the larger societal perspective. It is, therefore, assumed here that consumers and producers are the demanders of political action in an attempt to maximize their utility or profit. The political supply of intervention from the policy makers is assumed to respond to both these groups.

The next section provides a schematic overview of the factors influencing the government intervention in the agricultural markets. The benefits of price stabilization to consumers seeking to reduce the food insecurity risk are modeled in Section IV.2. Section IV.3 develops a theoretical model of producers seeking government intervention in order to maximize their profits subject to the political resource contribution. The politician welfare function which incorporates the interests of both consumers and producers is developed in the final section.

IV.1 The Conceptual Framework

Based upon the political market framework developed in Section III.1, a schematic overview of the interaction among different interest groups influencing the interventionary policy outcome is formulated in this section. Following Berry (1989), an interest group is defined here as "an organized body of individuals who share some goals and who try to influence public policy" (p. 4). Stevens (1993) points out that the broadest definition of an interest group includes both voluntary and involuntary memberships. Groups differ in terms of their interest, size, resources and political influence and orientation. The unifying element

33 Much of the public choice literature tends to emphasize narrow self-interest as the primary motivation for individual behavior of economic agents. Quiggen (1987), Paarlberg (1989) and others have suggested the need to emphasize a broad spectrum of motivators including a degree of altruism.
within a group is the existence of some degree of shared interest. Interest groups may be formed by citizens with a common cause. Groups interested in the policy outcome in the agricultural sector include farmers, farm input suppliers, agribusiness firms, research, development and extension organizations, consumers, bureaucrats, lobbying organizations and politicians, to name a few. In the theoretical framework developed in this chapter, the interests of all these different groups are summarized in three distinct groups: consumers, producers and the policy maker.

This may all seem a simple way of viewing a complex interaction in the political market of agricultural policy formulation. Nonetheless, this allows the formation of a conceptual framework with comprehensible exposition that can be further analyzed. The interactions among these groups are depicted in the schematic diagram presented in Figure IV.1.

![Figure IV.1: Interactions in the political market for agricultural protection](image-url)
It is postulated that the perceived benefits from improved food security through stabilization of food prices translates into preferences of the consumers. These perceived benefits constitute the demand for intervention from the consumers. Since incomes and the size of risk in relation to income vary from society to society, this generates varying degree of demand from consumers across countries. Producer group, on the other hand, contributes resources to lobby the government in seeking agricultural subsidies to enhance their profits. The level of contribution would also differ across countries depending upon factors such as the size of the producer group, their incomes and their ability to control free-riding by the members. The effectiveness with which the producer interest group can exert political pressure then depends upon the perspective gains to the members of the group. Therefore, the overall demand for government intervention in the agricultural sector is created by the relative influence of these two groups in a given society.

The political leadership is assumed to form policy preferences by taking into account the marginal effects of policy outcomes on the utility of consumers and the profits of producers. The society's preferences are then transformed into programs and policies to the extent permitted by the available resources, including fiscal resources and bureaucratic capacity. The factors and relationships that determine the degrees of subsidies or taxation to any group would depend upon the compatibility or conflict between the interests of these two groups and the government's treasury position.

The extent of consumer subsidies or taxation decided by the policy maker depend upon the constraints within which the consumers operate, such as their income levels, Engel coefficients, and the degrees of risk aversion. The consumers in low-income countries (LDCs), with high share of food in household consumption expenditures and high coefficients of relative risk aversion, are more prone to immediate (short-run) food insecurity risks. In order to mitigate the threat of food shortfalls and to ensure stable consumption patterns, the prices of food in these countries are kept at below the international levels. Countries that provide low food prices to urban consumers, often require producers to bear most of the cost by holding crop prices at lower levels than would be the case in the absence
of intervention. Such policy outcomes, though providing tangible benefits to consumers, increase the risks of long-run food security by depressing domestic production incentives. These policies, thus, run counter to the long-run interests of the society. In countries where consumer incomes are sufficiently high, with considerably lower Engel coefficients, this objective translates into enhancing production through providing incentives to domestic producers.

Small affluent producer groups which can form a common position and mitigate the free-rider problem, are able to exert relatively more political pressure and be the beneficiaries of subsidies, as is the case in developed countries (DC). The relatively large producer groups in LDCs encounter substantial organization costs and free-riding problems. These and other factors forestall them from constituting effective demand for protection and receiving any favorable outcomes from agricultural policies.

It may be noted that the interests of the producer and consumer groups may not always be in conflict with each other. Giving subsidies to producers may also be in the larger societal interest. Thus, although the consumers in developed countries are explicitly taxed to pay for the farm programs, their acquiescence to the farm programs may not be represented a conflict of interests (Foster and Rausser, 1992). The factors discussed above are explicitly incorporated into the theoretical models of the consumer, producer and policy maker in the following sections.

IV.2 Consumer Model

This section highlights consumers' willingness to have government intervention in the agricultural sector, especially for staple food commodities. The PEAP literature cites several reasons as to why consumers in industrialized countries acquiesce to costly farm programs. These may include the relatively high cost of organization and collective action, greater free-rider problem, geographical dispersion, low per capita benefits and high cost of

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34 It can be argued that public policies are often rather designed to benefit the poorer sections of the society, as is the case in the consumer group. However, such altruistic motives may not be the basis of policy intervention in all cases. For example, the bulk of the benefits in the United States and the European Community goes to the largest farmers (Moyers and Josling, 1990).
becoming informed, and high per capita cost to farmers of subsidizing the consumers. On the other hand, consumers in developing nations are the beneficiaries of government intervention in the farm sector due to their relatively small size, better organization, high marginal benefits and low cost per capita to producers.

This section proposes an alternative hypothesis to explain this phenomenon. Consumers accept government intervention in the agricultural sector because of the benefits of food security accruing to them. The argument relates to the paradigm of the social concerns approach that groups seeking risk insurance are protected by the government (see Chapter II). The SWG approach is applied in that the governments in both industrialized and developing countries institute farm policies due, in part, to the consumers' food security concerns. This altruistic motive has largely been ignored in the PEAP literature so far. This section stresses the need for an analysis which quantifies the linkages between food security, price stabilization and PEAP policies. The consumer model establishes these linkages explicitly. The focus of analysis is not on the efficiency of price stabilization policies or food aid or development strategies. Rather the emphasis is to stress that there is a role of food security perceptions of consumers which affects the political leaderships' decision-making process in instituting farm policies.

Foster and Rausser (1992) point out that, "seemingly inefficient policy that appear to harm consumers could be, in fact, a rational component of a larger portfolio of policies ultimately benefiting consumers at the expense of producers" (p. 18). Gardner (1990b, p. 30) also proposes a hypothesis that, "... non-farmers acquiesce to farm programs because they believe the programs guarantee food availability at reasonable prices. ... Farm programs constitute consumer insurance or stabilization programs." He elaborates that there is a perception in the industrialized countries that an economically healthy agriculture is a kind of food-supply insurance. Tyers and Anderson (1992) also admit that there is a case of public

---

35 This argument is postulated to transcend across developing as well as industrialized countries, albeit with varying degrees.
36 In a discussion with Luther Tweeten on this topic, he suggested that the food security perception in the minds of consumers may justify the agricultural intervention from their point of view.
interest for domestic price stabilization if at least some agents are risk averse and price fluctuations impair their welfare.

The government involvement in the agricultural sector across both industrialized and developing countries may, therefore, also be in response to food consumers' concerns regarding stable prices and consistent food consumption patterns (Miller, 1986; Bigman, 1985). Consumers' contribution to the demand for government intervention in the agricultural sector in the presence of stochastic prices and supply is modeled below.

The model below addresses price stabilization from the perspective of an individual consumer. However, the results may easily be generalized at more aggregate levels. The commodity in question is taken to be a staple food commodity (for example, wheat). The consumer prefers a smooth consumption pattern over an erratic one. In a stochastic environment where production and prices are fluctuating, the consumer is interested in meeting a target level of consumption. An element of risk here is the existence of the possibility that prices might increase to a level such that it may not be feasible, given the income of the consumer, to meet the target level of consumption of this particular commodity. During the periods of excessively high prices, the inability of the consumer to meet this consumption level results in extreme distress. To avoid such an occurrence, the representative consumer is modeled to be interested in price stabilization being introduced, thus altering the probability distribution of prices. Tyers and Anderson (1992) also point out that the consumers prefer prices of necessary products to be "more rather than less stable over time." The consumer's benefits of price stabilization are measured similar to Newberry and Stiglitz (1981, Chapter 9). Specifically, the theoretical model incorporates the following features:

1. The consumer wants to avoid excessively high food prices and the associated shortfalls in the target level of consumption of the staple commodity,

---

37 In this discussion, reference to food and the consumption of this particular staple commodity are used interchangeably.
38 For present purposes, no distinction is made between extreme food supply shortfalls and risk of high prices.
2. To avoid food shortfalls and associated excessively high prices, the consumer is willing to accept government intervention in the market for staple commodity and have the price stabilization introduced.

Assume the consumer derives utility from the consumption of two commodities, $q_1$ and $q_2$, whose prices are $p_1$ and $p_2$, respectively. Let $q_1$ be the staple food commodity in question (wheat) and $q_2$ be a composite bundle of other commodities. Also, assume that $p_1$ and $p_2$ are random. Let the income of the consumer be $y$ and $\hat{q}_1$ and $\hat{q}_2$ be the minimum target consumption levels of $q_1$ and $q_2$, respectively. It can also be assumed that both goods are substitutes to a certain extent only after the minimum requirements of both have been met, that is, the feasible domain is restricted to the shaded area of Figure IV.2 (A). The minimum requirements of $q_1$ and $q_2$ would define a new origin. The tangency of indifference curve $IC_i$ to the budget constraint $AB$ gives the optimum consumption bundle $E$.

If the consumption of $q_1$ falls below the target level $\hat{q}_1$ then extreme discomfort occurs. In other words, given the consumers' income, extremely high prices that limit the consumption below $\hat{q}_1$ result in discomfort to the consumer. Let these critical prices be $\delta_1$ and $\delta_2$. Consumer wants to avoid the situations where $p_1 > \delta_1$ or $p_2 > \delta_2$.

Figure IV.2: Feasible domains restricted by the minimum requirements
Since prices are random, there is a possibility that prices could be so high. There is an incentive, therefore, on the part of the consumer to have price stabilization introduced and, thus, be assured to meet the target level of consumption. Since the objective here is to analyze the effects of shortfalls in food consumption only, for the rest of the analysis, it may be assumed for simplicity that \( \hat{q}_2 = 0 \) and that \( p_2 \) is non-random. The assumption may change the feasible domain as shown in Figure IV.2, panel (B).

Let \( u \) be the consumer's utility function in a stochastic environment with following properties:

\[
    u = \begin{cases} 
        u(q_1, q_2) & \text{if} & q_1 \geq \hat{q}_1 \\
        v_0 & \text{if} & q_1 < \hat{q}_1 
    \end{cases}
\]

where,

\[
    \left( \frac{\partial u}{\partial q_1} \right) > 0, \quad \left( \frac{\partial^2 u}{\partial q_1^2} \right) < 0 \quad \text{for} \quad q_1 \geq \hat{q}_1,
\]

and

\[
    \left( \frac{\partial u}{\partial q_i} \right) = 0 \quad \text{for} \quad q_1 < \hat{q}_1; \quad i = 1, 2.
\]

Here, \( v_o \) indicates the distress level of utility. For example, \( v_o = -\infty \) indicates an extreme case when \( q_1 < \hat{q}_1 \). Note that \( v_o < u(q_1, q_2) \) \( \forall q_2 \), implying that the utility function is discontinuous at \( q_1 = \hat{q}_1 \). In other words, the consumer's income must be at least \( (p_1 \cdot \hat{q}_1) \).

Accessibility to adequate supplies of the staple food is, thus, defined where the level of consumer's income and prices are such that the consumer is able to consume at least the target amount \( \hat{q}_1 \). If \( p_1 > y/\hat{q}_1 \), then the consumer cannot consume even the minimum required quantities of \( q_1 \). The food insecurity (FIS) risk can, therefore, be defined as the probability that the value of minimum consumption \( (p_1 \cdot \hat{q}_1) \) exceeds the consumers' income \( (y) \), that is,

\[
    FIS = \Pr \{ p_1 \cdot \hat{q}_1 > y \}.
\]

---

**Note:** For example, shortfalls in food supplies as a result of famines, natural disasters or embargoes may cause the prices to be excessively high in the short-run.
Or, in other words, if \( p_1 > y / \hat{q}_1 \) then \( q_1 < \hat{q}_1 \). Therefore, food insecurity can also be defined as the probability that prices will exceed the level that permits access to consumer to the minimum required quantities of \( q_i \), i.e.,

\[
\text{FIS} = \Pr \{ p_i > y / \hat{q}_1 \}.
\]

The probability of excessively high food prices and the corresponding food shortages may be considerably diminished through price stabilization and income enhancing programs for farmers that may alleviate uncertainty in food production (Hinchy and Fisher, 1988; Pinstrup-Andersen, 1988b). "A minimum-price program, for example, would encourage producers to increase production; and the additional supply would be beneficial for the consumers" (Bigman, 1985, p.16). However, in countries with low-income population characteristics (such as high share of food expenditure), stabilization policies aimed at encouraging food production through higher food prices are likely to result in reductions in the real incomes of food consumers (Schultz, 1978; Pinstrup-Andersen, 1988, p.241). Consequently, policies that raise food prices through encouraging production by providing incentives to farmers are generally adopted in countries where consumers are relatively more affluent (Miller, 1986). On the other hand, food policies that stabilize food prices at a level that ensures accessibility to food for consumers with low purchasing power generally prevail in low-income countries (Krueger, 1992; Bigman, 1985; Chisholm and Tyers, 1982; Ahmed and Mellor, 1988). Nonetheless, such stabilization policies for poor consumers often lower average prices received by farmers, thus further depressing domestic production (Krueger et al., 1991; Roumasset, 1982; Edirisinghe, 1982). Therefore, consumers' food concerns affect domestic food pricing policies in both developing and industrialized countries.

In terms of indirect utility function, \( v(p_1, p_2, y) \), which is twice differentiable within the feasible region with \( (\partial v / \partial p_i) < 0 \), \( (\partial v / \partial y) > 0 \), and \( (\partial^2 v / \partial y^2) < 0 \), where \( i = 1,2 \):

\[
v = \begin{cases} 
  v(p_1, p_2, y) & \text{if } p_1 < \frac{y}{\hat{q}_1} \\
  v_0 & \text{if } p_1 > \frac{y}{\hat{q}_1}
\end{cases}.
\]
Note that $p_t$ is random and the probability that $p_t > y/\hat{q}_1 \neq 0$. Now, let $f(p_t)$ be the probability density function of $p_t$ (Figure IV.3), with mean $\bar{p}_t$ and variance $\sigma^2_{p_t}$. Then,

$$E[p_t] = \int_0^\infty p_t f(p_t) \, dp_t = \bar{p}_t.$$ 

Therefore, using the above analysis, we can write

$$E[v] = \int_0^{y/\hat{q}_1} v(.) f(p_t) \, dp_t + \int_{y/\hat{q}_1}^\infty v_o f(p_t) \, dp_t$$

or, since $v_o$ is constant,

$$E[v] = \int_0^{y/\hat{q}_1} v(.) f(p_t) \, dp_t + v_o \{ 1 - F(y/\hat{q}_1) \}.$$ 

Note that

$$F\left(\frac{y}{\hat{q}_1}\right) = \int_{y/\hat{q}_1}^\infty f(p_t) \, dp_t = Pr \left[ p_t > \left(\frac{y}{\hat{q}_1}\right) \right].$$

In order to receive the distribution of prices that avoids the risk of consumption shortfalls by completely stabilizing the prices and, thus, eliminating the probability that prices may be

**Figure IV.3: Probability density function**

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40 The probability density function need not be normally distributed. It is assumed so here in order to enhance comprehensibility.
higher than the critical level \( (p_t > \delta_t) \), the consumer is modeled to be willing to pay a fraction \( \tau \) of his income. The fraction would be equivalent to the cash value of benefits to the consumer of the elimination of randomness in prices. Foster and Rausser (1992) point out that the consumer willingness to pay for price stabilization is indicative of the benefits that accrue to them. They contend that "... price-distorting compensation schemes may be nothing more than the cheapest means of securing public interest policies" (p. 3). The distortion in domestic prices stimulates supply which ensures long-term food security to consumers. Foster and Rausser conclude that price-distorting farm programs are useful to consumers because they counter the farmers' opposition to supply-enhancing policy which would, in the absence of a subsidy, lower the returns to farmers.

In the situation where the price of \( q_t \) is completely stabilized at, say, \( \bar{p}_1^* \), the utility function would become

\[
E[\bar{y}] = v(\bar{p}_1^*, p_2, y - b) = \int_0^{\bar{q}_1} v(\cdot) f(p_1) dp_1 + \nu_0 \left[ 1 - F\left( \frac{y}{\bar{q}_1} \right) \right],
\]

which is similar to Newberry and Stiglitz's framework where the consumer is willing to pay some amount \( b \) from the income in order to have the price of \( q_t \) completely stabilized at \( \bar{p} \).

However, the consumer may be interested in a price stabilization policy that eliminates the probability of prices being higher than the critical level. Moreover, the fiscal costs associated with such a policy may be prohibitively high and the only practical approach, therefore, may be to alter the distribution of prices such that the probability of prices being higher than the critical level is reduced (Bigman, 1982). Also, all the consumer may want is to make sure that the probability of \( p_t \) being greater than \( y/\bar{q}_1 \) is eliminated.

This may amount to implementing pricing policies that alter the distribution of \( p_t \) so that the prices don't go higher than \( y/\bar{q}_1 \). It can, then, be assumed that the policy(ies) pursued results in original density function, \( f(p_t) \), being replaced by another probability density function

\[\footnote{Following Newberry and Stiglitz, the actual value of \( p_1^* \) would depend on the type of stabilization policies pursued.}
\[\footnote{Price stabilization may be the outcome of different agricultural policies pursued by the government. For the present purposes, it is suffice to assume a policy that eliminates the probability of the critical region.} \]
$g(p_1)$ where,

$$\int_{y\hat{q}_1}^{y\hat{q}_2} g(p_1) \, dp_1 = 0.$$ 

Thus, the prices are not completely stabilized but made 'less' random in the sense that

$$\Pr \left\{ p_1 > \left( \frac{y}{q_1} \right) \right\} = 0.$$ 

In this case, then, the expression for the indirect utility function becomes

$$E \left[ \tilde{v} \right] = \int_{y\hat{q}_1}^{y\hat{q}_2} \nu(p) \, g(p_1) \, dp_1 + v_o \left[ 1 - G \left( \frac{y}{q_1} \right) \right] = \int_{0}^{y\hat{q}_2} v_o(p_1, p_2, y - b) \, g(p_1) \, dp_1$$

Note that now

$$G \left( \frac{y}{q_1} \right) = \int_{0}^{y\hat{q}_2} g(p_1) \, dp_1 = \Pr \left\{ p_1 \leq \left( \frac{y}{q_1} \right) \right\} = 1.$$ 

Using Taylor series approximation on both sides of the expected utility function,

$$E \left[ \nu(p_1, p_2, y) \right] = \nu \left( \bar{p}_1, p_2, y - b \right).$$

and taking expectations, the following expression is obtained for the cash benefits to the consumers of price stabilization, $b$. Alternatively, the expression of gains that would accrue from partial stabilization of the domestic market is:

$$b = -\frac{1}{2} \left( \frac{\beta_1 y p_1}{p_1^2} \right) \sigma_{p1}^2 - 2 \left( \frac{\sigma_{p1}}{\eta p_1} \right) \rho_{p1,p2} \sigma_{p1} \sigma_{p2} + 2 \left( \rho_{p1,y} \right) \sigma_{p1} \sigma_{y} \left( \bar{p}_1^* - \bar{p}_1 \right)$$

where,

- $\sigma_{p1}^2$ = variance of price of $i^{th}$ commodity, $i=1,2$,
- $\beta_1$ = budget shares of the first good,
- $R_c$ = consumer's relative risk aversion for income variability,
- $\eta$ = income elasticity of demand,
- $\epsilon_{ij}$ = cross price elasticity of the $i^{th}$ commodity with $j^{th}$ price,
- $\sigma_{pi}$ = standard deviation of the price of the $i^{th}$ commodity,
- $\sigma_y$ = standard deviation of income,
- $\rho_{p1,p2}$ = correlation coefficient between the two prices, and
- $\rho_{p1,y}$ = correlation coefficient between the price of $q_1$ and income.

