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Identification of patterns of producer and consumer protection levels in food commodities: a cross-country, aggregate and commodity-specific analysis

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Identification of patterns of producer and consumer protection levels in food commodities: A cross-country, aggregate and commodity-specific analysis

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CHAPTER I. INTRODUCTION

I.1 The Problem

The agricultural sector in almost all the countries is characterized by substantial government intervention (USDA, 1990; OECD, 1991). Governments in various countries implement markedly different food and agricultural policies resulting in sharply contrasted patterns of protection. A predominant pattern of government involvement across countries in agriculture is that while producers are subsidized in industrialized countries, developing countries tend to tax their agricultural sector (Olson, 1985 and 1988; de Gorter and Tsur, 1990; Anderson and Tyers, 1989; de Janvry, 1983; Bale and Lutz, 1981; Binswanger and Scandizzo, 1983). On the other hand, food commodities are generally overpriced and are relatively expensive in industrialized countries (Schultz, 1978) while developing countries strive to provide food at substantially lower prices to consumers (Balisacan and Roumasset, 1987; Byerlee and Sain, 1986; Peterson, 1979; Lutz and Scandizzo, 1980).

There has been a growing interest in identifying and analyzing the patterns of agricultural protection (Lee, 1989; Paarlberg, 1989; Gardner, 1989; and Collins 1989). Econometric evidence for patterns of overall agricultural protection, within or across selected industrialized or newly industrialized countries are available in Anderson and Hayami (1986), Honma and Hayami (1986), Gardner (1987), and Yamauchi and Kwon (1989). However, studies examining this pattern across industrialized and developing countries are relatively few (for instance, Balisacan and Roumasset) and have been less satisfactory in their explanation of cross-country variation in protection levels (Herrmann, 1989; Gautam and Chaudhary, 1992).

Most of the earlier work have not concentrated on a product-specific approach to agricultural protection and have rather focused on an aggregate approach to total agricultural protection. Protection levels vary significantly across agricultural commodities (Herrmann; Olson, 1986). For instance, while producers of rice and

wheat are taxed in India, rapeseed and peanut growers are provided subsidies. Thus, a product-specific approach seems necessary (Herrmann; Gautam et al., 1991; and USDA, 1988).

Moreover, the coverage of the determinants of agricultural protection has also been limited in earlier studies. While Honma and Hayami considered the impact of industrialization and economic growth, Anderson and Tyers (1989) and Balisacan and Roumasset determine a correlation between agricultural protection and per capita national income, and Herrmann studied the impact of economic development and import dependence on wheat protection in wheat importing countries.

The present study is more comprehensive in terms of its coverage of the patterns of protection as it also concentrates on demand characteristics of individual commodities, regional patterns of protection, importance of the commodity in daily diet, Engel coefficient, instability of production and food security issues. Since the source of producer support are taxpayers and consumers (Blandford, 1990), examination of the influence of these factors on agricultural protection seems pertinent. However, the study of determination of agricultural protection from consumers' point of view has largely been ignored or studied in isolation (Balisacan and Roumasset; and Byerlee and Sain).

Earlier studies have used variations of nominal protection rate (NPR) as a measure of agricultural protection level. However, direct price comparisons between farm prices and border prices, used in the computation of NPRs, do not include government subsidies such as deficiency payments and other direct support measures (USDA, 1990). NPR estimates fail to measure the full extent of intervention (Josling and Tangermann, 1989). In order to overcome this problem, this study would use the Producer and Consumer Subsidy Equivalents (PSE and CSE), the more comprehensive and flexible measures of the level of protection that attempt to capture transfers occasioned by price and non-price policies made to domestic producers and consumers through government policies (Josling and Tangermann;

Schiff, 1989; and Blandford, 1990). A comparative analysis for these different measures of protection, along with their policy coverage, is also provided at the beginning of the next section.

I.2 Purpose of the Study

In this study an attempt would be made to identify some consistent and regular patterns of agricultural protection in a commodity specific as well as in an aggregate approach. The specific protection patterns for some individual commodities are highly sensitive to changes in the explanatory variables studied as compared to the overall agricultural protection. Some regional patterns may also be observed in the protection awarded to specific agricultural commodities as well as to the whole agricultural sector. Although such patterns are tremendously complex and are also influenced by unique country-specific characteristics, in order to be able to economically theorize such patterns, it is imperative to identify the most consistent and regular among these that are prevalent across countries. Therefore, unlike most of the earlier works, the scope of this study would include both industrialized as well as developing countries and compare and contrast their protectionistic patterns. The influence of demand characteristics of commodities on these patterns would also be studied. A more comprehensive measure of the level of intervention would be adopted that can measure both direct and indirect transfers to agricultural producers and consumers.

Moreover, the patterns of agricultural protection would be studied in isolation with regard to the influence of individual factors to facilitate improved comprehension of such patterns. However, the focus of this attempt is not an in-depth analysis of individual patterns but rather identification of some regular patterns especially in the consumer protection levels.

I.3 Scope of the Study

The study uses the data on producer subsidy equivalents and consumer subsidy equivalents as well as on a number of explanatory variables for the period 1982-87. The analysis is performed for the agricultural sector as a whole as well as for individual commodities like wheat, rice and milk, for 32 industrialized and developing countries: *Argentina, Australia, Austria, Bangladesh, Brazil, Canada,Chile, China, EC-10, Egypt, Finland, India, Indonesia, Japan, Kenya, Mexico, Nigeria, New Zealand, Norway, Pakistan, Poland, South Africa, South Korea, Sweden, Switzerland, Taiwan, Thailand, Turkey, United States, U.S.S.R. and Yugoslavia*. However, data limitations on the dependent variables (PSE and CSE) restricted the analysis to selected countries for specific commodities. The data on PSE and CSE were collected form USDA (1990, and 1991) and OECD (1991). There are some differences in these two sets of PSE and CSE estimates, but they are broadly comparable (Blandford). The PSEs and CSEs for all commodities are weighted averages of a commodity bundle according to their respective producer values. The commodities included in a commodity bundle vary across countries due to lack of availability of information.[1] The averages used in the graphical analysis are simple averages over the period covered. The data on independent variables were collected from various issues of *International Financial Statistics*, *World Development Report*, and *FAO Food Balance Sheets*. The exchange rates for domestic currencies of different countries are adjusted exchange rates for countries with exchange rate distortion policies.[2]

The results are presented in the form of graphical, tabular and empirical estimations. The graphical analysis is based upon average values for the period 1982-87. The regression analysis does not include U.S.S.R. since the data was available

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[1] For more details, see USDA, ERS (1990), *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87.*

[2] See footnote above. Exchange rates used in the calculation of PSEs and CSEs for OECD countries are provided in OECD (1991), *Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.*

only for 1986. The empirical estimation uses ordinary least squares technique for the pooled cross-section and time-series regression analysis. However, it must be cautioned that some of the explanatory variables used in this analysis are not really independent of the dependent variable. Also, there may exist some collinearity among some of the explanatory variables. Considering the possibility of bias due to the problems of simultaneity and collinearity, the results of the regression analysis must be interpreted with caution. The analysis on identification of protectionistic patterns is performed for individual commodities as well as the whole agricultural sector with respect to both producers and consumers.

I.3 Organization of the Study

The rest of the study is organized into six sections dealing with some prominent patterns of agricultural protection. The next section contains the overview of these patterns across industrialized and developing countries highlighting some general features. A comparative analysis of different measures of protection is also provided along with some observable regional patterns of protection. Section III focuses on the relationship between the national income aggregates and the level of protection. The influence of the import dependence and trade nature of the commodity on the protection awarded is documented in Section IV. Cross-country protection patterns relating to the demand characteristics of individual commodities have been contrasted against the aggregate level of protection in Section V. The effect of group size and relative share of agriculture in employment are discussed in Section VI. Section VII focuses on the relationship of consumer food security and self-sufficiency and production instability issues with protection levels across countries. Salient features of the study are summarized in the final section. References are provided at the end of the manuscript.

CHAPTER II. GENERAL PATTERN OF AGRICULTURAL PROTECTION ACROSS COUNTRIES

II.1 The Measurement for the Level of Protection

Government intervention in agriculture comes through various policies that affect the returns to farmers for their products both directly (including those affecting inputs and outputs) and indirectly (which are economy-wide policies such as exchange rate manipulations) (Krueger, 1989). Any particular commodity may be affected by a number of different agricultural programs. To study the overall level of intervention, therefore, the aggregate measure of protection employed should be capable of combining the effects of diverse policies on the commodity (Schwartz and Parker, 1988). Different studies have used alternative measures with different meanings, uses and degrees of complexity in an attempt to determine the actual level of protection (Josling and Tangermann, 1989).