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43 Analogous to food security, a case may also be made here for consumers' social preferences to pay to support farmers because of the perceived virtues of country life.
However, the focus here is on the benefits to consumer of the price stabilization for the staple commodity. Therefore, the cross effects between $q_1$ and $q_2$ can be ignored to obtain manageable expression for $\tau$:

$$ b \equiv \left( \frac{1}{2} \right) \beta_{1} y \left[ \beta_{1} (R_{c} - \eta) - \varepsilon_{11} \right] \sigma_{p_{1}}^{2} / \rho_{p_{1}} - \beta_{1} (R_{c} - \eta) \rho_{p_{1}, p_{1}} / \rho_{p_{1}}. $$

(In the above expression, $\varepsilon_{11}$ is assumed to be positive.) Using the implicit function theorem, the consumer benefits can be expressed in terms of price and income elasticities of demand, Arrow-Pratt's coefficient of relative risk aversion, Engel coefficients, and the income of the consumer. Ignoring the subscripts, then,

$$ b^* = \tau \{ \beta, \varepsilon, R_{c}, y, \eta, \omega \} $$

where, $\omega$ is a vector of other exogenous variables. These are the parameters changes in which would have substantial impact on the determination of domestic protectionistic policies. The proportion of expenditure on food, represented by $\beta$, tends to vary significantly across industrialized and developing countries. In poor countries, about half of the consumption expenditure is spent on food whereas in industrialized countries, this share is less than what is spent on manufactured items.

The stabilization policies are observed in both developing and industrialized countries due to the risk preferences of economic agents (Tyers and Anderson). Many studies have calculated the coefficient of relative risk aversion, $R_c$. Its values have been estimated to vary with income and with the size of risks in relation to income, from zero for risk neutral agents to two for sizable risk. Income and price elasticities of demand also vary significantly across rich and poor countries and may have important bearing on domestic farm policies. The econometric significance of these variables in the determination of agricultural protection is tested in the next chapter.

Moreover, there are also significant differences in consumer incomes across industrialized and developing countries. Also, the minimum requirements of the staple food

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Moreover, the dependent variable used in the analysis, the producer subsidy equivalent, assumes that no substitution possibilities exist in consumption and production among commodities. This implies that these calculations ignore the cross-commodity effects. To keep the empirical analysis consistent, it would be useful to ignore such effects in the theoretical model as well. Some other authors also adopted similar assumptions about the cross-commodity effects (see, for example, Tyers and Anderson, 1992, p. 413).
commodity may differ due to demographic and dietary patterns. The differences in the level of all these variables would then imply that there may exist a range of the critical prices \( \left( \frac{y}{q_1} \right) \) across countries, as shown in Figure IV.4.

In this figure, \( \left( \frac{y}{q_1} \right) \) may represent the critical price range in the case of the representative consumer in industrialized (rich) countries whereas \( \left( \frac{y}{q_1} \right)_2 \) indicates the same for the representative consumer with low income in developing countries.\(^{45}\) The consumer in a developing country would prefer to have the lower distribution of stabilized prices, \( l(p_j) \), because of the constraints imposed by the variables identified above. The consumer in an industrialized country may be willing to settle for the higher distribution, \( h(p_j) \). This may in part explain the difference in prices across countries.\(^{46}\)

Given the above analysis of consumer behavior across industrialized and developing countries, it may be possible to infer the signs on the coefficients associated with these variables with respect to the level of benefits accruing to the consumers. Due to the complexity of deriving comparative static results directly from the structural equation, some

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\(^{41}\) The above analysis and its results may easily be generalized to more aggregate levels representing the consumers in a given country, without loss of generality.

\(^{46}\) An extension of the analysis may be to look at the cross-sectional differences among families regarding their age, number of children, opportunity cost of work, political participation and incomes, within a given country.
plausible assumptions about the signs of the partial derivatives can be made. As the share of 
food in household expenditures, $\beta$, increases, the per capita benefits of price stabilization 
would also increase. A casual observation of the cross-country food consumption patterns 
also reveals that the consumers' stake in low prices increases as their spending on food items 
increases. Countries with very high Engel coefficients tend to subsidize consumption to 
ensure short-term food security. In the industrialized countries, however, the relatively low 
Engel coefficients enable consumers to support domestic production through higher prices 
and thus ensure long-term stability of food supplies. This result is also supported by 
Balisacan and Roumasset who conclude that the share of food in household budget of 
consumers is the main determinant of protection levels. Moreover, as the per capita income, 
$y$, grows, budget share for food expenditures falls. Consequently, the consumers' welfare 
becomes less sensitive to changes in prices of food.

The poor consumers in developing countries may be expected to be more risk-averse 
as compared to their counterparts in the industrialized countries. This view is also shared by 
Tyers and Anderson in their model where they assign a value of $R_c=2$ to the consumers in 
developing countries and $R_c = 1$ in industrialized countries. For more risk-averse consumers, 
then, the stability in prices would be more beneficial than it would be to the less risk-averse. 
Similarly, higher income elasticity ($\eta$) and price elasticity ($\varepsilon$) of demand will increase 
marginal gains to consumer from reduction in consumer prices. This result is also supported 

This section, therefore, proposes an alternative hypothesis which suggests that 
agricultural taxes and subsidies are part of a larger portfolio of policies than analyzed in the 
literature on political competition among groups. An attempt is made to explicitly explain 
the viewpoint expressed by Gardner and Foster and Rausser. It is shown that the consumers' 
food security concern may, in part, explain the divergent patterns of agricultural protection 
across industrialized and developed countries. This alternative hypothesis is also analyzed 
empirically in the next chapter where consumer characteristics of the commodity have been 
explicitly incorporated into the analysis. However, it may be noted that the source of farm
subsidies to producers (consumers) are invariably the consumers and taxpayers (producers). Hence, in the short-run, their interests can run counter to the immediate benefits accruing to each other. Therefore, if these variables are viewed against producer protection levels, the opposite signs would be expected in the above relationships.

IV.3 Producer Model

In this section, a behavioral model of agricultural producers is developed following the CHG approach in the PEAP literature. Farm groups generally find it easier to organize than consumers since they are more homogeneous and less vulnerable to free-rider effect (Moyer and Josling, 1990). Producers with a common interest, therefore, combine together to form an organization to protect their interests. The activities of farmers towards this common purpose are modeled below to influence the outcome of farm policies.

The political power of the producer group depends upon the attributes such as their membership size, their efficiency at overcoming the free-rider problem and their incomes. The investment in political influence by farmers for the purpose of securing protection ($k$), their relative group size ($n$) and the level income ($w$), have been modeled explicitly into the traditional theory of profit maximizing firms. An important element of this framework is the resource contribution in generating political pressure which is, in part, constrained by the level of their incomes. The investment in political resource contribution may be in the form of time, money and political support. Therefore, the demand for protection from farmers represents, at the margin, the preparedness of the group in seeking a policy change to offer political leaders various forms of political support (Anderson and Tyers, 1989, p. 179).

The quantity ($q$) and market price with government intervention ($p$) in the model refer to a staple food commodity (for example, wheat). A well behaved cost function $c(q)$ is assumed which is continuous, and twice differentiable. Assuming a profit function ($\pi$) that

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47 An earlier version of this model has been published in the Quarterly Journal of International Agriculture, 30 (4): 297-310.

48 The model assumes that producers maximize their profits without taking into account the demand for agricultural protection coming from consumers. This is commonly referred to as the Nash-Cournot behavior in the public choice literature. In case where only one group spends resources in political lobbying, the interaction term regarding the effects of level of expenditures of one group on that of the other can be ignored.

49 Note that since only one output commodity is considered, therefore, $q$ here corresponds to the $q_i$ in the consumer model.
satisfies continuity, twice differentiability, and convexity (in prices) properties, the $i^{th}$ farmer's maximization problem, with the introduction of his contribution for lobbying, is modeled as follows:

$$\pi_i = p q_i - c(q_i) - k_i \quad i = 1, \ldots, n.$$  \hspace{1cm} (1)

Given the profit maximizing objective, any individual farmer can choose how much to produce and how much to contribute towards lobbying. If the individual contribution towards lobbying is zero, this problem reduces to the familiar profit maximization case. The price of the output is hypothesized to be influenced by the farmers' lobbying activity in the following manner:

$$p = \bar{p} + \tau \chi,$$ \hspace{1cm} (2)

where, $\bar{p}$ is the mean of free-market price without intervention (which may also be the world price mean), $\tau > 0$ is the increase in price (subsidy) due to lobbying and $\tau < 0$ implies taxation of producers.\(^{50}\) The amount of political support supplied in response to a given expenditure of time and resources by the group, $k = \sum_{i=1}^{n} k_i$, depends upon a number of characteristics of the group. These may include factors such as $n$, $w$, and other exogenous variables (agricultural productivity, for example) captured by $\theta$.

The amount of political support received by the group is shown in the literature to be positively related to the level of contribution. Miller (1991) argues that a group's political expenditures would be positively related to the marginal benefits received. Peltzman (1976) contends that the probability of support by beneficiaries would rise with per capita marginal benefits received by the group but at a decreasing rate. The greater the increase in producers' benefit, the more political contribution, $k$, they would be willing to make to the regulators. The political contributions in the model are net of organizational costs incurred by the group. The relationship between the size of the group and its political influence has been explored by Olson, Becker and Peltzman, among others. Increase in the number of farmers,
\( n \), has two offsetting effects. An increase in \( n \) would increase the total contributions. On the other hand, it would also accentuate the free-rider problem and would reduce the per capita gains associated with any given wealth transfer. Moreover, the costs of organization would probably rise with the size of the group. In large groups, a greater proportion of political contributions must be devoted to the administrative matters and enforcing participation by group members. This, in turn, would reduce the amount available for political lobbying. According to Olson, as the number of farmers decreases, it becomes easier for them to organize political lobbying, increasing their effective demand for protection. Therefore, it can be assumed that as the number of farmers increases relative to number of non-farmers, the subsidies provided to the group decreases.

Another pattern of the political economy of agricultural protection across countries is that protection afforded to farmers is positively correlated with average per capita incomes (Anderson and Hayami; Bale and Lutz; Binswanger and Scandizzo; de Gorter and Tsur). It is assumed, therefore, that as the income of the group increases, the resource contributions may rise, thereby increasing the effective demand for protection. The analysis here does not consider the altruistic or egalitarian motives as a reason for the redistribution of income from consumers to farmers following the structural adjustments in a growing economy as contended by Honma and Hayami (1986a and 1986b) and de Gorter and Tsur (1991). That the farm programs are instituted to benefit the poor farmers is contested by Tyers and Anderson (1992): "[T]he claim that agricultural protection and food prices are needed in industrial countries to transfer income to poor farmers looks hollow when the majority of such transfers from consumers goes to the wealthiest 20 percent or so of the farmers" (p. 81). Therefore, the political power of the group is instead hypothesized here to be positively associated with its income. The higher the marketable surplus of the farmers, the higher their stake in seeking political intervention, and the more would be the contribution towards lobbying.

Based on the above discussion, the farmer's profit function can be rewritten as
Max \( \pi_i = [p + \tau (k,w,n,\theta)] q_i - c(q_i) - k_i \)  \hspace{1cm} (3)

The optimality conditions for output and resource contribution are given by the first order conditions for (3):

\[ q_i : \frac{\partial \pi_i}{\partial q_i} = p + \tau (k,w,n,\theta) - c'(q_i) = 0 \]  \hspace{1cm} (4)

\[ k_i : \frac{\partial \pi_i}{\partial k_i} = q_i \left\{ (\frac{dx}{dk}) \cdot (\frac{dk}{dk}) \right\}^{-1} + 1 = 0 \]  \hspace{1cm} (5)

or

\[ q_i (\frac{dx}{dk}) = 1 \]  \hspace{1cm} (6)

The equation (4) represents the trivial profit maximization condition that the optimal output level is given by the equality between the output price and the marginal cost. The equation (6) states that the total increase in the value of output from lobbying should equal one. Note that \((\frac{\partial \tau}{\partial k})\) represents per unit increase in price (subsidy) due to the last dollar spent on political activity. Therefore, alternatively, the condition implies that producers spent on lobbying as long as the last dollar spent brings about an increase in income of one dollar. Olson's framework, however, evaluates only the cost to different groups in seeking political protection and does not evaluate potential benefits. In the above framework, benefits to producers are explicitly incorporated since condition (6) reflects increased marginal gains with respect to a unit increase in price.

Since imposing symmetry implies that \((\frac{\partial^2 \pi}{\partial q_i \partial q_j}) = (\frac{\partial^2 \pi}{\partial q_j \partial q_i})\), hence, by the second order conditions, the Hessian can be written as

\[
\begin{bmatrix}
\pi_{i,q_i,q_j} & \pi_{i,q_i,k_j} \\
\pi_{i,q_j,k_i} & \pi_{i,k_i,k_j}
\end{bmatrix} =
\begin{bmatrix}
-c''(q_i) & (\frac{\partial \tau}{\partial k}) \\
(\frac{\partial \tau}{\partial k}) & q_i (\frac{\partial^2 \tau}{\partial k^2})
\end{bmatrix}
\]  \hspace{1cm} (7)

The profit maximizing conditions would imply that the Hessian is negative definite (sufficient condition) which would imply the following:

\[-c''(q_i) < 0 \text{ which implies } c''(q_i) > 0,\]

\[q_i (\frac{\partial^2 \tau}{\partial k^2}) < 0 \text{ which implies } \frac{\partial^2 \tau}{\partial k^2} < 0,\]

and that \(-c''(q_i) q_i (\frac{\partial^2 \tau}{\partial k^2}) - (\frac{\partial \tau}{\partial k})^2 > 0.\)  \hspace{1cm} (8)
The producers' maximization problem gives the following expressions for the optimal output and contribution decisions upon invoking the implicit function theorem:

$$q_i^* = q_i(p, w, n, \theta),$$
$$k_i^* = k_i(p, w, n, \theta).$$

Thus, the output produced and resources contributed by farmers in a country would depend on, among other things, the mean of the free-market price, and the income and number of farmers. The indirect profit function, therefore, using the implicit function theorem, would yield the expression, $$\pi^* = \pi(p, w, n, \theta).$$ Comparative statics analysis is used next to determine the resultant expressions for the choice variables $$q_i$$ and $$k_i$$.

Propositions (1) through (6) below analyze the effects changes in parameters on key policy issues.

**Proposition 1:** \( dq_i / dw > 0 \) provided \( \partial^2 \tau / \partial k \partial w > 0 \), i.e., an increase in income will result in more output forthcoming from the producers.

The proof of proposition 1 can be established by first presenting the total differentiation of (4) and (6), with respect to the income (w), in the following form:

$$\begin{bmatrix}
-c''(q_i) & \partial \tau / \partial k \\
\partial \tau / \partial k & q_i (\partial^2 \tau / \partial k^2)
\end{bmatrix}
\begin{bmatrix}
dq \\
dk_i
\end{bmatrix}
= \begin{bmatrix}
-(\partial \tau / \partial w) dw \\
-q_i (\partial^2 \tau / \partial k \partial w) dw
\end{bmatrix}$$

By the implicit function theorem and using Cramer's rule, the effect of income on output can be represented as:

$$dq_i / dw = \frac{-(\partial \tau / \partial w) q_i (\partial^2 \tau / \partial k^2) + (\partial \tau / \partial k) q_i (\partial^2 \tau / \partial k \partial w)}{-c''(q_i) q_i (\partial^2 \tau / \partial k^2) - (\partial \tau / \partial k)^2}$$

which is positive if \( \partial^2 \tau / \partial k \partial w > 0 \). Thus, as the income of the farming group increases, the farm output also increases.
Proposition 2: An increase in the income will result in more resource contribution forthcoming from the producers i.e., $dk/dw > 0$.

Using (9) and Cramer's rule, the proof of direct relationship between income and resource contribution can be derived as:

\[
dk/dw = \frac{c''(q_i) q_i \left( \partial^2 \tau / \partial k \partial w \right) + \left( \partial \tau / \partial k \right) \left( \partial \tau / \partial w \right)}{-c''(q_i) q_i \left( \partial^2 \tau / \partial k^2 \right) - \left( \partial \tau / \partial k \right)^2} > 0\]  
(11)

The implication of (11) is that the individual contribution moves in the same direction as that of the income. This suggests that the overall contribution will be more in the industrialized countries as compared to the developing countries and, therefore, may result in higher subsidies to producers.

Proposition 3: An increase in the mean of market price in the absence of intervention will result in more output forthcoming from the producers i.e., $dq/dp > 0$.

The proof involves the following expression derived from totally differentiating (4) and (6) with respect to the mean of the price:

\[
\begin{bmatrix}
\pi_{i, q_i q_i} & \pi_{i, q_i k_i} \\
\pi_{i, k_i q_i} & \pi_{i, k_i k_i}
\end{bmatrix}
\begin{bmatrix}
dq_i \\
dk_i
\end{bmatrix}
= 
\begin{bmatrix}
-q_{i, q_i \bar{p}} \, d\bar{p} \\
-q_{i, k_i \bar{p}} \, d\bar{p}
\end{bmatrix}
\]  
(12)

where, $\pi_{i, q_i \bar{p}} = 1$, and $\pi_{i, k_i \bar{p}} = 0$.

Using (12) and Cramer's rule, the change in output due to change in $\bar{p}$ can be derived as:

\[
dq/d\bar{p} = \frac{-q_i \left( \partial^2 \tau / \partial k^2 \right)}{-c''(q_i) q_i \left( \partial^2 \tau / \partial k^2 \right) - \left( \partial \tau / \partial k \right)^2} > 0.\]  
(13)

Proposition 4: An increase in the mean of market price in the absence of intervention will result in more resource contributions forthcoming from producers i.e., $dk/d\bar{p} > 0$. 