Of these different indicators, the most simple and commonly used (for example, Honma and Hayami, 1986; Balisacan and Roumasset) is the nominal rate of protection (NRP) or the Nominal Protection Coefficient (NPC). A relatively more accurate but complex measure od protection is the Effective Rate of Protection (ERP). However, since the publication of Corden's (1966) paper, the stringent information requirements in using ERP as a measure of protection have led to the development of alternative proxies like the producer subsidy equivalent (PSE), a measure that has recently received particular attention in the political sphere, such as the General Agreement on Tariff and Trade (GATT) (USDA, 1990; OECD, 1991; Landes; Josling and Tangermann). The PSE, which was initially introduced by Josling (FAO), is being adopted on an ongoing basis in OECD and USDA and also in international trade forums. These alternative measures of protection, along with their relative strengths and weaknesses, are discussed below.

II.1.1 Definitions of alternative measures of agricultural protection

Table 1 provides mathematical formulas and the types of policies covered for some alternative measures of protection like the NPC, NPR, ERP, PSE, NPRC (Nominal Rate of Protection for Consumers) and CSE (Consumer Subsidy Equivalents). The NPC is defined as the ratio of domestic prices to border prices (converted to domestic currency) while the NPR measures the protection level by calculating prices received by domestic producers as a percentage *of border prices. NPR measures how output prices received by domestic producers change in response* to government policies. NPRC, on the other hand, measures the consumer protection levels by taking the percentage difference between the domestic consumer price and the border price. It records how market price for consumes are altered by border measures (Schwartz and Parker). However, NPC, NPR and NPRC accurately measure the policy effects at the output level only (Josling and Tangermann). Intervention in the input market, such as taxes and subsidies on intermediate and primary inputs, as well as other output policies such as direct transfers to producers (deficiency payments), are not captured by these measures. As Schwartz and Parker point out, these measures are only partial indications of how intervention policies influence domestic production.

The effective rate of protection (ERP), on the other hand, is 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; Josling and Tangermann). ERP is calculated as the percentage difference in the unit value added at domestic prices and at border prices, converted into the domestic currency (Lutz and Scandizzo). 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 agriculture, the superiority of ERP over NPR is most apparent in sectors such as grain-fed livestock. In this sense, the ERP may be a useful tool to analyze the resource misallocation among various sectors of an economy. However, a number of policies, such as

Table 1: Alternative Measures of Agricultural Protection

Measure[a]	Definition[b]	Policy Coverage: Border Policies	Output Price Policies	Other Output Policies[c]	Primary Input Policies	Interm. Input Policies	Consumer Prices	Consumer Taxes and Subsidies
Producer Protection								
NPC	$PD / e P_w$	X	X					
NPR	$\{PD - e P_w\} / e P_w$		X	X				
ERP	$\{VA - e VA_w\} / e VA_w$	X	X			X		
PSE	$\frac{Q (PD - e P_w) + D + I}{Q \bullet PD + D}$	X	X	X	X	X		
Consumer Protection								
NPRC	$\{PC - e P_w\} / e P_w$		X					X
CSE	$\frac{Q (PC - e P_w) + DC}{Q \bullet PC + DC}$	X					X	X

a The measures for protection refer to a single agricultural commodity. NPC: Nominal Protection Coefficient; NPR: Nominal Protection Rate; ERP: Effective Rate of Protection; PSE: Producer Subsidy Equivalent; NPRC: Nominal Protection Rate for Consumers; CSE: Consumer Subsidy Equivalents.

b PD: Domestic Producer Price; P_w: World Price (in world currency units), which is same as the border price of the commodity; e: exchange rate conversion factor; VA: Value Added at Domestic Prices; VA_w: Value Added at World Prices; Q: Domestic Output of the Commodity; D: Direct Government Payments to Domestic Producers; I: Indirect Transfers to Producers (e.g., input subsidies, market assistance etc.); PC: Domestic Consumer Price; DC: Direct and/or Indirect Payments to Domestic Consumers.

c Other Output Policies are defined as policies with ambiguous and/or disproportionate price effects.

Sources: USDA, ERS (1990), *Producer and Consumer Subsidy Equivalents: 1982-87*; Schwartz, N. E. and S. Parker (1988), "Measuring Government Intervention in Agriculture for the GATT Negotiations" *American Journal of Agricultural Economics*, 70 (5): 1137-1145; Josling, T. and S. Tangermann (1989), "Measuring Levels of Protection in Agriculture: A Survey of Approaches and Results," in Allen Maunder and Alberto Valdes (eds.) *Agriculture and Governments in an Interdependent World*, Aldershot: Gower Publishing Company; Lutz, E. and P. L. Scandizzo (1980), "Price Distortions in Developing Countries: A Bias Against Agriculture", *European Review of Agricultural Economics*, 7: 5-27; Bigman, D. (1985), *Food Policies and Food Security Under Instability: Modeling and Analysis*, Lexington, MA: D.C. Heath and Company.

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 (Josling and Tangermann). Moreover, information requirements for calculating ERP are quite stringent since ERP

calculations involve estimating NPR for the final commodity, NPRCs for all intermediate inputs, and technical information on input-output coefficients, which are notoriously difficult to obtain on a representative basis (Schwartz and Parker).

PSE and CSE, on the other hand, have received increased attention recently, especially in the Uruguay round of trade negotiations. These measures provide a more comprehensive and flexible means of determining the level on intervention that attempt to capture effects price and non-price policies on producers and consumers, respectively. Josling and Tangermann define PSE as the level of (per-unit) producer subsidy necessary to replace the group of actual farm policies adopted by a particular country in order to leave unchanged the farm incomes. The calculations for CSE are symmetric to those for the PSE, except that the USDA, ERS calculations make no distinctions between direct and indirect payments to consumers. While a positive PSE for a commodity implies a favorable intervention in that case, a negative PSE generally indicates taxing of the producers of that commodity. Similarly, a subsidy to consumers would yield a positive CSE, a negative value of CSE would imply a tax on domestic consumers. Unlike the nominal rate of protection measure, the PSE and consumer subsidy equivalents (CSE) capture both the transfers from government expenditures and effects of policies such as import quotas that transfer incomes from domestic consumers to producers. PSEs, and their consumer counterpart, CSEs, provide the useful policy data set for a model of international agricultural markets used in examining government intervention (Chattin, 1989).

Throughout this study the PSE and CSE are used as the measurements of protection level. Although these measures are not perfect (for instance, countries could switch from less trade distorting to more trade distorting policies without affecting their aggregative measures of support, they provide a convenient, reasonably comprehensive and flexible means of summarizing policy interventions across countries taking into account both direct and indirect impacts of such interventions (Josling and Tangermann).

II.1.2 Comparative analysis of alternative measures of protection

Since each of the measures of agricultural protection discussed above take into account different price and income effects, they also measure the level of intervention differently. Discussed below are four different scenarios where government policies differ in their scope so as to compare the estimates from these different measures of protection. First, it is assumed that the intervention affects only the domestic producer price of output where in case (i) domestic price is assumed to be above the world price level while in case (ii) the domestic price is assumed to be lower than the world price. The third case incorporates lump sum payments, or input subsidies, to farmers which do not directly affect the domestic price of output which is assumed to be higher than the world price. In case (iv), effects of an import quota are measured and compared using these measures of protection.

Case (i):

Consider a country where domestic supply and demand are given by D_1 and S_1. Suppose that due to direct price intervention, the domestic price of commodity Q is kept at P_d , such that domestic output is Q_* , while the world price is at P_w . There are no other distortions, such as direct payments (D) or input subsidies (I), such that D+I = 0. In this case the NPR estimate, as well as the ERP estimate, would be:

$$NPR=ERP=\frac{Q_*P_d-Q_*P_w}{Q_*P_w}$$

or, in terms of Figure 1,

$$NPR=ERP=\frac{OQ_*CP_d-OQ_*KP_w}{OQ_*KP_W}=\frac{P_wKCP_d}{OQ_*KP_w}.$$

The estimate for PSE, in the absence of any direct payments or input subsidies, would also be similar except that the denominator would be different, that is,

$$PSE = \frac{Q_*P_d - Q_*P_w}{Q_*P_d} = \frac{OQ_*CP_d - OQ_*KP_w}{OQ_*CP_d} = \frac{P_wKCP_d}{OQ_*CP_d}.$$

These different estimates may be compared with conventional Marshallian producer surplus (PS) measures. The change in producer and consumer surplus (CS) due to the policy, from Figure 1, are $\Delta PS = + P_wBCP_d$; $\Delta CS = - P_wLCP_d$; and there would be net loss to the society equal to the area BLC. To facilitate the comparison of producer surplus measure with these other measures of protection level, the change in the producer surplus may be converted into the percent