Likewise as above, using (12) and Cramer's rule, the effect of change in the mean of price on contribution can be summarized as:

\[
\frac{dk}{dp} = \frac{\frac{\partial \tau}{\partial k}}{-c''(q) q_i \frac{\partial^2 \tau}{\partial k^2} - (\frac{\partial \tau}{\partial k})^2} > 0. \tag{14}
\]

The connotation of (14) is that as the mean of the free-market price rises, the individual firm's contribution also rises. As \(\bar{p}\) goes up, the producer surplus also goes up, which increases the willingness of the producers to increase their contribution for lobbying. This is noticeable in case of industrialized countries where higher producer surplus results in increased contribution towards lobbying efforts.

**Proposition 5**: (a) \(dq/dn > 0\) provided \((\partial^2 \tau / \partial k \partial n) > 0\) and (b) \(dq/dn < 0\) provided \((\partial^2 \tau / \partial k \partial n) < 0\) i.e. an increase in the lobbying group size may have either effect on the output forthcoming from the producers.

Proposition 5 can be trivially proved by the following result of total differentiation of (4) and (6) and using \(\pi_{i,quin} = \partial \tau / \partial n\), and \(\pi_{i,kin} = q_i (\partial^2 \tau / \partial k \partial n)\),

\[
dq/dn = \frac{-(\partial \tau / \partial n) q_i (\partial^2 \tau / \partial k^2) + (\partial \tau / \partial k) q_i (\partial^2 \tau / \partial k \partial n)}{-c''(q) q_i (\partial^2 \tau / \partial k^2) - (\partial \tau / \partial k)^2}, \tag{15}
\]

which is positive if \((\partial^2 \tau / \partial k \partial n) > 0\), and negative otherwise. There is a tradeoff between the group size and contribution in their effect on the level of subsidy obtained. As the number of farmers increases, the subsidy provided to the farmers falls as discussed above. On the other hand, an increase in contribution towards lobbying may increase the effective demand for political intervention, resulting in higher subsidies. If this interaction results in positive subsidies, then the increase in the number of farmers would increase the output. Therefore, the effect of the group size and contribution on the subsidies provided decides the relationship between the number of farmers and the output forthcoming from them.
Proposition 6: (a) $\frac{dk}{dn} > 0$ provided $(\frac{\partial^2 \tau}{\partial k \partial n}) > 0$ and (b) $\frac{dk}{dn} < 0$ provided $(\frac{\partial^2 \tau}{\partial k \partial n}) > 0$ i.e., an increase in the size of the lobbying group may have either effect on the resource contributions forthcoming from the producers.

Equation (15) and Cramer's rule yield the following result:

$$\frac{dk}{dn} = \frac{c''(q) q_i (\frac{\partial^2 \tau}{\partial k \partial n}) + (\frac{\partial \tau}{\partial k}) (\frac{\partial \tau}{\partial n})}{-c''(q) q_i (\frac{\partial^2 \tau}{\partial k^2}) - (\frac{\partial \tau}{\partial k})^2},$$  \hspace{1cm} (16)

which is positive if $(\frac{\partial \tau}{\partial n})$, $(\frac{\partial^2 \tau}{\partial k \partial n}) > 0$, and negative otherwise. The implication is that the effect of $n$ on the contribution also depends on the effect of the trade-off between $k$ and $n$ on $\tau$. Therefore, if the resultant effect increases the subsidies provided, then the number of farmers would be positively related to the amount of contribution forthcoming from them.

The model presented above points out that the number of farmers, their incomes, the mean of free-market prices and productivity are some of the important factors impacting the political resource contributions. These factors, therefore, influence the effective demand for protection coming from agricultural producers. Since there is significant variation among the number of farmers, their incomes and productivity across industrialized and developing countries, the demand for protection would also vary across these countries. The empirical test of the comparative static analysis would suggest whether the self-interest is the primary motivational force that explains preferences across industrialized and developing countries. The politician's optimization problem, taking into account both consumers' and producers' interests is discussed next.

IV.4 Politician Model

The factors affecting the demand for agricultural protection from consumers and producers can, at best, provide only a partial explanation of the prevalent government intervention. Therefore, the supply of government intervention from the politicians also merits examination. On the supply side of the political market, or what many would refer to
as the political side, one of the most significant conceptual framework has been developed by Downs (1957). In Downs' conceptualization of political market supply, politicians pursue policies so as to maximize their chances of remaining in office. Individuals and groups who expect to gain from a particular policy seek its adoption by investing in lobbying and propaganda to the point where they perceive the expected net benefits from further expenditures to be zero. In essence, Downs' framework determines the supply by evaluating the costs and benefits to the government at the margin of any particular policy decision.

In a case of distortionary policy, the supply curve represents the marginal political cost of providing an extra unit of protection. The demand curve represents, at the margin, the preparedness of groups seeking a policy change to offer political leaders various forms of political support. The prevalent levels of agricultural protection across industrialized and developing countries indicate that the patterns on the supply side of the political market vary across countries. The factors and relationships that determine the degrees of subsidies or taxation to any group would depend upon the compatibility or conflict between the interests of these two groups, the bureaucratic capacity, and the government's treasury position.

The cost of providing protection would also depend upon amount of production (consumption) if producers (consumers) are subsidized since protection may also be provided on per unit basis (USDA, 1990; OECD, 1991). Other factors such as dead-weight loss associated with the transfers also affect the costs of any policy (Gardner, 1987). The politician's model that follows incorporates these features. The policy maker chooses the level of policy instrument so as to maximize an objective function defined over producers' and consumers' objective functions and the budgetary position of the treasury. The conceptual framework in this model follows from the premise that the government forms preference over the welfare of consumers and producers. The theoretical model developed here is an extension of the one proposed by Riethmuller and Roe (1986) and later modified by Lopez (1989).

Government is assumed to choose the level of policy instrument, \( \tau \) (subsidy if positive or tax otherwise), so as to maximize an objective function defined over the indirect
utility function of consumers, the indirect profit function of producers and the cost of the policy. A government/politician's optimization problem is defined as:

$$\text{Max } U = U(v^*, \pi^*, m)$$

where, $U$ is the politician's utility function for the staple food policy-making assumed to be separable, additive and strictly concave in its arguments; $v^*$ is the indirect utility function obtained from the consumer model above; and $\pi^*$ is the producer's indirect profit function from the producer's choice problem. The vector of costs associated with the policy, $m$, may include variables associated with the government's budgetary position. It is further assumed that the politician's preferences in the staple commodity policy are separable from other concerns. The first-order condition for utility maximization is given by

$$\frac{\partial U}{\partial \tau} = \frac{\partial U}{\partial v^*} \frac{\partial v^*}{\partial \tau} + \frac{\partial U}{\partial \pi^*} \frac{\partial \pi^*}{\partial \tau} + \frac{\partial U}{\partial m} \frac{\partial m}{\partial \tau} = 0.$$ 

The right hand side of this equation describes the effects of the policy on the consumer's utility, producer's profits and the cost of the policy, respectively. The condition shows that the politician chooses the level of the policy instrument, $\tau^*$, such that marginal benefits from the policy equal the marginal cost. To illustrate the effect on domestic consumers and producers assume that the cost of the policy, $m$, is constant. Then, the above equation implies that

$$\left. \frac{-\partial U/\partial v^*}{\partial U/\partial \pi^*} \right|_{m=\text{const.}} = \frac{\partial \pi^*/\partial \tau}{\partial v^*/\partial \tau}.$$ 

In other words, the politician will set the policy instrument level where the marginal rate of substitution of consumer's interests for producer's interests is equal to the trade-off between the producer's and consumer's interests due to change in the policy instrument.

Using the implicit function theorem, the politician's choice variable can be stated as a function of exogenous variables:

$$\tau^* = \tau(\beta, R, \eta, \epsilon, \gamma, p, w, n, \theta, m, \Psi).$$
The hypothesis is that the politician chooses the instrument $x^*$ taking into account the variables associated with both consumers' and producers' interests and the cost of the policy. Here, $\beta$, $R_c$, $\epsilon$, $\eta$ and $\gamma$ represent the consumer's budget share of the commodity, relative risk aversion, the price and income elasticities of demand, and income, respectively, as derived from the consumer model. The variables $p$, $w$, $n$ and $\theta$ are the exogenous variables derived earlier from the producer model depicting the free-market price of the commodity, the income and numbers of producers, and other variables, respectively. Finally, $\Psi$ reflects the vector of other exogenous variables.

If the politician's preferences are formed only over the producer's interests, the above expression for the optimal policy instrument reduces to:

$$x^* = \tau (p, w, n, \theta, \Omega),$$

where $\Omega$ includes other exogenous variables from producers' model as well as the factors affecting costs of the policy. On the other hand, if the politician's preferences are defined over the consumer's interests only, the following result is obtained:

$$x^* = \tau (\beta, R_c, \eta, \epsilon, y, \Gamma).$$

where, the $\Gamma$ vector represents the residual exogenous variables associated with the costs and consumer's optimization.

In conclusion, the theoretical models developed above explain the process of choice of intervention policy adopted highlighting the fact that the choice of policy instrument depends on the interests of both consumers and producers. Since these variables differ significantly across industrialized and developing countries, therefore, the choice of the optimum policy $x^*$ would also differ significantly across these countries. In the next chapter, these reduced form equations will be subjected to empirical testing using cross-country data from industrialized and developing countries.
CHAPTER V
EMPIRICAL ANALYSIS

In this chapter, the comparative static results of the theoretical models are subjected to empirical verification. A number of alternative estimation techniques and model specifications have been used to analyze the cross-country determinants of agricultural protection. The analysis is performed with a view to include the largest possible sample of countries for which the data on the dependent variable are available. In order to have a balanced data set compatible with the software, the period over which the analysis could be performed was restricted to the years 1982-87.

The determinants of farm policies identified in the consumer and producer models are tested for complementarity as well as for relative superiority. Of special interest is the consumers' food security issue. An attempt is therefore made to analyze these concerns and their significance in explaining the protection levels across industrialized and developing countries. The analysis is analogous to testing the validity of the SWG approach discussed previously. The variables explaining significant variation in the protection levels are also analyzed in terms of their impact on the probability of domestic agricultural producers being subsidized. Each section in this chapter is supported by a brief explanation of the procedures involved in the estimation.

The next section describes sources and approximation of dependent and independent variables included in the study. The section also highlights some issues involved in pooled cross-section time-series estimation. Some prominent determinants of international agricultural protection have been identified in Section V.2. The results are provided along interest-group. The relationship between the economic development of a country and the level of farm subsidies are also analyzed in a dynamic framework. Empirical specification and test results of pair-wise non-nested $J$ tests for the superiority hypothesis are provided in

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52 The data on producer subsidy equivalents for wheat are available up to 1991 for 11 industrialized countries. However, similar data were not available for all sample developing countries beyond the year 1987. The econometric software package -- SHAZAM -- that was used throughout the analysis requires that the pooled cross-section time-series data set should not be unbalanced, hence limiting the time period.
Section V.3. Section V.4 outlines the empirical models and provides the results of the nested tests for the complementarity hypothesis. Probit estimation technique is employed in the final section.

V.1 Data and Estimation Techniques

This section provides the sources and definitions of the variables used in the empirical analysis. The ordinary least squares (OLS) and pooled cross-section time-series estimation techniques are used for analyzing the cross-country agricultural protection levels. Some issues involved in the pooled estimation, such as the problems of heteroscedasticity and autocorrelation, are also addressed. In addition, the common problem of simultaneity in the quantitative studies on agricultural protection is also analyzed.

V.1.1 Data and Scope of the Study

The dependent variable in the empirical analysis -- the level of government intervention in the wheat sector -- has been approximated by the Producer Subsidy Equivalents (PSE). The data on subsidy equivalents have been collected from two sources, the United States Department of Agriculture (USDA) and the Organization for Economic Co-operation and Development (OECD), as discussed in Chapter III. The USDA (1988), *Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-86* provides the PSE data for 17 countries covering the period 1982-86. A much broader sample of countries and commodities is available in USDA (1990: *Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-87*). Moreover, data for some additional developing countries were also obtained through personal communications with USDA officials. The OECD data are for eleven industrialized countries, including the European Community, for the years 1979 to 1990.

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53 It may be noted that since the PSE estimates incorporate a wide range of policies and since the present analysis is commodity-specific covering a short period of time, the problem of resultant bias in comparison of these estimates over time and across countries has been substantially reduced.

54 The data for Algeria, Colombia, Morocco and Zimbabwe were obtained from Dr. Karl Mabbs-Zeno. His help in this regard is duly acknowledged.
The two sources provide overlapping data for 11 industrialized countries. In that case, the OECD data are selected. In addition, the PSE figures for these countries for the year 1991 (used in Chapter III) are collected from *Agricultural Policies, Markets and Trade: Monitoring and Outlook, 1992*.

The analysis is performed across 30 industrialized and developing countries or group of countries: Algeria, Argentina, Australia, Austria, Bangladesh, Brazil, Canada, Chile, China, Colombia, the European Community (Belgium, Denmark, France, West Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, and United Kingdom and, after 1986, Portugal and Spain) Egypt, Finland, India, Japan, Mexico, Morocco, Nigeria, New Zealand, Norway, Pakistan, Poland, South Africa, South Korea, Sweden, Switzerland, Turkey, United States, Yugoslavia and Zimbabwe. The results have been reported separately for all countries as well as for industrialized countries in case of the producer model.

A large number of explanatory variables are used in the trial tests and their acronyms, units of measurement, and sources are given in Table V.1. The figures available in domestic currency units were translated into a common currency (the U.S. dollar) using the exchange rates listed in the *International Financial Statistics*.55 The data on national income statistics have been taken from two sources: the *International Financial Statistics*; and the *World Development Report*. The data from both sources have been used interchangingly in the models.

The data on income and price elasticities of demand for wheat as well as the price elasticity of supply are taken from Tyers and Anderson (1992). The income elasticity of demand for "food" is computed by averaging the data on income elasticities of demand with respect to six primary food commodities -- Rice, Wheat, Sugar, Dairy Products, Ruminant and Non-Ruminant meats -- available in the same source.