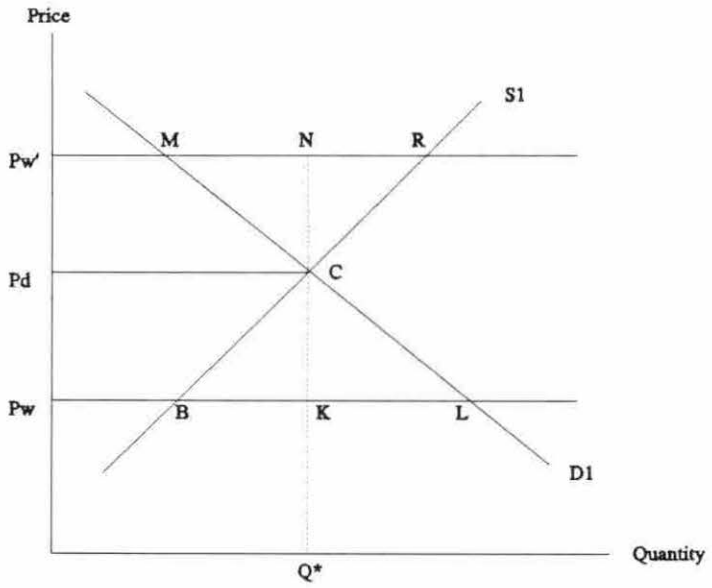

Figure 1: Comparison of alternative measures of protection under output pricing policy

change at (i) border value using the base of NPR (which would also be same for ERP), and (ii) market value using base of PSE:

$$(i) NPR = ERP = \frac{P_w KCP_d}{OQ_* KP_w} > PS(\%)|_{BorderPrice} = \frac{P_w BCP_d}{OQ_* KP_w}$$

$$(ii) PSE = \frac{P_w KCP_d}{OQ_* CP_d} > PS(\%)|_{MarketPrice} = \frac{P_w BCP_d}{OQ_* CP_d}$$

It is evident, therefore, that both NPR/ERP and PSE overestimate the protection levels as compared to their respective producer surplus estimates. However, PSE underestimates the producer surplus at border prices whereas NPR (and ERP) overestimate protection at both market price and border price estimates of producer surplus:

$$NPR = ERP > PS(\%)|_{BorderPrice} > PSE$$

$$NPR = ERP > PSE > PS(\%)|_{MarketPrice}$$

Thus, NPR and ERP, in the absence of direct payment or input subsidy programs, overestimate the effects of intervention as compared to PSE.

Case (ii):

Now consider the case of a country where domestic price, P_d , is below the world price level, P_w' . With supply curve S_1 and demand curve D_1 , the output, given the government invention, is at Q_* . In this case, the NPR and ERP estimates would be:

$$NPR=ERP=\frac{OQ_*CP_d-OQ_*NP_w'}{OQ_*NP_w'}=\frac{-P_dCNP_w'}{OQ_*NP_w'}.$$

The PSE estimates, in this case, would be:

$$PSE=\frac{OQ_*CP_d-OQ_*NP_W'}{OQ_*CP_d}=\frac{-P_dCNP_W'}{OQ_*CP_d}.$$

Since the denominator is smaller in case of PSE as compared to NRP, therefore, PSE estimate would be greater than both NPR and ERP. The change in Marshallian producer surplus, consumer surplus and net societal effects, in this case, are: - $P_w'RCP_d$; P_w' MCP_d ; and the area MCR, respectively (Figure 1). Converting the change in producer surplus in percent of border and market prices and comparing them with NPR, ERP and PSE estimates, we get:

$$NPR=ERP=\frac{-P_dCNP_w'}{OQ_*NP_w'}<PS(\%)|_{BorderPrices}=\frac{-P_w'RCP_d}{OQ_*NP_w'},$$

$$PSE=\frac{-P_dCNP_w'}{OQ_*CP_d}<PS(\%)|_{MarketPrices}=\frac{-P_W'RCP_d}{OQ_*CP_d}.$$

Note that NRP, ERP, PSE and PS are all negative indicating a tax on domestic producers. The comparison above shows that all these measures underestimate the level of percent change in producer surplus. However, PSE would overestimate the change in producer surplus at border prices while NPR and ERP would still underestimate it at market prices. That is,

$$NPR=ERP<PS(\%)|_{BorderPrices}<PSE$$

and

$$NPR=ERP<PSE<PS(\%)\,|_{MarketPrices'}$$

Case (iii):

Consider a price-induced income transfer to producers that would decrease the prices. Let the initial supply curve be S and demand curve be D_1 with corresponding output at Q_1 (Figure 2). Now, suppose that the government makes a price-induced income to farmers such that $D \neq 0$; and let I still be zero, for simplicity. This shifts the supply curve to the right to S_1 increasing the output to Q_*. The per unit subsidy then would be $(D+I)/Q_*$. The NRP estimates in this case would be

$$NPR=\frac{OQ_*CP_d-OQ_*KP_w}{OQ_*KP_w}=\frac{P_wKCP_d}{OQ_*KP_w}.$$

The estimate for PSE would, however, include the direct payments and would be

$$PSE=\frac{Q_*P_d-Q_*P_w+Q_*(D+I)}{Q_*P_d+Q_*D}=\frac{OQ_*CP_d-OQ_*KP_w+P_dCEP_o}{OQ_*CP_d+P_dCEP_o}=\frac{P_wCKP_d+P_dCEp_o}{OQ_*CP_d+P_dCEP_o}=\frac{P_wKEP_o}{OQ_*EP_o}$$

The numerator for PSE is larger than that for NPR by the term P_dCEP_o, whereas the denominator for PSE is larger than the NPR by $P_dCEP_o + P_wKCP_d$. Therefore, the estimate of PSE would be smaller than that of NPR. Note that ERP estimates would be similar to that of NPR if the subsidy provided does not affect the value of intermediate input. Otherwise, the estimates for NPR and ERP would differ since ERP would include effects of any policy affecting the value added of the intermediate inputs.

The estimates of producer and consumer surplus and cost to the government of the policy are: Δ PS = TNGC - P_dGFP_1 ; Δ CS = P_dCFP_1 = P_dGFP_1 + GFC; and Cost = P_dCEP_o. However, increase in consumer surplus more than offsets the loss in

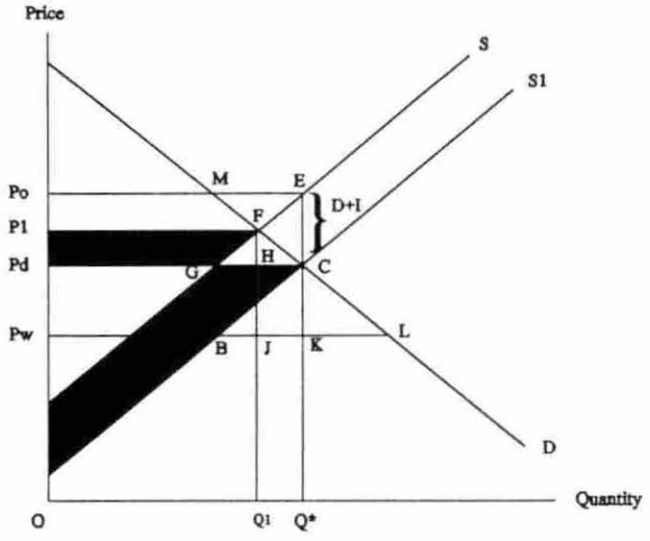

Figure 2: Comparison of alternative measures of protection under price-inducing transfers

producer surplus. Therefore, whether the society as a whole gains or looses from this policy depends upon whether TNGC+GFC greater than or less than P_dCEP_o. The next case deals with the impacts of an import quota that facilitates further comparison among these different measures.

Case (iv):

The ensuing discussion follows the framework developed by Schwartz and Parker (1988) where they examine the effects of an import quota on domestic production, consumption and prices in an attempt to compare the alternative measures of protection. Consider a country that imports the good Q. The domestic production is Q_1, and the country imports the quantity Q_1Q_4 so as to facilitate domestic consumption of Q_4 (Figure 3). The world price P_w prevails in the domestic

economy. Now, suppose that an import quota equal to Q_2Q_3 is imposed. This raises domestic prices to P_d , increases the domestic output to Q_2 and decreases the domestic consumption by the amount Q_3Q_4. The trade distortion resulting from the quota will be P_wP_d .

The producer and consumer surplus and the net welfare measures associated with this quota will be P_wAHP_d ; - P_wFGP_d ; and -(ACH+EFG) , respectively. The area CEGH represents the transfers to the holders of the quota rights.