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55 It may be noted that when comparing a statistical series for variables expressed in value terms, the use of one currency unit rather than the other may alter the apparent trend.
Table V.1: Definitions, units and sources of explanatory variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Acronym</th>
<th>Units1</th>
<th>Source2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange Rate</td>
<td>EXRATE</td>
<td>Domestic Currency per U.S. $</td>
<td>IFS</td>
</tr>
<tr>
<td>Consumer Price Index</td>
<td>INXCP</td>
<td>1985=100</td>
<td>IFS</td>
</tr>
<tr>
<td>Wholesale Price Index</td>
<td>INXWSP</td>
<td>1985=100</td>
<td>IFS</td>
</tr>
<tr>
<td>Total Exports</td>
<td>EXPORTS</td>
<td>Domestic Currency (Millions)</td>
<td>IFS</td>
</tr>
<tr>
<td>Total Imports</td>
<td>IMPORTS</td>
<td>Domestic Currency (Millions)</td>
<td>IFS</td>
</tr>
<tr>
<td>Trade Balance</td>
<td>TRADBAL</td>
<td>U.S. $ (Millions)</td>
<td>IFS</td>
</tr>
<tr>
<td>Merchandise Exports f.o.b.</td>
<td>MEXPORTS</td>
<td>U.S. $ (Millions)</td>
<td>IFS</td>
</tr>
<tr>
<td>Government Finance</td>
<td>GOVTFIN</td>
<td>Domestic Currency (Millions)</td>
<td>IFS</td>
</tr>
<tr>
<td>Exports of Goods and Services</td>
<td>EXPORTGS</td>
<td>Domestic Currency (millions)</td>
<td>IFS</td>
</tr>
<tr>
<td>Private Consumption</td>
<td>PRIVCONS</td>
<td>Domestic Currency (Millions)</td>
<td>IFS</td>
</tr>
<tr>
<td>Gross Domestic Product</td>
<td>GDP</td>
<td>Domestic Currency (Millions)</td>
<td>IFS</td>
</tr>
<tr>
<td>Gross Domestic Product at 1985 Prices</td>
<td>GDP85</td>
<td>Domestic Currency (Millions)</td>
<td>IFS</td>
</tr>
<tr>
<td>Gross National Product</td>
<td>GNP</td>
<td>Domestic Currency (Millions)</td>
<td>IFS</td>
</tr>
<tr>
<td>Population</td>
<td>POPN</td>
<td>Millions</td>
<td>IFS and WDR</td>
</tr>
<tr>
<td>Gross National Product per Capita</td>
<td>GNPC</td>
<td>U.S. $</td>
<td>WDR</td>
</tr>
<tr>
<td>Gross Domestic Product per Capita</td>
<td>GDPC</td>
<td>U.S. $</td>
<td>Computed</td>
</tr>
<tr>
<td>Value Added in Agriculture</td>
<td>VADAG</td>
<td>U.S. $ (Millions)</td>
<td>WDR</td>
</tr>
<tr>
<td>Value Added in Manufacturing</td>
<td>VADMN</td>
<td>U.S. $ (Millions)</td>
<td>WDR</td>
</tr>
<tr>
<td>Share of Agriculture in GDP</td>
<td>GDPAG</td>
<td>%</td>
<td>WDR</td>
</tr>
<tr>
<td>Share of Industry in GDP</td>
<td>GDPIN</td>
<td>%</td>
<td>WDR</td>
</tr>
<tr>
<td>Share of Agriculture in GDP Relative to Industry</td>
<td>GDPAGIN</td>
<td>GDPAG/GDPIN</td>
<td>Computed</td>
</tr>
<tr>
<td>Share of Manufacturing in GDP</td>
<td>GDPMN</td>
<td>%</td>
<td>WDR</td>
</tr>
<tr>
<td>Share of Services in GDP</td>
<td>GDPSRV</td>
<td>%</td>
<td>WDR</td>
</tr>
<tr>
<td>Working Population</td>
<td>POPWK</td>
<td>%</td>
<td>WDR</td>
</tr>
<tr>
<td>Share of Agriculture in Labor Force</td>
<td>LFAG</td>
<td>%</td>
<td>WDR</td>
</tr>
<tr>
<td>Number of Farm Workers</td>
<td>LFAGN</td>
<td>Millions</td>
<td>Computed</td>
</tr>
<tr>
<td>Growth Rate of Agricultural Labor Force</td>
<td>GRLFAG</td>
<td>%</td>
<td>Computed</td>
</tr>
<tr>
<td>Share of Industry in Labor Force</td>
<td>LFIND</td>
<td>%</td>
<td>WDR</td>
</tr>
<tr>
<td>Growth Rate of Industrial Labor Force</td>
<td>GRLFIND</td>
<td>%</td>
<td>Computed</td>
</tr>
<tr>
<td>Share of Agriculture in Labor Force Relative to Industry</td>
<td>LFAGIND</td>
<td>LFAG/LFIND</td>
<td>Computed</td>
</tr>
<tr>
<td>Share of Food in Household Consumption Expenditure</td>
<td>ENGEL</td>
<td>%</td>
<td>WDR</td>
</tr>
</tbody>
</table>
Table V.1: (contd.)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Acronym</th>
<th>Units¹</th>
<th>Source²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Cereals in Household Consumption Expenditure</td>
<td>CEREALS %</td>
<td></td>
<td>WDR</td>
</tr>
<tr>
<td>Total Calorie Intake per Capita per Day</td>
<td>CALORIE Calories</td>
<td></td>
<td>FAO-1</td>
</tr>
<tr>
<td>Total Protein Intake per Capita per Day</td>
<td>PROTEIN Amount</td>
<td></td>
<td>FAO-1</td>
</tr>
<tr>
<td>Protein Intake From Meat</td>
<td>PROTMEAT %</td>
<td></td>
<td>FAO-1</td>
</tr>
<tr>
<td>Calorie Intake from Wheat</td>
<td>CALORIEW Calories</td>
<td></td>
<td>FAO-1</td>
</tr>
<tr>
<td>Share of Wheat in Total Calorie Intake</td>
<td>CALWHT %</td>
<td></td>
<td>Computed</td>
</tr>
<tr>
<td>Total Arable Land Area</td>
<td>AREA 1000 Hectares</td>
<td></td>
<td>FAO-2</td>
</tr>
<tr>
<td>Area Under Wheat</td>
<td>AREAWHT 1000 Hectares</td>
<td></td>
<td>FAO-2</td>
</tr>
<tr>
<td>Share of Wheat in Total Area Cultivated</td>
<td>AREAWPER %</td>
<td></td>
<td>Computed</td>
</tr>
<tr>
<td>Wheat Production</td>
<td>PRODNW 1000 Metric Tons</td>
<td></td>
<td>PS&amp;D View</td>
</tr>
<tr>
<td>Lagged Wheat Production</td>
<td>PRODNWL 1000 Metric Tons</td>
<td></td>
<td>Computed</td>
</tr>
<tr>
<td>Wheat Consumption</td>
<td>CONSNW 1000 Metric Tons</td>
<td></td>
<td>PS&amp;D View</td>
</tr>
<tr>
<td>Lagged Wheat Consumption</td>
<td>CONSNWL 1000 Metric Tons</td>
<td></td>
<td>Computed</td>
</tr>
<tr>
<td>Imports of Wheat</td>
<td>IMPORTW 1000 Metric Tons</td>
<td></td>
<td>PS&amp;D View</td>
</tr>
<tr>
<td>Exports of Wheat</td>
<td>EXPORTW 1000 Metric Tons</td>
<td></td>
<td>PS&amp;D View</td>
</tr>
<tr>
<td>Ending Stocks of Wheat</td>
<td>STOCKSW 1000 Metric Tons</td>
<td></td>
<td>PS&amp;D View</td>
</tr>
<tr>
<td>Yields of Wheat</td>
<td>YIELDW Tons per Hectare</td>
<td></td>
<td>PS&amp;D View</td>
</tr>
<tr>
<td>Import Dependence in Wheat</td>
<td>IMPDEPW IMPORTW/(PRODNW+IMPORTW)</td>
<td></td>
<td>Computed</td>
</tr>
<tr>
<td>Self-Sufficiency Ration in Wheat</td>
<td>SSRATIOW PRODNW/(PRODNW+IMPORTW)</td>
<td></td>
<td>Computed</td>
</tr>
<tr>
<td>Self-Sufficiency Rate in Wheat</td>
<td>SSRATEW PRODNW/CONSNW</td>
<td></td>
<td>Computed</td>
</tr>
<tr>
<td>Variance of Production - 1</td>
<td>VARPROD1 (PRODN - PRODNAva)/PRODNAva²</td>
<td></td>
<td>Computed</td>
</tr>
<tr>
<td>Variance of Production - 2</td>
<td>VARPROD2 (PRODN - PRODN,.)/PRODN,.</td>
<td>²</td>
<td>Computed</td>
</tr>
<tr>
<td>Factor Ratio</td>
<td>FACTOR (Land per Farm Worker/Average Capital Endowment per Worker)</td>
<td></td>
<td>Computed</td>
</tr>
<tr>
<td>Productivity Ratio</td>
<td>PRODUCT (Labor Productivity in Agriculture/Labor Productivity in Industry)</td>
<td></td>
<td>Computed</td>
</tr>
<tr>
<td>Income Elasticity of Demand- Wheat</td>
<td>η         Number</td>
<td></td>
<td>T&amp;A</td>
</tr>
<tr>
<td>Income Elasticity of Demand- Food</td>
<td>ηₜₐ₁ Number</td>
<td></td>
<td>Computed from T&amp;A</td>
</tr>
<tr>
<td>Price Elasticity of Wheat Demand</td>
<td>ε         Number</td>
<td></td>
<td>T&amp;A</td>
</tr>
<tr>
<td>Price Elasticity of Wheat Supply</td>
<td>εₙₚ Number</td>
<td></td>
<td>T&amp;A</td>
</tr>
<tr>
<td>Relative Risk Aversion</td>
<td>R₀ Number</td>
<td></td>
<td>T&amp;A</td>
</tr>
<tr>
<td>Domestic Producer Prices of Wheat</td>
<td>Pₙ₁ Domestic Currency per Ton</td>
<td></td>
<td>OECD;USDA</td>
</tr>
<tr>
<td>Domestic Producer Prices of Wheat- Lagged</td>
<td>Pₙ₋₁ Domestic Currency per Ton</td>
<td></td>
<td>OECD;USDA</td>
</tr>
</tbody>
</table>
Table V.1: (contd.)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Acronym</th>
<th>Units¹</th>
<th>Source²</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Price of Wheat</td>
<td>$P_{w,t}$</td>
<td>Domestic Currency per Ton</td>
<td>OECD;USDA</td>
</tr>
<tr>
<td>World Price of Wheat - Lagged</td>
<td>$P_{w,t-1}$</td>
<td>Domestic Currency per Ton</td>
<td>OECD;USDA</td>
</tr>
<tr>
<td>Trend Variable</td>
<td>TREND</td>
<td>Time Period (Years)</td>
<td>-</td>
</tr>
<tr>
<td>Dummy: Japan</td>
<td>DUMMY1</td>
<td>= 1 if Japan, 0 otherwise</td>
<td>Created</td>
</tr>
<tr>
<td>Dummy: EFTA³</td>
<td>DUMMY2</td>
<td>= 1 if EFTA country, 0 otherwise</td>
<td>Created</td>
</tr>
<tr>
<td>Dummy: Income</td>
<td>DUMMY3</td>
<td>= 1 if Low-Income; 2 if Middle Income; 3 if Industrialized</td>
<td>Created</td>
</tr>
<tr>
<td>Dummy: Industrialized and Developing</td>
<td>DUMMY4</td>
<td>= 1 if Industrial Country; 0 otherwise</td>
<td>Created</td>
</tr>
<tr>
<td>Dummy: Middle-Income</td>
<td>DUMMY5</td>
<td>= 1 if middle-income country, 0 otherwise</td>
<td>Created</td>
</tr>
</tbody>
</table>

¹ The variables in domestic currency units were translated into a single common currency (the U.S. dollar) using the exchange rate figures from the IMF, *International Financial Statistics*.


³ The European Free-trade Association (EFTA) includes Austria, Finland, Iceland, Norway, Sweden and Switzerland. However, since the relevant data for Iceland were not available, the EFTA dummy was defined only for the rest five countries.
The study uses the Arrow-Pratt's coefficient of relative risk-aversion ($R_c$) to account for consumers' risk-aversion. It relates to the elasticity of the marginal utility of income. Its values are found to vary with income and size of risk in relation to income. Newbery and Stiglitz (1981, Ch. 7) and Tyers and Anderson (1992, Ch. 3) report that the risk-neutral individuals have values of $R_c$ close to zero while corresponding values for risk-averse individuals range up to 2. The country sample, therefore, was divided into three income groups: high-income (with a per capita gross national product above $2,500); middle-income ($1000 to $2499); and low-income (below $1,000). Following Tyers and Anderson, a value of $R_c = 2$ is assigned to consumers in low-income countries; $R_c = 1.5$ for middle-income countries; and $R_c = 1$ in case of high-income countries.

To account for the comparative advantage in agriculture, two proxy variables are created: the factor ratio ($FACTOR$) and the productivity ratio ($PRODUCT$). The factor ratio is defined as the ratio of agricultural land per farm worker to the average capital endowment per worker. The capital endowment, following Honma and Hayami (1986a and 1986b), is approximated by the national income per capita. The productivity ratio is defined as the ratio of labor productivity in agriculture to labor productivity in the industrial sector.

A number of binary variables have also been used in the trial runs. Some unique effects on agricultural policies are captured by various intercept and slope dummies for Japan; Northern Europe ($EFTA$); industrialized and middle-income countries. To capture the income differentials across industrialized, middle-income and low-income countries, a dummy variable, $DUMMY3$, was created. A trend variable ($TREND$) is used in some regression models. It may be noted that not all the variables defined in Table V.1 have been reported in the final results presented in this chapter.

V.1.2 Pooled Cross-Section Time-Series Estimation

Let there be $N$ cross-sectional units, each with $T$ observations in the time-series, thus providing $NxT$ total number of observations. The present data set uses a sample of 30 countries with six time-series observations, providing a total of 180 observations of each
variable. Assuming that the cross-section parameters remain constant over time, the data can be combined to obtain more efficient estimates of the parameters, which is called *pooling* the data. Pindyck and Rubinfeld (1991, pp. 253-261) describe various techniques for pooling cross-section time-series data including performing *OLS* regression on the entire data set, changing cross-section and time-series intercepts by using dummy variables, and specifying error-components and time-series autocorrelation models.

Since the stochastic term in a cross-section time-series model might possibly include both time-series-related and cross-section-related disturbances as well as a combination of both disturbances, modeling in such a setting requires fairly complex specifications about the nature of disturbance terms. According to Kmenta (1986), while using pooled cross-section time-series data, the model may be specified to have both cross-sectional heteroscedasticity and time-series autoregression.

A regression equation that has time-series and cross-sectional observations may be written as:

\[
\tau_i = \gamma_0 + \gamma_1 X_{i,t,1} + \gamma_2 X_{i,t,2} + \gamma_3 X_{i,t,3} + \ldots + \gamma_K X_{i,t,K} + \mu_i
\]

where, \(i=1, \ldots, N\) denotes countries; \(t=1, \ldots, T\) denotes time; and \(k=1, \ldots, K\) denotes independent variables. \(\tau_i\) are the observations on the dependent variable across time and countries. The \(X_{i,t,k}\) represent explanatory variables and \(\gamma_i\) are the coefficients. In the cross-sectional data, the main focus of the analysis is usually on *heteroscedasticity*, that is, different stochastic processes applying to different cross-sectional units. The variance of the error term \(\mu_i\) is not constant across observations and the error structure in this case is unique for each cross-section unit. For example, \(E[\mu_{\text{India}}^2] = \sigma_{\text{India}}^2\) and \(E[\mu_{\text{U.S.}}^2] = \sigma_{\text{U.S.}}^2\) with \(\sigma_{\text{India}}^2 \neq \sigma_{\text{U.S.}}^2\).

A number of tests are available for checking the data for heteroscedasticity. The White's (1980) General Test is commonly used for detecting heteroscedasticity in a cross-sectional data. In this case, the *OLS* estimates would be biased. A two-step *Feasible Generalized Least Squares (GLS)* estimation technique may be used to account for
heteroscedasticity (Greene, 1990, p. 465). The problem of autocorrelation, found in the
time-series data, may be checked by the Durbin-Watson test and can be dealt with by
specifying a GLS estimation.

In the quantitative studies on the determinants of agricultural protection, the most
frequently encountered econometric problems are those of multicollinearity and simultaneity.
For example, in the model,

\[ \tau_{it} = a_0 + \alpha_i \text{GNPC} + \ldots + \alpha_k \text{GDPAG}_{ik} + \mu_i \]

the per capita gross national product (GNPC) and the share of agriculture in gross domestic
product (GDPAG) may be correlated with each other especially in an agrarian economy. In
the near multicollinearity case, the estimation would yield high values of the coefficient of
determination \( R^2 \) but the parameter estimates would be statistically insignificant. The
results would also be sensitive to small changes in the model specification. The estimation
may be improved by enlarging the sample size or imposing restrictions on the coefficients. A
stepwise regression may also be used.

The problem of simultaneity may exist when, in the above model, the GDPAG might
be influenced by the level of the dependent variable. Honma and Hayami (1986a), in their
seminal work on the structure of agricultural protection in ten industrialized countries, point
out that "some of the explanatory variables used in the analysis are not really independent of
the dependent variable." They cite the example of protection preventing the share of
agriculture in the total economy from declining. Many other quantitative studies on the
determination of agricultural protection, for example, Honma and Hayami (1986b), Fulginiti
and Shogren (1992), and Fulginiti (1992) also report the problem of simultaneity and suggest
cautions while interpreting the results of their analyses.

The following model illustrates the simultaneity problem in estimating the effects of
explanatory variables on the protection awarded to wheat farmers:

\[ \tau = \alpha_1 + \alpha_2 \text{LFAG} + \alpha_3 \text{GDPAGD} + \mu \]
Here, a second equation needs to be estimated to test for the simultaneity between the dependent variable and the GDPAGD. In the first stage, the GDPAGD is regressed on the share of agriculture in the labor force (LFAG) and the import dependence of the country in wheat (IMPDEP) and the residual variable, $\hat{e}$ is calculated ($t$-statistics in parentheses):

$$\hat{e} = GDPAGD - 21815 - 162.05 \times LFAG + 168.83 \times IMPDEP$$

$$R^2 = 0.033$$

$$t = 4.78 \quad 1.42 \quad -2.21$$

In the second stage, to correct for the simultaneity, the estimated residual is added as a regressor in the original model:

$$T = 68.804 - 0.871 \times LFAG + 0.001 \times \hat{e} - 0.001 \times GDPAGD$$

$$R^2 = 0.359$$

$$t = 7.87 \quad -7.23 \quad 2.91 \quad -2.48$$

Subsequently, the null hypothesis that the coefficient estimate on $\hat{e}$ is equal to zero may be tested using the $t$-statistic. The results above imply that the null hypothesis cannot be rejected at one percent level of significance. A plausible reason for the significant coefficient may be that the above model suffers from the excluded variables problem. Another way to deal with the problem of simultaneity may be to include the lagged values of the variables in the estimation.

V.2 Determinants of International Agricultural Protection

In this section, an attempt is made to empirically validate the results of the consumer, producer and policy-makers' models developed in the previous chapter. The purpose is to ascertain whether the variables identified in these models can be supported by empirical evidence. The goal is to provide an econometric analysis with substantial theoretical justification. The next subsection tests the significance of consumers' food security concerns in the determination of agricultural protectionistic policies. The theoretical results of the producer model are similarly tested in the subsection V.2.2. The complementarity of the two models as reflected by the political preference function is ascertained in the part V.2.3. The final subsection highlights the relationship between the level of protection and the income
structure of the country. The subsection also chalks out the dynamic adjustment path of the growth of protectionism vis-a-vis economic development.

V.2.1 Empirical Validation of the Consumer Model

In this subsection, the results are reported regarding the empirical test of the influence of consumer concerns on the protection accorded to wheat farmers across selected countries. The objective is to analyze whether the consumer food security hypothesis is validated by the empirical evidence. The OLS, GLS and pooled estimation techniques are used to fit the regression models. The main variables identified in the theoretical model regarding the consumer's food security concerns included the share of food in household consumption expenditures, income and price elasticities of demand, relative risk aversion and the consumer's income. These variables, along with few other explanatory variables, such as import dependence and self-sufficiency rate, are included in the regressions so as to provide a closer approximation of the consumers' concerns.

An important variable of consumer concerns is the share of food in household budgets, indicated by the Engel coefficients. The correlation between the Engel coefficients and the farm sector protection depicted in Figures III.8 and III.9 indicate the possibility of a non-linear relationship. In order to examine the correct nature of this relationship, three plausible alternatives of the Engel coefficients -- linear, log-linear and quadratic -- were tested for model specification. The results are provided in Table V.2.

The table shows that no general conclusion could be reached since in each of the models the null hypothesis could not be rejected. This implies that all three model can provide identical specification of the true nature of the relationship. Therefore, all three alternative specifications of Engel coefficients are used in the regressions: linear (model 7), quadratic (models 1, 3, 5, 6 and 8) and log linear (model 2) in Table V.3. All of these specifications indicate the expected negative correlation between the Engel coefficients and the protection levels. The coefficient estimates are mostly statistically significant at one percent level.
Table V.2: Test for the model specification for the Engel coefficient variable

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Test 1</th>
<th>Test 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t-Statistics</td>
<td>Decision</td>
</tr>
<tr>
<td>Linear vs. Quadratic</td>
<td>0.53</td>
<td>Could Not Reject</td>
</tr>
<tr>
<td>Linear vs. Log</td>
<td>0.3</td>
<td>Could Not Reject</td>
</tr>
<tr>
<td>Log vs. Quadratic</td>
<td>0.7</td>
<td>Could Not Reject</td>
</tr>
</tbody>
</table>

1 The models are tested using the Davidson and MacKinnon’s pair-wise J tests which are discussed in detail in Section V.5. The test statistics under the column Test 1 are for the null hypothesis that the first listed model in the comparison is the correct model. The test statistics under the Test 2 column are for the null hypothesis that the second listed model in the comparison is correct. The critical value at the 1% level of significance is 2.60.

In poor countries, food accounts for about half of the household expenditures. As the proportion of personal disposable income spent on food decreases, the protection awarded to the agricultural sector rises. Higher the share of the commodity in total household expenditures, the greater will be the stake of consumers in food security. These results are also supported by Balisacan and Roumasset (1987). Hayami (1990) and Honma and Hayami (1986b) contend that the reduction in resistance against agricultural protectionism would be reinforced by the Engel’s law. Honma and Hayami (1986a) conclude that:

"As the share of food in total consumption expenditures declines, the effect of high food prices on the cost of living becomes smaller. Therefore, agricultural protectionism becomes more tolerable to consumers as their incomes rise. At the same time, it becomes tolerable to business interests, because the effects of high food prices on the cost of living and hence on the labor wage rates declines". (p. 120)

Another important variable identified in the theoretical model of consumers, the income elasticity of demand ($\eta$), also had the expected negative sign and was statistically significant in all the regression models. High income elasticity may also be expected to increase the marginal gains to consumers from food security. Income elasticity of demand for wheat in the sample countries varied from -0.25 to 1.00. The highest income elasticities were observed in the case of low income countries. Consequently, the consumers in these countries might be expected to oppose the protectionistic policies that support the
Table V.3: Results for consumer interest models, 1982-87

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimation Technique:</td>
<td>Pool</td>
<td>Pool</td>
<td>GLS</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>Pool</td>
<td>Pool</td>
</tr>
<tr>
<td>Engel Coefficient</td>
<td>7.248*</td>
<td>-</td>
<td>5.937*</td>
<td>-</td>
<td>6.247*</td>
<td>5.742*</td>
<td>-0.968*</td>
<td>5.063*</td>
</tr>
<tr>
<td>(Engel Coefficient)^2</td>
<td>-0.072*</td>
<td>-</td>
<td>-0.072*</td>
<td>-</td>
<td>-0.062*</td>
<td>-0.059*</td>
<td>-0.044**</td>
<td>(4.54)</td>
</tr>
<tr>
<td>ln Engel</td>
<td>-</td>
<td>-27.817*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(-3.77)</td>
<td></td>
</tr>
<tr>
<td>Income Elasticity-Wheat</td>
<td>-60.478*</td>
<td>-</td>
<td>-75.303*</td>
<td>-</td>
<td>-29.787**</td>
<td>-22.775**</td>
<td>-25.817**</td>
<td>-56.558*</td>
</tr>
<tr>
<td>Income Elasticity-Food</td>
<td>-34.175</td>
<td>(-4.18)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Price Elasticity-Wheat</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-19.250</td>
<td></td>
</tr>
<tr>
<td>Relative Risk-Aversion</td>
<td>-108.430*</td>
<td>-</td>
<td>-</td>
<td>-49.311*</td>
<td>-78.638*</td>
<td>-76.878*</td>
<td>-121.69*</td>
<td></td>
</tr>
<tr>
<td>Per Capita Income</td>
<td>-</td>
<td>0.006*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(5.76)</td>
<td></td>
</tr>
<tr>
<td>Per Capita GDP Non-Farm</td>
<td>0.002*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.004*</td>
<td>0.004*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Self-Sufficiency Rate</td>
<td>-0.079*</td>
<td>-0.061**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.067*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Import Dependence</td>
<td>-</td>
<td>0.221*</td>
<td>-</td>
<td>0.142**</td>
<td>-</td>
<td>-</td>
<td>(3.18)</td>
<td></td>
</tr>
<tr>
<td>Dummy: Japan</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>46.610*</td>
<td>-</td>
<td>-</td>
<td>(3.84)</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>53.851*</td>
<td>140.52*</td>
<td>-83.838*</td>
<td>93.069*</td>
<td>-1.400</td>
<td>1.632</td>
<td>76.473*</td>
<td>106*</td>
</tr>
<tr>
<td>Adjusted R^2</td>
<td>0.42</td>
<td>0.36</td>
<td>0.51</td>
<td>0.42</td>
<td>0.51</td>
<td>0.48</td>
<td>0.34</td>
<td>0.37</td>
</tr>
<tr>
<td>DF</td>
<td>174</td>
<td>176</td>
<td>174</td>
<td>176</td>
<td>173</td>
<td>173</td>
<td>176</td>
<td>174</td>
</tr>
</tbody>
</table>

Note: All models use data from 30 industrialized and developing countries. In case of models estimated using the pooled cross-section time-series technique, the coefficient of determination is the Hausman R-Square. The Hausman Raw Moment R-Square was substantially higher in these cases (not reported). The Self-Sufficiency Rate for wheat and Import Dependence are as defined in Table V.1.
agricultural sector more strongly. As Tyers and Anderson (1992) point out, the larger the percentage by which the real incomes of consumers are affected, the more vigorously would they oppose or support a distortionary policy. The income elasticity of food also had the correct negative sign but was not significant possibly due to aggregation.

The price elasticity of demand for wheat is also found to be negatively related to the protection level awarded to wheat farmers (Model 8). As the per capita incomes of the non-farm population increase, consumer welfare becomes less sensitive to changes in the prices of wheat. The higher the price elasticity of demand, the higher the consumers' marginal gains from reduction in prices. When the demand is relatively elastic, members of the non-farm population will have greater demand for political power to resist production subsidies (Miller, 1991). The demand for food becomes less price elastic with the rise in per capita incomes (Sanderson and Mehra, 1990). Some other studies have also referred to the importance of the price elasticity of demand in the determination of agricultural protection levels and lower price elasticities are shown to be associated with more intervention (Gardner, 1983 and 1987). However, many quantitative studies on the determinants of agricultural protection have not included the price elasticities of demand in the analysis for lack of reliable estimates. The results presented here, thus, represent a first such attempt to explicitly include the income and price elasticities of demand in a cross-country analysis.

The relative risk aversion of consumers (R) is also found to be negatively correlated with wheat protection levels. The coefficient estimates are highly significant in all the models. Low income consumers in developing countries, therefore, are more risk averse relative to their well-to-do counterparts in industrialized countries. Due to the relatively large risk-aversion coefficient, producer prices tend to be kept at lower level in developing countries. This supports the public interest interpretation (the SWG approach in the PEAP literature) of the motives for government intervention in the agricultural sector. The lower prices afford poor consumers the access to available food supplies. In this process, they tend to focus on immediate food needs. The long-term food security, on the other hand, may be achieved through enhancing production by providing price incentives to producers. Thus,
there is an obvious conflict between the short-term and long-term security food goals (Pinstrup-Andersen, 1993, 1987; Reutlinger, 1987). This is possibly due to the differences in the relative risk-aversion and other consumer characteristics across developing and industrialized countries as discussed above.

Two variants of consumers' income have been used in the regression analysis: the per capita gross national product (Model 3) and the gross domestic product per capita of non-farm population (Models 1, 5 and 6). Both variants have the expected positive sign and are statistically significant at one percent level. The results provide support for the conclusion reached above. The richer the consumers, the lower the proportion of income spent on food and, thus, lower the resistance to increasing protection levels. The results support the view that the society has an income elastic demand for assisting farmers. The findings corroborate those reported by Honma, Hayami, Tyers, Anderson, de Gorter and others.

Other measures of consumers' food security concerns may be provided by the rate of self-sufficiency and import dependence of wheat. The higher the consumption of wheat relative to its domestic production, the lower will be the self-sufficiency of the country. The self-sufficiency rate had the correct negative sign and was significant at one or five percent level. In countries with excess supply of wheat relative to its demand, the producer support tends to be lower. Krueger (1992) and Krueger et al. (1991) have also reported that the self-sufficiency in staple food commodities and price stabilization are the prime motives of government intervention in developing countries.

On the other hand, the higher the ratio of domestic consumption to production, the higher will be the imports of the commodity. Subsequently, the higher will be the import dependence which is defined as the percentage share of imports in the sum of wheat imports and domestic production. Moreover, the higher the dependence on imports, the higher the risk that, in a given year, the demand for that commodity might exceed the total availability. Consequently, consumers might be willing to support the production of the commodity by providing incentives to domestic producers to ensure uninterrupted supplies. This contention
is supported by the results where import dependence is observed to be positively correlated with the producer protection levels. Domestic production of wheat is subsidized both across industrialized and developing countries where wheat is an importable commodity. The results also corroborate earlier findings (Herrmann, 1989) that as the extent of import dependence of wheat increases, the level of protection provided to the wheat producers also rises.

A dummy variable was used in model (5) to account for the excessively high protection levels in Japan. Hayami (1990) and Miller (1987) point out that achieving food security has been one of the most important responsibilities of the Japanese government. The producer subsidy equivalents received by Japanese wheat producers were to tune of 99 percent during 1987. The dummy variable is significant at one percent level affirming the contention that protection levels in Japan are relatively higher than other countries included in the sample.

In terms of the goodness of fit, a more desirable measure than the commonly used coefficient of determination ($R^2$), namely, the *adjusted* coefficient of determination ($\hat{R}^2$), has been selected.\(^{56}\) The analysis improves upon earlier works in the PEAP literature in a number of ways. First, the empirical model for the first time explicitly incorporates the food security concerns of consumers in the determination of farm policies. Second, the analysis is based on a well-founded theoretical framework whereas most of the earlier quantitative works are based on *ad hoc* specifications of their empirical models. Third, a more comprehensive measure of producer protection levels has been used. Fourth, the present study represents a first systematic analysis of a much broader coverage of industrialized and developing countries. Finally, the overall results of the analysis are very robust in that up to 51 percent variation in producer support is explained by consumer food security concerns *alone*. All the variables suggested by the theoretical model (except the price elasticity of demand for wheat)

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\(^{56}\) The ordinary $R^2$ is sensitive to the number of independent variables included in the model. When new variables are added to the regression model, $R^2$ always increases while the adjusted $R^2$ may rise or fall. Pindyck and Rubinfeld (1991) provide an example of a model estimated with 25 observation with a reported $R^2$ of 0.80 with 17 independent variables. However, the adjusted $R^2$ with the same model was 0.40. Obviously, a more accurate picture of the limitations of the model is provided by the adjusted $R^2$. 
are highly statistically significant in explaining the protection levels. In contrast, the earlier studies using the variables form both consumer and producer groups, reported $R^2$ values between 20 to 35 percent only with many variables showing insignificant contribution in explaining the protection levels (see for example, Herrmann, Miller, Gardner etc.).

V.2.2 Empirical Validation of the Producer Model

The empirical analysis in this subsection is designed to test the comparative static results of the theoretical model of producers. Unlike the previous subsection, no altruistic motives are considered in the determination of protection levels. The analysis in this case, therefore, is based on the CHG paradigm that producers unite towards a common purpose. Some important variables identified in the producer model that influence the producer protection include the size and wealth of the farming group and the price elasticity of supply. These variables, along with their variants and appropriate proxies, have been included in the analysis. The regression models for comparisons across industrialized and developing countries are estimated using the pooled cross-section time-series estimation (Table V.4). Some additional results are also provided in Table V.5 for industrialized countries alone using both the OLS and pooled estimation techniques.

The group-size effects on producer protection levels have been approximated by the share of agriculture in the labor force as well as the number of farmers in models (1), (2), (4) and (7). As expected, the coefficients had negative and statistically significant sign, except for the absolute number of farmers. The results indicate that as the size of the agricultural labor force decreases, it becomes easier for farmers to unite and successfully lobby the government for securing protection.

Unlike Miller (1991) and Fulginiti (1992) and Fulginiti and Shogren (1992), the analysis provides conclusive results which are statistically significant. These results confirm the group-size theories proposed by Olson and Becker that small groups tend to be more

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57 A more appropriate variable would be the actual number of wheat farmers. However, unavailability of reliable data on this variable across the selected 30 industrialized and developing countries constrained the analysis to use these proxy variables.
Table V.4 Results for producer interest models across industrialized and developing countries, 1982-87

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Agriculture in Labor Force</td>
<td>-0.971*</td>
<td>-0.021#</td>
<td>-1.01*</td>
<td>-</td>
<td>-</td>
<td>-1.259*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-6.99)</td>
<td>(-1.20)</td>
<td>(-6.26)</td>
<td></td>
<td></td>
<td>(-10.0)</td>
<td></td>
</tr>
<tr>
<td>Relative Share of Agriculture to Industry in Labor Force</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-11.304*</td>
<td></td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(-3.77)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of Agriculture in GDP (log)</td>
<td></td>
<td></td>
<td></td>
<td>-11.850**</td>
<td></td>
<td>-22.423*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(-2.52)</td>
<td></td>
<td>(-5.92)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-4.11)</td>
<td>(-3.93)</td>
<td>(-2.25)</td>
<td>(-3.58)</td>
<td>(-2.87)</td>
<td>(-3.48)</td>
<td>(-6.05)</td>
</tr>
<tr>
<td>World Price (Lagged)</td>
<td>-0.028</td>
<td>-0.029</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-0.038***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(-1.34)</td>
<td>(-1.37)</td>
<td></td>
<td></td>
<td></td>
<td>(-1.72)</td>
<td></td>
</tr>
<tr>
<td>Japan Dummy</td>
<td>52.233*</td>
<td>48.077*</td>
<td>61.322*</td>
<td>56.246*</td>
<td>59.068*</td>
<td>-</td>
<td>43.083*</td>
</tr>
<tr>
<td></td>
<td>(7.17)</td>
<td>(5.58)</td>
<td>(5.928)</td>
<td>(6.87)</td>
<td>(6.52)</td>
<td></td>
<td>(6.71)</td>
</tr>
<tr>
<td></td>
<td>(2.60)</td>
<td>(2.30)</td>
<td>(2.32)</td>
<td>(2.45)</td>
<td>(3.03)</td>
<td>(2.62)</td>
<td></td>
</tr>
<tr>
<td>Industrial Countries' Dummy x Esp¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income Dummy</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>59.306*</td>
<td>-16.847***</td>
<td>42.491*</td>
<td>55.930*</td>
<td>28.108***</td>
<td>84.288*</td>
<td>71.951*</td>
</tr>
<tr>
<td></td>
<td>(7.98)</td>
<td>(-1.72)</td>
<td>(2.92)</td>
<td>(6.67)</td>
<td>(1.79)</td>
<td>(7.66)</td>
<td>(12.67)</td>
</tr>
<tr>
<td>R²</td>
<td>0.72</td>
<td>0.68</td>
<td>0.61</td>
<td>0.67</td>
<td>0.67</td>
<td>0.38</td>
<td>0.66</td>
</tr>
<tr>
<td>DF</td>
<td>174</td>
<td>173</td>
<td>174</td>
<td>175</td>
<td>174</td>
<td>175</td>
<td>176</td>
</tr>
</tbody>
</table>

Note: All models are estimated using the pooled cross-section time-series technique for 30 industrialized and developing countries. The coefficient of determination is the Buse R-Square. The Buse Raw Moment R-Square was substantially higher in all cases (not reported). Factor Ratio is as defined in Table V.1.

1 Esp: Price Elasticity of Wheat Supply
2 Labor Force in Agriculture (Numbers)
successful relative to large ones in obtaining political favors. As the number of members in a
group increases, the effectiveness of the group decreases due to several factors such as the
free-rider problem and large organization costs. In addition, another proxy used for the
group-size was the share of agricultural in the labor force relative to the share of the
industrial sector. The overall relationship between the relative size of farm population and
the rate of agricultural taxation is positive (Model 5). This is consistent with earlier studies
showing that the politically successful groups tend to be small relative to the size of the
groups taxed to pay their subsidies (Becker, 1983). The results indicate that relatively fewer
farmers will be subsidized since it is in the interest of the support-maximizing politician as
discussed in Chapter III.

Another important variable affecting the level of protection awarded to wheat
producers across countries is the share of agriculture in the gross domestic product. This
variable provides a close approximation of the wealth of farmers identified in the theoretical
model. The variable is included in the log form to account for the possible non-linear
relationship. The coefficients have the hypothesized negative sign and are significant. The
more the importance of agriculture in the national economy, the lower would be the level of
support provided to commodity growers. The result reinforces the above findings regarding
the influence of group-size on protection levels. In developing countries, where agriculture
constitutes a larger portion of the gross domestic product, the farm group is usually larger
than the non-farm group.

Factor ratio is used in the analysis as an index of the comparative advantage in
agriculture. It is defined as the ratio of arable land per farm worker to the average capital
endowment per worker in the society. The significant negative coefficients obtained in the
regressions corroborate the findings reported in Honma and Hayami (1986a and 1986b) that
as the comparative advantage shifts away from agriculture, the farmers are able to garner
increased protection from imports. The world price of wheat (lagged one year) also has the

---

58 Lagged values of this variable could not be used since there is hardly any change in this variables reported in the data from
year to year.
expected negative sign. This suggests that the higher the mean of the free-market price, the lower would be the support needed to enhance farm incomes.

According to Tyers and Anderson (1992), a one percent increase in the prices of agricultural commodities relative to those of non-farm products, will boost real farm incomes in rich industrial countries by 2.3 percent. The same increase in prices would lower incomes of industrial capitalists and of non-farm workers by only 0.3 percent and 0.1 percent, respectively. This generates an increased demand for farm protection in industrialized countries relative to those in developing countries. Gardner (1987) hypothesizes a negative correlation between supply elasticity and the producer gains from farm programs in the United States. However, this result could not be supported by the cross-country empirical evidence as shown by the positive sign on the slope dummy of price elasticity. It may be due to the inclusion of EFTA countries in the analysis where the supply elasticity is high (around 0.9) and the average protection levels are also considerably higher than in other industrialized countries. The dummy variable used to identify the EFTA countries was significant and so was the dummy used for Japan. An income dummy was also used to capture the income differential across industrialized, middle income and low income countries. This variable was also found to be positively correlated with the level of protection awarded to wheat farmers.

Essentially similar results are obtained for the eleven industrialized members of the OECD (Table V.5). However, a few additional variables are specified in this case, such as the growth rates of agricultural and industrial labor force, total wheat exports, the area under wheat cultivation and the lagged domestic prices. The signs of these coefficients are all as expected and significant. Where wheat is an exportable commodity (for example, the United States and Australia), the protection awarded to wheat farmers is relatively lower than in the countries that import wheat (for example, Japan and Norway). The results are similar to those obtained by Krueger (1989) in case of developing countries that export commodities are "rather heavily" taxed. Also, countries deficient in the land under wheat cultivation, tend to support their domestic producers.
Table V.5 Results for producer interest models: Industrialized countries, 1982-87

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimation Technique</td>
<td>Pool</td>
<td>Pool</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>Pool</td>
</tr>
<tr>
<td>Share of Ag. Relative to Industry in GDP</td>
<td>-119.43*</td>
<td>-119.43*</td>
<td>-119.43*</td>
<td>-119.43*</td>
<td>-119.43*</td>
<td>-119.43*</td>
<td>-119.43*</td>
<td>-119.43*</td>
</tr>
<tr>
<td>Exports</td>
<td>-0.0001*</td>
<td>-0.002*</td>
<td>0.073*</td>
<td>0.038*</td>
<td>0.073*</td>
<td>0.038*</td>
<td>0.073*</td>
<td>0.038*</td>
</tr>
<tr>
<td>Area Under Wheat</td>
<td>-0.002*</td>
<td>-0.002*</td>
<td>0.073*</td>
<td>0.038*</td>
<td>0.073*</td>
<td>0.038*</td>
<td>0.073*</td>
<td>0.038*</td>
</tr>
<tr>
<td>Domestic Price (Lagged)</td>
<td>-0.002*</td>
<td>-0.002*</td>
<td>0.073*</td>
<td>0.038*</td>
<td>0.073*</td>
<td>0.038*</td>
<td>0.073*</td>
<td>0.038*</td>
</tr>
<tr>
<td>Dummy: Japan</td>
<td>0.556**</td>
<td>0.489**</td>
<td>-</td>
<td>-</td>
<td>0.556**</td>
<td>0.489**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dummy: EFTA</td>
<td>64.755*</td>
<td>32.503*</td>
<td>11.72</td>
<td>41.487*</td>
<td>41.487*</td>
<td>64.218*</td>
<td>48.768*</td>
<td>64.218*</td>
</tr>
<tr>
<td>Intercept</td>
<td>105.33*</td>
<td>78.324*</td>
<td>87.061*</td>
<td>57.669*</td>
<td>96.027*</td>
<td>-35.588*</td>
<td>-17.551***</td>
<td>-12.033***</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.62</td>
<td>0.63</td>
<td>0.62</td>
<td>0.64</td>
<td>0.48</td>
<td>0.72</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>DF</td>
<td>62</td>
<td>62</td>
<td>61</td>
<td>61</td>
<td>62</td>
<td>62</td>
<td>61</td>
<td>61</td>
</tr>
</tbody>
</table>

Note: All regression models use data from eleven industrialized countries. The coefficient of determination in case of the models estimated using the pooled cross-section time-series technique is the Buse R-Square. The Buse Raw Moment R-Square was substantially higher in all cases (not reported). Factor Ratio is as defined in Table V.1.
V.2.3 Determinants of the Political Welfare Function

The above subsections attempt to explain the determination of agricultural protection from the viewpoints of two distinct interest groups. The interests of a particular group can overweigh the interests of the other in the policy formulation process. For example, in industrialized countries, the producer groups tend to be politically more powerful whereas consumers are the main beneficiaries of government intervention in the agricultural sector in the developing countries. As depicted in the politician model in Chapter IV, the policy makers take into account the interests of both the producers and the consumers in policy formulations. Thus, the policy outcomes in a particular country are influenced in part by the interests of both these groups as well as other government characteristics. Therefore, in this subsection, the determinants identified in the consumer and producer models have been combined with the variables constraining the politicians in the decision-making process, in order to assess their joint influence on the policy outcome.