The NRP and PSE estimates and their relationship, in this case, would be:

$$NRP=\frac{P_wCHP_d}{OQ_2CP_w}>PSE=\frac{P_wCHP_d}{OQ_2HP_d}$$

Comparing these estimates with percent producer surplus at border and market prices, respectively, we get:

$$NPR>PS(\%)|_{BorderPrices}>PSE$$

$$NPR>PSE>PS(\%)|_{MarketPrices}.$$

In order to calculate the estimates of ERP, assume that S_1 is the undistorted supply curve for, say, livestock which uses feed grains as an intermediate input. Suppose that livestock producers are now given an input subsidy which lowers their feed grains costs by the amount CH. This would shift the supply curve for livestock to the right to S_2 , thus increasing the domestic output to Q_2 and reducing imports by Q_1Q_2. Since consumer prices are not affected, the domestic consumption does not change. In this case, the value added for the final output (livestock) is subsidized equivalent to the area P_wCHP_d and, hence, would be taken into consideration for calculating ERP. However, since domestic producer prices and consumer prices remain same, NRP would not capture this subsidy, and hence, ERP provides a better measure of how government policies influence price incentives for producers. PSE estimates, on

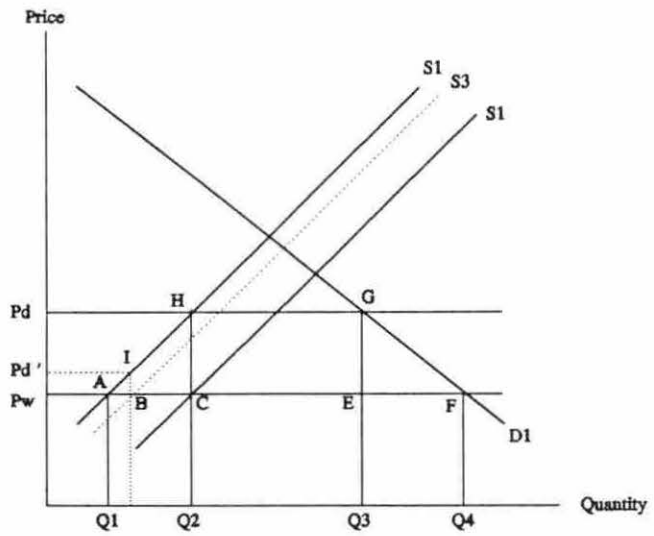

Figure 3: Comparison of alternative measures of protection under import quota

the other hand, would be approximately equal to those of ERP in case of an intermediate input subsidy. However, PSE would overestimate producer incentives, as compared to ERP, in case of an intermediate input tax.

In short, then, PSE would provide better measurement of distortions where policies include import quota, export taxes, import subsidies, domestic producer subsidies and taxes etc. However, in case of government policies which do not affect prices, the link between PSE and trade distortions becomes uncertain. Schwartz and Parker argue that one reason for this is that PSE measures the effects of farm programs by the level of government expenditure, which may bear little relationship to its effects on trade distortions. The unit cost of government expenditure would not

necessarily match how these kind of policies affect prices. For example, a policy with an overall cost equal to P_wCHP_d might shift out the supply curve only by IB - from S_1 to S_3 . Such a policy would yield a price effect of only P_wP_d' with the associated price-induced income effect of P_wBIP_d' . Part of the rest of the government expenditure may reflect a lump-sum transfer to producers or may not have any effect on producers at all. In this case, PSE would overstate the effects of government intervention.[3]

An overview of some of the prominent patterns of agricultural protection across industrialized and developing countries is provided in the next section.

II.2 An Overview of Patterns of International Agricultural Protection

Most industrialized and developing countries have adopted various policies for specific commodities that directly and indirectly affect the returns to agricultural producers (Krueger). A general comparison of protection levels across industrialized and developing countries reveals a three tier pattern of government intervention. While, in general, industrialized countries tend to favor agricultural producers, the taxation of agriculture is widespread among poorest developing countries. Among industrialized countries, on the other hand, while traditional food exporters like the U.S.A., New Zealand, Australia and Canada also support their agricultural sector, the level of protection is relatively higher in case of food importers like Japan, as well as the newly industrialized countries of Taiwan and South Korea (Anderson and Tyers) (Figure 4). This pattern is contrastingly opposite in case of consumer protection levels for industrialized as well as developing countries. While low-income countries like India, Pakistan, Nigeria and Kenya support their consumers by availing food at subsidized prices, food consumers in industrialized countries often act as a source of price supports awarded to their agricultural producers (Blandford, p. 403).