The results reported in Table V.6 indicate that the inclusion of variables from all these interest groups increases the explanatory power of the models. For example, the model (5) is able to explain up to 82 percent of the variation in protection levels across selected countries (the Raw Moment Buse $R^2$ in this case was about 0.93). This indicates that the determinants identified in the theoretical models and subsequently tested empirically in this chapter account for a substantial portion of the variation in the agricultural protection levels across industrialized and developing countries. The Results obtained for variables associated with the producer and consumer groups are similar to those obtained above.

An important variable associated with the political leadership's decision-making process is the government finance which states the surplus or deficit position of the treasury. This variable was included in all the models. The variable had the expected positive sign and was statistically significant in model (3). The government finance was usually negative in almost all countries, albeit in varying magnitude. This indicates that the governments with lower deficits are able to supply more subsidies to the farm sector.

The time trend variable was also positive and significant indicating the increasing
Table V.6: The results of integrated producer, consumer and politician models

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimation Technique</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>Pool</td>
<td>Pool</td>
</tr>
<tr>
<td>Engel Coefficient</td>
<td>4.655*</td>
<td>-</td>
<td>3.546*</td>
<td>2.649*</td>
<td>2.265*</td>
</tr>
<tr>
<td></td>
<td>(3.52)</td>
<td>(2.80)</td>
<td>(3.16)</td>
<td>(2.25)</td>
<td>(2.02)</td>
</tr>
<tr>
<td>(Engel Coefficient)^2</td>
<td>-0.046*</td>
<td>-</td>
<td>-0.034**</td>
<td>-0.033*</td>
<td>-0.013</td>
</tr>
<tr>
<td></td>
<td>(-3.30)</td>
<td>(2.54)</td>
<td>(-2.76)</td>
<td>(-1.02)</td>
<td>(1.02)</td>
</tr>
<tr>
<td>Income Elasticity- Wheat</td>
<td>-56.648*</td>
<td>-49.850*</td>
<td>-49.953*</td>
<td>-63.833*</td>
<td>-38.846*</td>
</tr>
<tr>
<td></td>
<td>(4.94)</td>
<td>(-4.54)</td>
<td>(-4.58)</td>
<td>(-5.33)</td>
<td>(-2.82)</td>
</tr>
<tr>
<td>Relative Risk- Aversion</td>
<td>-47.348**</td>
<td>-36.487*</td>
<td>-32.709***</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(2.34)</td>
<td>(-4.93)</td>
<td>(-1.69)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Per Capita Income (GNPC)</td>
<td>0.004*</td>
<td>-</td>
<td>0.005*</td>
<td>0.004*</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(4.47)</td>
<td>(5.51)</td>
<td>(7.42)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ln (GNPC)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>27.855*</td>
<td>(5.585)</td>
</tr>
<tr>
<td></td>
<td>(-5.72)</td>
<td>(-7.21)</td>
<td>(-7.33)</td>
<td>(-7.74)</td>
<td>(-5.86)</td>
</tr>
<tr>
<td>World Price (Lagged)</td>
<td>-</td>
<td>-0.104*</td>
<td>-0.148*</td>
<td>-0.029</td>
<td>-0.029</td>
</tr>
<tr>
<td></td>
<td>(-3.74)</td>
<td>(5.67)</td>
<td>(-1.63)</td>
<td>(-1.40)</td>
<td>-</td>
</tr>
<tr>
<td>Government Finance</td>
<td>0.00007</td>
<td>-</td>
<td>0.0001**</td>
<td>0.00001</td>
<td>0.00005</td>
</tr>
<tr>
<td></td>
<td>(1.13)</td>
<td>(2.03)</td>
<td>(1.17)</td>
<td>(0.63)</td>
<td>-</td>
</tr>
<tr>
<td>Trend</td>
<td>-</td>
<td>3.948*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(3.51)</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Dummy: Japan</td>
<td>35.637*</td>
<td>25.009**</td>
<td>-</td>
<td>29.567*</td>
<td>31.733*</td>
</tr>
<tr>
<td></td>
<td>(3.11)</td>
<td>(2.12)</td>
<td>(4.95)</td>
<td>(5.58)</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>3.384</td>
<td>-7724.1*</td>
<td>20.862</td>
<td>-8.854</td>
<td>-225.58*</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(-3.46)</td>
<td>(0.87)</td>
<td>(-0.55)</td>
<td>(-3.95)</td>
</tr>
<tr>
<td>Adjusted R^2</td>
<td>0.61</td>
<td>0.64</td>
<td>0.65</td>
<td>0.75</td>
<td>0.82</td>
</tr>
<tr>
<td>DF</td>
<td>171</td>
<td>173</td>
<td>171</td>
<td>171</td>
<td>171</td>
</tr>
</tbody>
</table>

Note: In case of the pooled cross-section time-series estimation, the coefficient of determination is the Buse $R^2$. The Buse Raw Moment $R^2$ was about 0.93 in model (5).
protectionistic policies across the selected 30 industrialized and developing countries. The per capita income appeared to be highly statistically significant in both the linear as well as log linear specifications. It will be interesting to examine the correct specification of this variable in the models of political economy of agricultural protection. This would essentially determine the rate of growth of protection, as depicted by the trend variable, associated with the level of economic development. The next subsection highlights this relationship and develops a dynamic map of the political market forces that influence the protection levels across countries.

Overall, the results of this subsection are very encouraging. This analysis overcomes the problem of excluded variables which is prevalent in most of the earlier studies. In this sense, this is the first systematic and comprehensive attempt that provides a broader coverage of the determinants of the political economy of agricultural protection across countries. Not only are the empirical results highly significant, a well-founded theoretical background is also provided for their inclusion in the empirical estimation.

V.2.4 Economic Development and the Dynamics of Agricultural Protection

In this subsection, an attempt is made to examine the nature of the relationship between the level of economic development and the growth patterns of agricultural protection across countries. Empirical studies have usually approximated economic development by the per capita national income. A number of studies in the PEAP literature have pointed out the existence of a linear relationship between the level of protection and the per capita gross national product (de Gorter and Tsur, 1991; Herrmann, 1987; Honma and Hayami, 1986a; Balisacan and Roumasset, 1986). A few other studies have instead used a log linear specification (Honma and Hayami, 1986b; Fulginiti and Shogren, 1992; Fulginiti, 1992).

The argument of the non-linear relationship would indicate that the agricultural subsidies increase at a decreasing rate with the increase in the per capita incomes of the society. An implication of this argument is that the protection provided to domestic producers increases in the initial phase of economic development but may stabilize or even
subside at higher level of economic development. The analysis below formally develops a conceptual framework of the relationship between the agricultural protection and the level of income. The findings also highlight the dynamic process of the growth of agricultural protection as an economy develops.

Figure V.1 displays income-protection quadrants for agricultural producers. The horizontal axis, which measures the producer subsidies, is divided into two quadrants at the zero level of protection. A division of the vertical axis is considered at GNP per capita level of $7,000. These divisions show that the countries that fall in the upper-right quadrant have high incomes and tend to subsidize their agricultural producers. Low-income countries that tax their farmers generally fall in the lower-left quadrant. Another subjective division of the x-axis is made in the lower-right quadrant, at the PSE level of 20 percent. This separates the middle income countries from the newly industrializing countries (NICs), such as Taiwan and South Korea, which have substantially higher levels of producer support. The same division in case of industrialized countries (upper-right quadrant) separates the countries with significantly high levels of distortion (Switzerland, Norway, Japan, E.C. etc.) from those where distortion levels are relatively lower (Australia and New Zealand). None of the industrialized countries falls in the upper-left quadrant, which depicts effective taxation of agricultural producers. However, if consumer protection levels were displayed in this schematic diagram, most of the industrialized countries would appear in this quadrant.

The figure offers significant insight into the dynamics of the political market forces of agricultural protection. The map of the political market forces that emerges from the analysis is summarized in Figure V.2. The four main quadrants of Figure V.1 are displayed in this figure maintaining the division of horizontal axis into positive and negative quadrants. A subjective division of the level of income at y is made on the vertical axis. It may be noted that in both these figures, the hypothetical division on the vertical axis may occur anywhere in the proximity of the level of income that may differentiate high-income countries from developing countries.
Note: 1. Producer support has been approximated by average PSEs for a number of commodities for the period 1982-87.

Figure V.1: Income-protection quadrants for agricultural producers

Figure V.2: Map of the political market forces of agricultural protection
In all the quadrants, two unique forces may be shown as working simultaneously. One of the forces shows the country's movement towards growth in income and development, while the other pertains to the demand for net protection arising from the producer group.\(^9\) In the first quadrant, a low-income country would exhibit effective taxation of agricultural producers due to the reasons explained above. The momentum in this quadrant, towards economic growth and development (force one) encourages the demand for agricultural subsidies (second force) from the producer group. When these two forces become sufficiently strong, they may initiate a movement towards quadrant II. These dynamics of agricultural protection across countries reveal that the countries switch from taxing their agricultural producers to increasingly subsidizing them in the course of economic development and rise in gross national product (GNP) per capita. The switch in policy usually occurs around initial levels of development, as shown in Figure V.1.\(^6\) As Anderson and Hayami (1986) note, "the faster the economy grows, the more rapidly these changes occur in the political market for distortionary agricultural policies" (p. 3).

Now, in the second quadrant, the country would have achieved the status of a middle-income country or an NIC. The horizontal movement would progress more rapidly, the faster the country moves vertically upward. In this quadrant, the forces point in the Northeast direction. For example, until the 1960s, the agricultural prices in South Korea and Taiwan were administered below the world prices. With the economic progress in these countries and rising per capita incomes, the demand for protection from the farmers grew steadily. In the early 1980s, the domestic prices in these countries were observed to be twice the level of international prices.

As a country achieves further gains in the levels of income, it crosses the threshold level, \(y\), and becomes industrialized. In quadrant III, the push for further growth in income would be in the upward direction. However, as the subsidization of producers reaches a

\(^9\) Although these forces may be correlated, the correlation does not alter the focus of the proposition.

\(^6\) These observations might also have important implications for the international multilateral trade negotiations such as the Uruguay Round whose goal is the containment and gradual reduction of global protectionism in the agricultural sector.
relatively high level, several countervailing forces may begin to be observed. It may not be feasible to keep on increasing the level of farming subsidies any further. The hitherto successful farming organizations may also witness inefficiencies creeping up into the system and their marginal benefits from lobbying would diminish. In addition, the consumer group, with high levels of income and education, may become increasingly aware of the transfers to producers and the wastes involved, as is the case now in the European Community. The increased budgetary outlays would further heighten the awareness among consumers.

These mounting pressures may force the political leadership to retract their support for agricultural producers. Besides, as the level of domestic protection reaches a certain distortionary level, the trading partners of the country as well as international organizations might mount external pressure on the government to reduce the political support to producers. These external forces, combined with the increasing internal pressures, may necessitate a decrease in support for agricultural producers in industrialized countries, resulting in the backward bending of the forces. For example, the ongoing GATT negotiations have been increasingly focusing on effectively reducing the agricultural support levels in countries such as E.C., U.S., Japan and Canada.

It may be noted, however, that such external and internal pressures may start building up at lower levels of protection and incomes as well. In fact, multilateral trade negotiations are showing much concern for halting the increase in protectionism in case of NICs, which fall in quadrant II. In addition, the exact path of the movement may vary from country to country depending upon factors such as the proportion of food expenditures in household budgets, food security reasons, consumers' risk aversion, national self-sufficiency and comparative advantage in agriculture, national security, and budgetary pressures etc.

The dynamic adjustment process explained above is subject to empirical verification in order to assess the exact nature of relationship between these two variables. If a constant relationship exists between the protection levels and incomes, it can be expected that the protection levels would continue to grow as the incomes of the society rise. On the other hand, if a non-linear relationship exists, as is argued above, the growth in agricultural
subsidies would not be proportional to the rise in income levels. A corollary of these arguments is that the producer support may increase at initial levels of growth in incomes but may taper off at later stages. A test for the exact nature of relationship is, therefore, performed using the linear and log-linear specifications for the per capita incomes. The methodology follows the Davidson and MacKinnon's test for model specification. The results are presented in Table V.7.

**Table V.7: Tests for the dynamics of political market forces**

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>t-Statistics</th>
<th>Decision</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_0$: Linear Relationship</td>
<td>3.906</td>
<td>Cannot accept $H_0$</td>
<td>Non-linear relationship exists between the protection level and economic development.</td>
</tr>
<tr>
<td>$H_0$: Log Linear Relationship</td>
<td>1.224</td>
<td>Accept $H_0$</td>
<td>Non-linear relationship exists between the protection level and economic development.</td>
</tr>
</tbody>
</table>

Note: The models are tested using the Davidson and MacKinnon's pair-wise J tests which are discussed in detail in the next section. The t-statistics are for the null hypothesis where the alternate hypothesis is the other specification. The critical value at 1% level of significance is 2.60.

The null hypothesis implying that a linear relationship exists between the level of income and protection awarded to wheat farmers could not be accepted at one or five percent level of significance. The results indicate that the alternate hypothesis holds and that there exists a log-linear relationship. In the second test, the null hypothesis is that the exact nature of relationship is non-linear. The results support the null hypothesis that the log-linear specification is correct and reject the alternative hypothesis of linear relationship. These results provide strong empirical evidence to support the dynamic process discussed above. The results point towards a non-linear relationship between economic development and protection levels. The trend observed during the last decade, thus, may not be observed indefinitely.

Additional information on the influence of economic development and protection can be obtained through the calculation of wheat producer protection elasticity. A wheat
producer protection elasticity is defined as the percentage change in producer protection caused by a one unit change in the exogenous variable. The income elasticity of wheat protection is estimated to be 1.313 at the mean. This implies that each one percent increase in the level of per capita income would increase the producer subsidies to wheat farmers by approximately 1.3 percent.\(^6\) The findings corroborate earlier discussion about the society having an income-elastic demand for assisting agricultural producers.

**V.3 Non-Nested Tests for Model Specification**

Explanations of most economic phenomenon are beset with alternative or competing theoretical specifications. While two alternative explanations may be theoretically justifiable, no \textit{a priori} grounds exist for choosing one model over the other. For example, the \textit{PEAP} literature has developed along two different lines. While altruistic motives may be the reasons for protectionistic policies in the \textit{SWG} literature, the \textit{CHG} group of studies do not recognize such motives as the mainstay of political intervention. In the present study, the role of consumer benefits of food security from price stabilization may follow the altruistic motives more closely. Risk and uncertainty have been put as reasons for the social concerns view of the political economy of protection. The producer model, with political contributions towards lobbying, lies closer to the \textit{CHG} approach.

It would be interesting to analyze which of the two approaches is supported by the empirical evidence. If self-interest is the primary motivational force that explains the political preferences, then the producer model would be the "correct" specification. If, on the other hand, the social welfare is the true cause of intervention, the consumer model would hold.\(^6\) This result would be analogous to testing the relative strengths of consumers and producers in policy formulation across countries. The empirical evidence may also either reject both these models or embrace them both at the same time. In case the results are

\(^{61}\) Balisacan and Roumasset (1986) report an income elasticity of agricultural price protection of 3.23 whereas Herrmann (1989) reports the wheat price protection elasticity of 0.31.

\(^{62}\) It must be noted that in the agricultural policy formulation, the producer and consumer interests may not be mutually exclusive. A producer may also be a consumer while consumers may also be involved in the production process. Besides, the political leadership generally takes into account the interests of different groups in the society.
inconclusive, it may be inferred that the politicians' preferences do not accord superiority to either the SWG or the CHG approach.

The purpose here is not to propose an alternative model specification of the determinants of the political economy of agricultural protection. Rather, the aim is to evaluate the role of consumers' concerns that have been labeled as food security concerns in the study. The variables identified in the consumer model, such as the relative risk-aversion, Engel coefficients, income and price elasticities of demand, can be expected to sufficiently capture the consumers' preferences in this regard. These variables, then, can be alternated with the variables suggested by the producer model (such as, the number of farmers, the share of agricultural income, price elasticity of supply) to perform the pair-wise non-nested J tests as proposed by Davidson and MacKinnon (1981).

It is pointed out that a positive producer subsidy equivalent or an NPC greater than one does not necessarily suggest that the producer group has more political power, as is generally inferred in the PEAP literature (Miller, 1991). Providing subsidies to farmers to produce more may be in the general interest of the people. The non-nested tests in this section are, therefore, performed to check which group's concerns overweigh in the policy formulation since it cannot be ascertained just by observing the sign of the protection level.

V.3.1 The Empirical Model

The non-nested testing techniques can be employed to ascertain the superiority of one approach over the other. Using the classical work of Cox (1961, 1962), Pesaran and Deaton (PD, 1978) proposed procedures for testing the validity of a possibly nonlinear and multivariate regression model in the presence of a non-nested alternative hypotheses. Since then, Davidson and MacKinnon (DM, 1981) have put forth a relatively easier non-nested hypotheses test called the J test. They showed that the resulting test was asymptotically equivalent to the tests proposed by PD. Therefore, to test the consumer and producer

63 White (1982 and 1983) later showed that one of the test procedures proposed by DM can be directly obtained by implementing the Cox test in a straightforward manner. Later, Mackinnon, White and Davidson (1983) extended the results of DM by relaxing some of their assumptions and proposed a test for non-nested linear regression models in which some of the regressors are endogenous.
models, the present study shall employ the $J$ test as proposed by DM. A brief outline of the test is given below.

If the politician's preferences are formed only over the consumers' interests, the reduced form expression for $\tau^*$ would include the variables identified in the consumer model alone. In this case, the empirical model may be specified as:

$$\tau^* = C \alpha + e_C,$$

where, $\tau^*$ is a $(TN \times 1)$ vector of dependent variable, $\alpha$ is $(K \times 1)$ vector of coefficients and $C$ is a $(TN \times K)$ matrix of variables identified in consumer model (with $C_1 = 1$: intercept) and $e_C$ is a $(TN \times 1)$ vector of disturbances assumed to be normally distributed $N(0, \sigma^2_{e_C})$. If, on the other hand, the policy preferences are formed over the interests of commodity producers, the empirical model to be tested would be:

$$\tau^* = P \gamma + e_P$$

where $\gamma$ is an $(M \times 1)$ vector of coefficients, $P$ is a $(TN \times M)$ matrix of variables identified in the producer model (with $P_1 = 1$: intercept) and $e_P$ is a $(TN \times 1)$ vector of disturbances with $N(0, \sigma^2_{e_P})$. It is assumed that $C$ and $P$ cannot be written as a linear combination of each other.

These non-nested models may now be tested by the following hypotheses:

$$H_0: \tau^* = C \alpha + e_C,$$

$$H_1: \tau^* = P \gamma + e_P.$$

In applying the $J$ test, the first model can be fitted using the $OLS$ or the pooled cross-section time-series technique to obtain the parameter estimates:

$$\hat{\tau}^* = \hat{\alpha}^* C$$

where, $\alpha^*$ represents the estimated coefficients. In the second stage, the following model would be estimated using these parameter estimates:

$$\tau^* = \delta \{\alpha^* C\} + (1-\delta) \{\gamma P\} + e$$

where, $\delta$ is a "mixing" parameter. Now, the following hypothesis can be tested instead:

$$H_0: \delta = 0,$$

$$H_1: \delta \neq 0.$$
Since $\alpha^*$ will be asymptotically independent of $e$, therefore the conventional $t$-test can be used. If $\delta = 0$, then the test statistics would imply that the null hypothesis is not rejected. The next step in the pair-wise test is to proceed similarly with the producer model as the null hypothesis.

V.3.2 Results and Discussion

Two pair-wise non-nested tests are performed in this section. The first estimation uses the ordinary least squares estimation while the pooled cross-section time-series estimation technique was used for the second pair-wise tests. The following consumer and producer models are specified in both cases:

\[ T = \alpha_1 + \alpha_2 \text{ENGEL} + \alpha_3 (\text{ENGEL})^2 + \alpha_4 R_c + \alpha_5 \eta + e_c, \]

\[ T = \gamma_1 + \gamma_2 \ln \text{GDPAG} + \gamma_3 \text{FACTOR} + \gamma_4 P_{w,t,i} + \gamma_5 D_t \times E_{sp} + e_p. \]

The OLS estimation of these models yielded the following results:

\[ \tau^*_c = 105.97 + 3.138 \text{ENGEL} - 0.026 (\text{ENGEL})^2 - 98.864 R_c - 33.573 \eta, \]
\[ (7.10) (2.38) (-1.90) (-4.28) (-2.64) \]

\[ \tau^*_p = 82.216 - 15.6 \ln \text{GDPAG} - 11.913 \text{FACTOR} - 0.19 P_{w,t,i} + 30.894 D_t \times E_{sp}. \]
\[ (7.29) (-4.01) (-5.88) (-6.39) (3.88) \]

The predicted values of the dependent variables were saved from both models as $\hat{T}_c$ and $\hat{T}_p$, respectively. The figures in parentheses represent the $t$-statistics. All these variables are statistically significant at 1% level, except $(\text{ENGEL})$ which is significant at 10% level. Similar results were obtained from the pooled estimation where coefficients were all significant at 1% level except $(\text{ENGEL})^2$ (at 5%) and $P_{w,t,i}$ (10%), as given below:

\[ \tau^*_c = 103.63 + 5.169 \text{ENGEL} - 0.046 (\text{ENGEL})^2 - 115.57 R_c - 46.375 \eta, \]
\[ (5.43) (3.04) (-2.58) (-3.89) (-2.74) \]

\[^{64}\text{In case of more than two models, the procedure may be generalized along the similar lines.}\]
\[ \tau^*_p = 71.093 - 17.542 \ln GDPAG - 11.021 \text{FACTOR} - 0.042 P_{e, h, t} + 30.017 D_k x E_{sp}. \]

(5.73) (-4.05) (-7.11) (-1.84) (3.32)

To perform the pair-wise J tests, the consumer and producer models were then reestimated using OLS and pooled techniques, with alternating null hypotheses. The results of these tests are presented in Table V.8. The test statistics reported for the null hypothesis that the consumer model specified is the "correct" model are reported on the left hand side. The null hypothesis in agreement with the producer model is on the right. Under the consumer model, the \( t \)-statistic for the mixing parameter (\( \tau^*_p \)) in the OLS case was highly significant (1% level). The null hypothesis, thus, could not be accepted. Similarly, the \( t \)-statistic in the OLS estimation of the producer model was also significant at 1% level and the null hypothesis was rejected in this case too. No general conclusion, therefore, can be reached from the pair-wise J tests since the null hypotheses are rejected in both cases.

On the basis of the inconclusive nature of the results, it can be inferred that neither of the two approaches in PEAP literature is superior to the other. The pooled estimation, however, does provide conclusive results. The test statistics reported for the mixing parameter in case of consumer model was statistically insignificant. However, the mixing parameter in case of the producer model was significant at one percent level. The consumer model specification, thus, could not be rejected in either of the models. The pooled results, therefore, imply that the consumer model specified for explaining the cross-country variation in the protection levels is superior to the producer model. It is tempting to suggest that the food security concerns of consumers are relevant in the determination of farm programs across industrialized and developing countries. The results also indicate that social concerns do matter in the food policy formulation. This may have been due to the inclusion of many developing countries in the models that pursue "cheap food" policies for the poor consumers. The results, therefore, suggest that the pressure-group studies in the PEAP literature cannot ignore the consumer risk concerns. This result is contrary to the conclusions reached by
Table V.8: Results of the pair-wise non-nested $J$ tests

<table>
<thead>
<tr>
<th>Regressor</th>
<th>OLS</th>
<th>Pool</th>
<th>Regressors</th>
<th>OLS</th>
<th>Pool</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumer Model</strong></td>
<td></td>
<td></td>
<td><strong>Producer Model</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENGEL</td>
<td>2.876**</td>
<td>5.215*</td>
<td>In GDPAG</td>
<td>-2.211</td>
<td>-18.468*</td>
</tr>
<tr>
<td></td>
<td>(2.51)</td>
<td>(3.38)</td>
<td></td>
<td>(-0.528)</td>
<td>(-4.54)</td>
</tr>
<tr>
<td>(ENGEL)$^2$</td>
<td>-0.021***</td>
<td>-0.048*</td>
<td>FACTOR</td>
<td>-12.575*</td>
<td>-11.067*</td>
</tr>
<tr>
<td></td>
<td>(1.79)</td>
<td>(-2.89)</td>
<td></td>
<td>(-6.80)</td>
<td>(-8.40)</td>
</tr>
<tr>
<td>$R_d$</td>
<td>-48.775**</td>
<td>-111.34*</td>
<td>$P_w + l$</td>
<td>-0.139*</td>
<td>-0.069*</td>
</tr>
<tr>
<td></td>
<td>(2.31)</td>
<td>(-4.09)</td>
<td></td>
<td>(-4.88)</td>
<td>(-2.98)</td>
</tr>
<tr>
<td>$\eta$</td>
<td>-42.018*</td>
<td>-48.780*</td>
<td>$D_z \times E_{rp}$</td>
<td>10.434</td>
<td>21.774**</td>
</tr>
<tr>
<td></td>
<td>(-3.79)</td>
<td>(-3.26)</td>
<td></td>
<td>(1.30)</td>
<td>(2.53)</td>
</tr>
<tr>
<td>$\tau_p$</td>
<td>0.824*</td>
<td>4.623</td>
<td>$\tau^*_c$</td>
<td>0.805</td>
<td>9.904*</td>
</tr>
<tr>
<td></td>
<td>(7.66)</td>
<td>(1.17)</td>
<td></td>
<td>(6.02)</td>
<td>(3.09)</td>
</tr>
<tr>
<td>Intercept</td>
<td>22.156</td>
<td>95.091*</td>
<td>Intercept</td>
<td>36.85*</td>
<td>77.875*</td>
</tr>
<tr>
<td></td>
<td>(1.31)</td>
<td>(5.28)</td>
<td></td>
<td>(2.89)</td>
<td>(6.66)</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses represent the t-statistics. The parenthesized bold t-statistics are for the respective null hypotheses. Under the null hypotheses, the test statistics is distributed as standard normal. The critical value at the 0.01 level is 2.60 at 174 degrees of freedom.
* *, **, *** represent statistically significant at 1%, 5% and 10%, respectively.

Variyam et al. and Carter et al. who argue that the self-interest is the primary motivational force that explains political preferences.

V.4 Nested Tests for Model Specification

In the previous section, the consumer and producer models were estimated separately. In this section, the policy-makers' welfare function, as developed in Chapter IV, is estimated empirically with additional restrictions imposed. The analysis is performed in order to ascertain the joint significance or the extent of complementarity of the consumer and producer interests in the political welfare function. The specification of the empirical model is explained briefly in the next subsection. The results of the estimation and the nested hypotheses testing are provided in the second subsection.
V.4.1 The Empirical Model

The theoretical model of the policy-maker incorporates the variables from both consumer and producer models. The reduced form for the optimal policy instrument, $\tau^*$, becomes:

$$
\tau^* = \tau \left( \beta, R_c, \varepsilon, \eta, p, w, n, \psi \right)
$$

where the variables are as identified earlier. In this case, the following empirical model may be tested:

$$
\tau^* = \alpha_1 + \alpha_2 \beta + \alpha_3 R_c + \alpha_4 \varepsilon + \alpha_5 \eta + \delta_1 p + \delta_2 w + \delta_3 n + \gamma \psi + \mu
$$

where appropriate proxies can be used for the independent variables. If a model can be written as a special case of a more general model, the former is said to be nested in the latter model. In this case, the standard $F$-norm or the $t$-test statistics can be applied to discriminate between the structures (Holt and Johnson, 1986). In the above model, two separate nested tests can be conducted to ascertain the relative significance of the two groups in the political preference function.

To test whether only the variables identified in the producer model matter in the explanation of the protection levels, the test would be analogous to the hypothesis:

$$
H_0: \quad \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0,
H_1: \quad \alpha_2, \alpha_3, \alpha_4, \alpha_5 \neq 0.
$$

The resulting test statistic ($F$) can then be compared to $F$-values from the table to verify the hypothesis. If the test statistics support the null hypothesis, then it can be concluded that the above model should only include the variables identified in the producer model.

A similar test can be performed to ascertain whether only the variables identified in the consumer model should be included in the political preference function:

$$
H_0: \quad \delta_1 = \delta_2 = \delta_3 = 0,
H_1: \quad \delta_1, \delta_2, \delta_3 \neq 0.
$$
Accepting the null hypothesis in this case would amount to the conclusion that politician's preferences are formed only over the consumers' concerns regarding the optimal value of the policy instrument. In case that none of the hypotheses are rejected, the results would suggest that the political preference function incorporates both the producers' lobbying efforts as well as consumers' food security concerns.

V.4.2 Results and Discussion

The following general regression model was fitted with appropriate proxy variables to ascertain the significance of consumer and producer groups in the policy-makers' preference function:

\[
\tau^* = \alpha_1 + \alpha_2 \text{ENGEL} + \alpha_3 (\text{ENGEL})^2 + \alpha_4 R_c + \alpha_5 \eta \\
+ \delta_1 \ln \text{GDPAG} + \delta_2 \text{FACTOR} + \delta_3 P_{w,i,t} + \delta_4 D_t \times E_{ip} + e_p.
\]

The first four variables are as identified in the consumer model while the last four are from the theoretical model of agricultural producers, with \(e_p\) representing the error term. Separate regression analysis were performed using the OLS and pooled cross-section and time-series estimation techniques. The results of the hypothesis testing from the estimation are given in Table V.9.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>OLS</th>
<th>POOL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F-Statistic</td>
<td>DF</td>
</tr>
<tr>
<td>Only Producer Interests</td>
<td>10.45</td>
<td>4 and 171</td>
</tr>
<tr>
<td>Only Consumer Interests</td>
<td>17.45</td>
<td>4 and 171</td>
</tr>
</tbody>
</table>

Note: The critical value of F-statistic at 4 and 171 degrees of freedom and 1% level is 3.32.
The results indicate that the null hypothesis that only the producers' interests are taken into account by the policy-makers cannot be accepted at 1% level of significance under both the OLS and the pooled estimations. The calculated value of $F$-statistic under the OLS and the pooled estimation is 10.45 and 16.19, respectively while the critical value is 3.32. The results imply that consumer interests are also significant in explaining the cross-country variations in agricultural protection levels.

In the second test, the null hypothesis implies that only consumer interests matter in the politicians' preference function. In this case also, the alternate hypothesis is accepted implying that the producer interests too are not ignored by the political leadership in deciding the level of agricultural protection.

The results confirm that policy-makers take into account the interests of both producers and consumers. The pressure group characteristics of the producers and consumers' food security concerns are important elements of the policy preference function across industrialized and developing countries. These results further solidify the conclusions reached earlier that the SWG and CHG approaches are essentially complementary. The next section takes a different approach to determine the relative influence of different variables identified in the empirical models so far.

V.5 The Probit Model

The effects of the independent variables in the above models do not distinguish between whether the protection levels are positive or negative. In order to account for this outcome, and to ascertain the effects of these variables on the probability that the protection levels will be positive, the dependent variable can be modified. The producer subsidy equivalents can, therefore, be transformed to form a discrete choice model. The dependent variable may take a value of one or zero depending upon the way the variable is defined. In this case, the normal ordinary least square estimation will not yield efficient results and the Probit or Logit estimation techniques may be used based on the assumptions about the dependent variable.

*In fact, the dependent variable may be defined not only as a (1, 0) variable but also in the form of (1, 2, 3) or (0, 1, 2, 3) etc. depending upon the research criterion.*
distribution function. The estimated coefficients in case of Probit or Logit models cannot be interpreted as in the earlier models. The coefficients need to be modified to obtain the estimate of the effect that the independent variable will have on the probability of the dependent variable taking a specific value. Assuming a normal distribution function, the Probit procedure is briefly explained below and the results of estimation are provided in the last subsection.

V.5.1 The Empirical Model

In case of a discrete dependent variable, with values (0, 1) for example, a linear probability model may be estimated using the ordinary least squares technique. The resulting estimates of coefficients will be unbiased but will not reflect the minimum variance. The predicted values of the dependent variable will not be bound between zero and one (Pindyck and Rubinfeld, 1991; Greene, 1990; Maddala, 1983; Kmenta, 1986). Therefore, the estimates of coefficients will not be efficient. In order to overcome this problem, it is desired to transform the original model in such a way that predictions will lie in the (0, 1) interval for all values of the independent variables. Assuming a normal cumulative distribution function, the Probit estimation procedure may be used as follows.

Consider a model, \( y = \beta' x + \mu \), where \( y \) may be unobservable. Instead, the data may be available whether a particular observation of \( y \) falls in one category (\( y > 0 \)) or the other (\( y \leq 0 \)). The Probit analysis may be used to solve the problem of how to obtain the efficient coefficient estimates. Let \( z \) represent a binary variable which takes a value of one if \( y > 0 \), and zero otherwise. In this case, the probabilities that \( z \) takes a value of one or zero may be defined as:

\[
P_i = Pr(y > 0) = F(\beta' x), \quad \text{and} \quad (1 - P_i) = Pr(y \leq 0) = 1 - F(\beta' x),
\]

where, \( F(\cdot) \) is the normal cumulative distribution function of the error terms associated with the normal density function \( f(\beta' x) \). Then, the likelihood function for this case may be defined as:
\[ L(\beta, x, z) = \prod_{i=1}^{n_1} \Pr [z_i = 1] \cdot \prod_{i=n_1+1}^{N} \Pr [z_i = 0], \]

where \( n = 1, \ldots, n_1, n_1+1, \ldots, N \) are the observations, with first \( n_1 \) observations taking the value of one and the rest are zero. Alternatively, in terms of the distribution function,

\[ L(\beta, x, z) = \prod_{i=1}^{n_1} F_\mu (\beta' x) \cdot \prod_{i=n_1+1}^{N} [1 - F_\mu (\beta' x)]. \]

The maximum likelihood estimation (MLE) technique can be used to obtain the best, linear, unbiased estimates (BLUE) for the coefficients, \( \hat{\beta} \), by solving

\[
\frac{\partial L(\beta)}{\partial \beta} = \sum_{i=1}^{n_1} \left[ \frac{z_i - F_\mu}{F_\mu(1-F_\mu)} \right] \cdot f(\beta' x) = 0.
\]

Moreover, since \( z \) may only take values one or zero, the variance of error terms may be assumed as unity. However, the coefficient estimates in this case do not represent the marginal effects on the probability of the dependent variable taking a value of one. To obtain the estimates of the effects of independent variables on this probability, the estimated coefficients need to be transformed by taking the product of the estimated coefficient and the probability density function, \( \hat{\beta} \cdot f(\hat{\beta}' x) \). The resulting effect on the probability of dependent variable taking a value of one of a unit change in the \( i^{th} \) explanatory variable may, then, be calculated as follows:

\[
\frac{\partial \hat{P}_i}{\partial x_i} = \frac{\partial F(\cdot)}{\partial x_i} = \hat{\beta}_i \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2} (\hat{\beta}_i x_i)^2}.
\]

The usual \( t \)-statistics can now be used to test a hypothesis about the statistical significance of a single variable. The likelihood ratio test statistic, with a \( \chi^2 \) distribution, can be used in case of a joint hypothesis about more than one variables. A derivative of the Probit model is the Logit model which is based on the logistic cumulative distribution function. The logistic function closely approximates the distribution function of a normal variable (Judge et al., 1982). However, the coefficient estimates from Probit and Logit models are generally not significantly different as shown below.
V.5.2 Results and Discussion

To identify factors that affect the political positions of consumers and producers and the likelihood of producers being subsidized, a Probit model is estimated. The data on PSEs are grouped according to whether the protection is positive or negative. That is, the dependent variable, \( PSE_{\text{wheat}} \), was transformed such that \( z = 1 \) if \( PSE_{\text{wheat}} > 0 \), and \( z = 0 \) otherwise. In order to compare the results of Probit estimation with those provided by the linear probability and the Logit models, the same model was estimated using the Probit, OLS and Logit estimation techniques. The comparative results are provided in Table V.10.

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Linear Probability Model</th>
<th>Probit Model</th>
<th>Logit Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Coefficient</td>
<td>t-Statistic</td>
<td>Estimated Coefficient</td>
</tr>
<tr>
<td>Engel Coefficient</td>
<td>-0.009*</td>
<td>-3.45</td>
<td>-0.033**</td>
</tr>
<tr>
<td>Labor Force in Industry</td>
<td>0.006</td>
<td>1.38</td>
<td>0.045</td>
</tr>
<tr>
<td>Income Elasticity (( \eta ))</td>
<td>-0.556**</td>
<td>-3.91</td>
<td>-3.276*</td>
</tr>
<tr>
<td>Factor Ratio</td>
<td>-0.087*</td>
<td>-3.51</td>
<td>-0.606*</td>
</tr>
<tr>
<td>World Price (Lagged)</td>
<td>-0.001*</td>
<td>-2.97</td>
<td>-0.006*</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.148*</td>
<td>5.42</td>
<td>2.92**</td>
</tr>
<tr>
<td>Cragg -Uhler R²</td>
<td>0.54</td>
<td></td>
<td>0.71</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>126.94 at 5 d.f.</td>
<td></td>
<td>126.05 at 5 d.f.</td>
</tr>
<tr>
<td>Percent of Correct Predictions</td>
<td>86.67</td>
<td></td>
<td>86.11</td>
</tr>
</tbody>
</table>

Note: In case of the Linear Probability Model, the coefficient of determination is the Adjusted R². * Statistically significant at 1% level. ** Statistically significant at 5% level.
The results from the linear probability model show significant impact of Engel coefficient, income elasticity of demand, factor ratio and the previous year's world price on the probability that the farmers in that year would receive subsidies. All these coefficients have the expected negative sign indicating that a unit increase in these variables decreases the probability of farmers being subsidized. The results of the Probit and Logit models are not very different from the linear probability model. All the coefficients on the Probit model are consistent with the theory and validate earlier results. The Cragg-Uhler $R^2$ coefficient is 0.71 and the model predicted the correct outcome 86.7 percent of the time. However, the numerical implications of the models yield different interpretation of the estimated coefficients. Further, when the individual coefficients are considered, it is the relative magnitude that matters and not the absolute size of the coefficients. For example, in the Probit and Logit models, the coefficient on the income elasticity is about a 100 times that on the Engel coefficient. The incomes elasticity coefficient in the linear probability model is only 62 times as large as the Engel coefficient. However, as discussed, the estimates provided by the linear probability estimation technique are inefficient, and, therefore, the Probit model is superior.

As mentioned above, the estimated coefficients in case of Probit as well as Logit models do not represent marginal effects on the probability of the producer protection being greater than zero. These coefficients indicate a movement along the cumulative distribution function for a unit change in the explanatory variable. The Probit coefficients indicate the direction of change in the probability of $PSE_{wheat}$ being positive, but not necessarily a measure of the magnitude of the change. These coefficients have to be transformed to be interpreted as the marginal effects and are given in Table V.11.

The marginal probabilities in the Probit model vary depending upon the original level of probability while in the OLS model, the marginal probabilities are constant (Pindyck and Rubinfeld, 1991). The results given in Table V.11 are calculated at the mean values of the independent variables. The mean values used in the transformation, along with their standard deviations, are provided in Table V.12.
Table V.11: Marginal effect coefficients and elasticities of positive protection levels predicted by the Probit and Logit models

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Probit Model</th>
<th>Logit Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marginal Coefficient</td>
<td>Elasticity at Mean</td>
</tr>
<tr>
<td>Engel Coefficient</td>
<td>-0.012</td>
<td>-0.303</td>
</tr>
<tr>
<td>Labor Force in Industry</td>
<td>0.016</td>
<td>0.382</td>
</tr>
<tr>
<td>Income Elasticity (η)</td>
<td>-1.157</td>
<td>-0.255</td>
</tr>
<tr>
<td>Factor Ratio</td>
<td>-0.214</td>
<td>-0.18</td>
</tr>
<tr>
<td>World Price (Lagged)</td>
<td>-0.002</td>
<td>-0.241</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.033</td>
<td>1.122</td>
</tr>
</tbody>
</table>

Table V.12: Means and standard deviations of selected explanatory variables

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engel Coefficient</td>
<td>30.567</td>
<td>15.172</td>
</tr>
<tr>
<td>Labor Force in Industry</td>
<td>28.028</td>
<td>8.9706</td>
</tr>
<tr>
<td>Income Elasticity (η)</td>
<td>0.256</td>
<td>0.288</td>
</tr>
<tr>
<td>Factor Ratio</td>
<td>0.977</td>
<td>1.107</td>
</tr>
<tr>
<td>World Price (Lagged)</td>
<td>138.08</td>
<td>76.978</td>
</tr>
<tr>
<td>Growth Rate of Agricultural Labor Force</td>
<td>-2.004</td>
<td>1.103</td>
</tr>
<tr>
<td>Gross National Product</td>
<td>337,230</td>
<td>803,880</td>
</tr>
<tr>
<td>Price Elasticity- Demand (ε)</td>
<td>-0.401</td>
<td>0.209</td>
</tr>
<tr>
<td>Price Elasticity- Supply (εp)</td>
<td>0.625</td>
<td>0.29</td>
</tr>
</tbody>
</table>
The coefficients indicate the effect of a one unit change in the independent variable, *ceteris paribus*, on the probability of producers being subsidized. Both the Probit and Logit models provide similar estimates for the elasticities. For example, the Probit model predicts that a one percent increase in the Engel coefficient will decrease the probability of producer subsidies by 0.303 percent. A comparison of these results shows that the Probit and Logit models also yield significantly similar coefficient estimates. For example, the models yield same predictions for the effect of a unit increase in the Engel coefficient or the previous year's world wheat price on the probability of farmers receiving subsidies. A one unit increase in the factor ratio would decrease their probability of being subsidized by 0.214 in case of Probit model and 0.246 in the case of Logit model.

Probit estimates for some alternative model specifications with some additional variables are also performed and the results are reported in Table V.13, along with the mean elasticities. The marginal coefficients are reported in case of model (1) only. In models (1) and (3), the gross national product (GNP) was a significant additional variable that affects the probability of producer protection. The elasticity of the GNP and the Engel coefficient at their mean values, are the most significant among the variables considered. In case of Engel coefficients, which range between 11 to 61 percent across the sample, a one percent increase is expected to decrease the probability of positive protection levels by 0.02. The income elasticity of demand has the largest effect on this probability. A one unit increase in income elasticity of wheat is expected to decrease the probability of wheat farmers being subsidized by about 0.91.

The Cragg-Uhler $R^2$ for these models ranges between 0.71 to 0.73 and the models predicted the correct outcome about 87 percent of the time. The results of this section highlight the impact of each explanatory variable on the probability that the domestic producers would receive positive protection. The results validate the findings reported in earlier subsections. All the independent variables have the correct sign with most of them highly statistically significant.

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Since the cumulative distribution function is assumed to be standard normal, and Logit results are not different from the Probit model, the table reports only the results for the Probit estimation.
Table V.13: Probit estimates to explain the probability of positive producer protection levels

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1)</th>
<th></th>
<th>(2)</th>
<th></th>
<th>(3)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated</td>
<td>Elasticity</td>
<td>Marginal</td>
<td>Estimated</td>
<td>Elasticity</td>
<td>Estimated</td>
</tr>
<tr>
<td></td>
<td>Coefficient</td>
<td>at Mean</td>
<td>Coefficient</td>
<td>at Mean</td>
<td>Coefficient</td>
<td>at Mean</td>
</tr>
<tr>
<td>Engel Coefficient</td>
<td>-0.043**</td>
<td>-0.082</td>
<td>-0.016</td>
<td>-0.039**</td>
<td>-0.378</td>
<td>-0.091</td>
</tr>
<tr>
<td></td>
<td>(-2.28)</td>
<td></td>
<td></td>
<td>(-2.44)</td>
<td></td>
<td>(-2.5)</td>
</tr>
<tr>
<td>Labor Force in Industry</td>
<td>0.04</td>
<td>0.069</td>
<td>0.015</td>
<td></td>
<td>0.041</td>
<td>0.076</td>
</tr>
<tr>
<td></td>
<td>(1.27)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income Elasticity (η)</td>
<td>-2.404**</td>
<td>-0.038</td>
<td>-0.905</td>
<td>-3.634*</td>
<td>-0.296</td>
<td>-2.35**</td>
</tr>
<tr>
<td></td>
<td>(-2.0)</td>
<td></td>
<td></td>
<td>(-3.56)</td>
<td></td>
<td>(-2.23)</td>
</tr>
<tr>
<td>Factor Ratio</td>
<td>-0.577*</td>
<td>-0.035</td>
<td>-0.223</td>
<td>-0.641*</td>
<td>-0.199</td>
<td>-0.566*</td>
</tr>
<tr>
<td></td>
<td>(-3.61)</td>
<td></td>
<td></td>
<td>(-4.05)</td>
<td></td>
<td>(-3.59)</td>
</tr>
<tr>
<td>World Price (Lagged)</td>
<td>-0.005**</td>
<td>-0.044</td>
<td>-0.002</td>
<td>-0.005*</td>
<td>-0.244</td>
<td>-0.005**</td>
</tr>
<tr>
<td></td>
<td>(-2.36)</td>
<td></td>
<td></td>
<td>(-2.68)</td>
<td></td>
<td>(-2.43)</td>
</tr>
<tr>
<td>Growth Rate of Agricultural Labor</td>
<td></td>
<td></td>
<td></td>
<td>-0.175</td>
<td>-0.111</td>
<td></td>
</tr>
<tr>
<td>Force</td>
<td></td>
<td></td>
<td></td>
<td>(-0.78)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross National Product</td>
<td>0.000004***</td>
<td>0.083</td>
<td>0.000001</td>
<td></td>
<td>0.000004**</td>
<td>0.086</td>
</tr>
<tr>
<td></td>
<td>(1.88)</td>
<td></td>
<td></td>
<td></td>
<td>(2.1)</td>
<td></td>
</tr>
<tr>
<td>Price Elasticity-Demand (e)</td>
<td>-0.027</td>
<td>-0.0007</td>
<td>-0.043</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-0.023)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price Elasticity-Supply (e^p)</td>
<td>0.259</td>
<td>0.01</td>
<td>0.081</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.43)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>2.529***</td>
<td></td>
<td></td>
<td>4.08*</td>
<td></td>
<td>2.72**</td>
</tr>
<tr>
<td></td>
<td>(1.73)</td>
<td></td>
<td></td>
<td>(4.32)</td>
<td></td>
<td>(2.04)</td>
</tr>
<tr>
<td>Cragg -Uhler R²</td>
<td>0.73</td>
<td></td>
<td></td>
<td>0.71</td>
<td></td>
<td>0.73</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>132.18 at 8 d.f.</td>
<td></td>
<td></td>
<td>125.29 at 5 d.f.</td>
<td></td>
<td>132.0 at 5 d.f.</td>
</tr>
<tr>
<td>Percent of Correct Predictions</td>
<td>87.78</td>
<td></td>
<td></td>
<td>86.11</td>
<td></td>
<td>86.67</td>
</tr>
</tbody>
</table>
The results of the empirical analysis in this chapter provide a significant contribution to the understanding of the agricultural protectionistic policies across industrialized and developing countries. The theoretical models developed earlier have been validated here. The analysis, in general, suggests a complementarity between the CHG and SWG approaches. However, in the case of pooled cross-section time-series tests of model specification, the model representing consumers' food security concerns (the SWG approach) has found stronger support. The results corroborate the public support argument of government intervention in the presence of risk and uncertainty.
The purpose of this study has been to investigate the prominent determinants of agricultural protection across industrialized and developing countries. The hypotheses tested are that consumers' food security concerns and producers' pressure group characteristics play an eminent role in the determination of political market equilibrium in the agricultural sector. The methodology employed provides an integrated development of theoretical and empirical analysis.

The political economy of agricultural protection literature has progressed along two distinct paradigms of the interactions among the economic agents: the self-willed government (SWG) models and the clearing house government (CHG) models. The first approach assumes that the government is an autonomous unit maximizing a social welfare function. The CHG approach treats the political process as a clearing house where a relatively passive government redistributes resources among different interest groups. These two approaches, therefore, represent two extremes in terms of their explanation of the political economy of agricultural protection. In this study, the two approaches have been viewed as complementary explanations of government intervention.

Chapter II provides a review of studies in agricultural protection literature pertaining to these two paradigms. The food security and price stabilization literature has also been reviewed in a separate section. The section highlights that food programs and food price stabilization policies seem responsive, in part, to consumers' attitudes towards food insecurity risk. The focus of this section is not on evaluating the best and most efficient instruments of achieving food security. Rather, the purpose is to emphasize the linkage between the food security concerns of consumers, price stabilization policies and government intervention in the agricultural sector. However, these concerns have not been explicitly incorporated in the earlier studies on the determinants of agricultural protection.
The purpose of Chapter III has been to provide an analytical overview of the political economy market of agricultural protection. The chapter begins by providing a simple political market framework of agricultural protection in order to explain the factors that lead to divergent policy outcomes across industrialized and developing countries. Since an accurate measurement of the actual level of intervention is a prerequisite for the effectiveness of the analysis, a comprehensive comparative analysis of different measurement concepts and their respective policy coverage is also discussed at length. The choice of the measurement concept to be used in the empirical analysis that emerges from this analysis apparently favors the producer subsidy equivalents (PSEs) on the basis of their comprehensiveness and wider coverage of different policies and their suitability to analyze the extent of government intervention across countries. A graphical exposition of the policy effects captured by some selected measurement concepts is provided under many different scenarios and market conditions. Finally, the case of price discrimination, where foreign markets are competitive and domestic market is monopolized, is also discussed at the end of the chapter. The analysis reveals the superiority of the PSE concept over other alternative measures of agricultural protection.

The theoretical models developed in Chapter IV incorporate two analytical viewpoints. The self-interest of individuals seeking personal benefits is combined with the larger societal goals representing altruistic motives. The consumers seeking government intervention in the agricultural sector to reduce the risk of food insecurity are viewed from the larger societal perspective. It is postulated that the perceived benefits from improved food security through stabilization of food prices translates into preferences of the consumers. These perceived benefits constitute the demand for intervention from them. Since incomes and the size of risk in relation to income vary from society to society, this generates varying degree of demand from consumers across countries. The comparative static results of the model indicate that the share of food in consumers' household budget, their incomes, degrees of relative risk-aversion, and price and income elasticities are important variables that affect their demand for protection. This section, thus, proposes an alternative hypothesis to explain
the causes of government intervention in the agricultural sector and identifies the linkages between food security, price stabilization and PEAP policies. Consumers accept government intervention because of the benefits of food security accruing to them. This altruistic motive has largely been ignored in the PEAP literature so far.

The self-interest elements, on the other hand, are the mainstay of the producer model. Producer group contributes resources to lobby the government in seeking agricultural subsidies to enhance their profits. The level of contribution is shown to differ across countries depending upon factors such as the size of the producer group, their incomes and its ability to control free-riding by the members. The effectiveness with which the group can exert political pressure then depends upon the perspective gains to the members. The results of the model point out that the number of farmers, their incomes, the mean of free-market prices and productivity are some of the important factors impacting the political resource contributions. Since there is significant variation in these variables across industrialized and developing countries, the demand for protection would also vary across these countries.

Therefore, the overall demand for government intervention in the agricultural sector is shown to be created by the relative influence of these two groups in a given society. The political supply of intervention from the policy makers is assumed to respond to both these groups. The political leadership forms policy preferences by taking into account the marginal effects of policy outcomes on the utility of consumers and the profits of producers. The society's preferences are then transformed into programs and policies to the extent permitted by the available resources, including fiscal resources and bureaucratic capacity. The factors and relationships that determine the degrees of subsidies or taxation to any group would depend upon the compatibility or conflict between the interests of these two groups and the government's treasury position. These results are subject to empirical tests in Chapter V.

The results of the empirical analysis provide a significant contribution to the understanding of the agricultural protectionistic policies across industrialized and developing countries. The theoretical models developed earlier have been validated here. The analysis uses the ordinary least squares, generalized least squares, pooled cross-section time-series,
and Probit and Logit estimation techniques to test the data from 30 industrialized and developing countries for the period 1982-87. The relative effectiveness of the consumer and producer models have been examined using the non-nested as well as nested testing procedures.

The variables identified in the consumer and producer models have been empirically tested and all were found to be highly statistically significant. The political welfare function was able to explain up to 82 percent (the Buse Raw-Moment $R^2$ was about 0.93) of the variation in the protection levels across countries. An important variable associated with the political leadership's decision-making process is found to be the government finance which states the surplus or deficit position of the treasury. This indicates that the governments with lower deficits are able to supply more subsidies to the farm sector.

In order to correctly specify the functional relationship between some important explanatory and the dependent variables, the model specification tests are performed. The results in case of the GNP suggested a non-linear relationship with the level of protection. This result supported the dynamics of the demand for agricultural protection discussed in Section V.2.4. The model specification tests in case of the Engel coefficients were inconclusive since the results did not favor any of the specifications -- linear, log-linear and quadratic -- over one another.

Davidson and MacKinnon's pair-wise $J$ tests have been used to analyze the *superiority* of the two approaches in the PEAP literature. If self-interest, or the CHG approach, is the primary motivational force that explains the political preferences, then the producer model would be the "correct" specification. If, on the other hand, the social welfare (the SWG approach) is the true cause of intervention, the consumer model would hold. This test is also analogous to determining the relative strengths of consumers and producers in policy formulation across countries. The results from the OLS analysis did not yield conclusive results regarding the superiority hypothesis. However, in the case of pooled cross-section time-series tests of model specification, the model representing consumers' food security concerns has found stronger support. Therefore, the results suggest that the food
security concerns of consumers are relevant in the determination of farm programs across industrialized and developing countries. This also indicates that the social concerns do matter in the food policy formulation. The results, therefore, point out that the pressure-group studies in the PEAP literature cannot ignore the consumers' risk concerns as an important determinant.

The earlier PEAP studies have viewed the protectionistic policies as either the outcomes of altruistic motives or as being determined by the self-interest motives. However, PEAP economists have, of late, begun to point out the complementarity between the altruistic and self-interest motives in the policy formulation. To evaluate this contention, the nested tests are performed by imposing restrictions on the political welfare function. On the basis of the results it can be inferred that the variables from both consumer and producer models have significant effect on the level of protection awarded to wheat farmers and neither can be ignored. Both significantly explain protection but none alone is sufficient. The results confirm that policy-makers take into account the interests of both producers and consumers. The pressure group characteristics of the producers and consumers' risk concerns are important elements of the political welfare function across industrialized and developing countries. Therefore, a significant implication of the results is that both SWG and CHG approaches are complementary.

In order to ascertain the effects of the explanatory variables on the probability that the protection levels will be positive, the Probit estimation procedure is used. For comparison purposes, the results of linear probability and the Logit models are also provided. The results regarding the marginal effects of explanatory variables as well as their mean elasticities are also provided. Signs of all the variables in Probit and Logit models were essentially the same as those determined by the OLS and pooled estimations. The Craigg-Uhler $R^2$ values obtained were as high as 0.73. The results suggest that the probability of positive protection levels is highly sensitive to the changes in the Engel coefficients, the gross national product, income elasticity of demand for wheat, factor ratio and the lagged world prices. As expected,
there were no significant difference between the coefficient estimates provided by the Probit and Logit models.

Overall, this study represents a first systematic and comprehensive attempt at explaining international agricultural protection across countries. The study proposes an alternative hypothesis to explain the determination of international agricultural protection. The results of the hypothesis testing corroborate the public support argument of government intervention in the presence of risk and uncertainty. The relative superiority and complementarity of the CHG and SWG approaches has been examined whereas the earlier PEAP studies have concentrated on either of the two approaches. The models were also tested for correct specification of important variables. The study improves upon earlier works in the PEAP literature in a number of other ways also.

First, an attempt has been made to provide an integrated theoretical and empirical justification for the determinants of protection. The study is more complete since the empirical analysis is based on a well-founded theoretical framework whereas most of the earlier quantitative works are based on \textit{ad hoc} specifications of their empirical models.

Second, the study provides a broad coverage of the determinants emanating from the interactions between the interest groups of consumers, commodity producers and the political leadership. All the variables suggested by the theoretical models are highly statistically significant in explaining the protection levels. The overall results of the analysis are very robust in that up to 83 percent variation in protection has been accounted for by the models. In contrast, many earlier studies have reported $R^2$ values between 20 to 35 percent only with many variables showing insignificant contribution in explaining the protection levels (see for example, Herrmann, 1989; Miller, 1991; Gardner, 1987 etc.).

Third, a more comprehensive and flexible measure of agricultural protection levels, the producer subsidy equivalent, has been used throughout the analysis after analyzing and comparing the effectiveness of various alternative measures of protection. This measurement concept encompasses the effects of the broadest range of direct and indirect distortionary policies. In contrast, the earlier studies have commonly used the wedge between the
domestic and world prices, which is, at best, only a partial indication of how government affects domestic production.

Fourth, the analysis concentrates on a specific staple food commodity, thus avoiding the problems associated with averaging the positive and negative protection levels across commodities. This is especially important in developing countries, since certain commodities in these countries are taxed while some others are subsidized. Finally, the analysis uses a broad sample of developing and industrialized countries in order to identify some consistent and prominent patterns of international agricultural protection.
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