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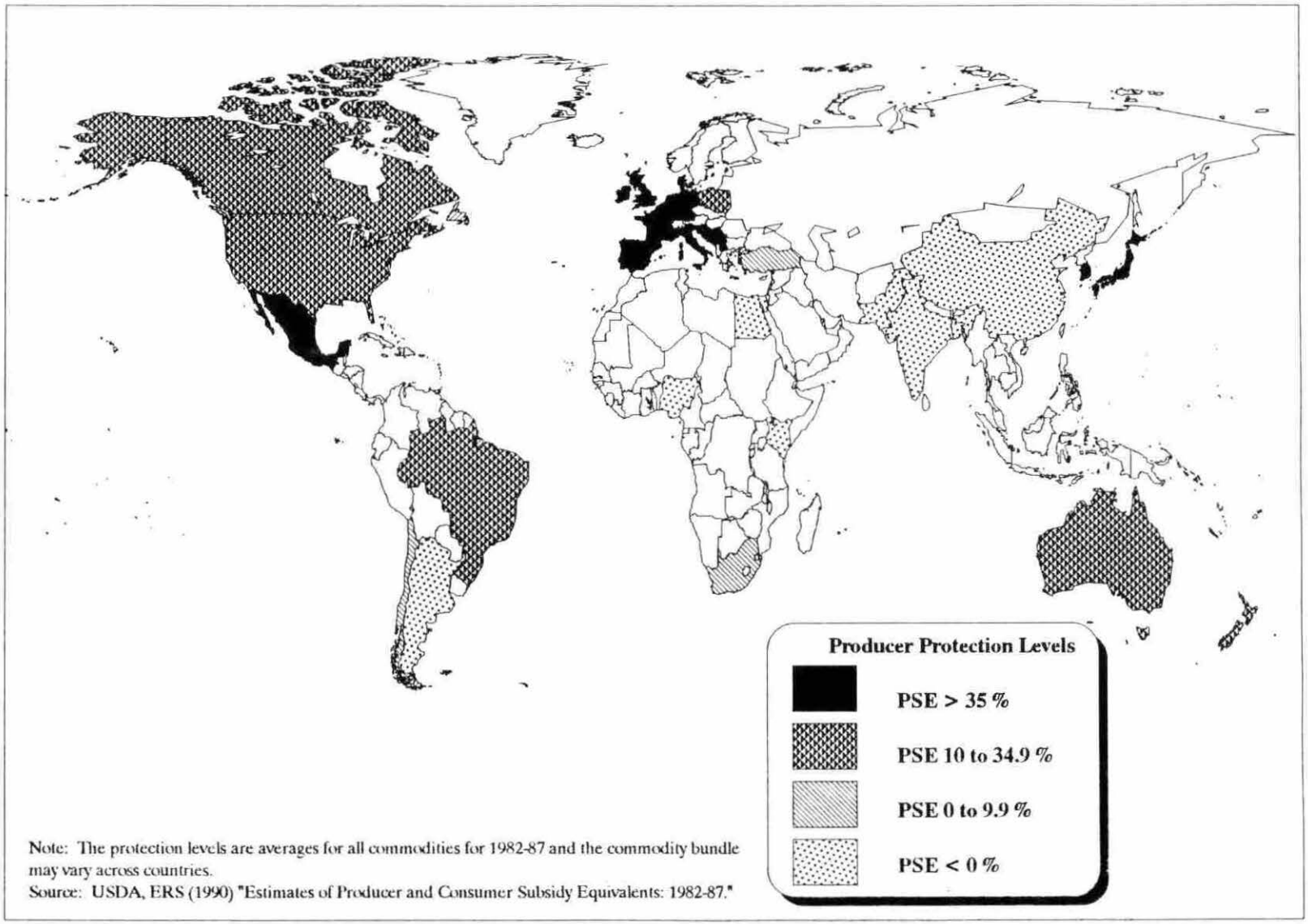
[3] For more details about measurement of this sort of policy effects, see Schwartz and Parker (1988).

Traditional food importers as well as newly industrialized countries heavily tax their consumers of agricultural products (Figure 5).

These patterns of agricultural protection discussed above become even more accentuated when we consider a specific agricultural commodity, like wheat, as compared to the overall protection levels. As shown in Figure 6, the poorest of the developing countries substantially tax their wheat producers while industrialized countries protect their wheat farmers. The protection level in industrialized countries is relatively higher than the middle income countries like South Africa, Mexico and Chile. Protection is highest in case of Japan where the level of PSE for wheat stands at almost 100%. Northern European countries like Norway, Finland, Switzerland and Sweden protect their wheat sectors more than other industrialized countries (Herrmann) and tax their wheat consumers more heavily as shown in Figure 7. Wheat consumers in both the low-income (like India, Pakistan, Bangladesh, Nigeria) as well as the middle-income countries (like Argentina, Mexico, Poland, South Africa), on the other hand, are subsidized.

The patterns of protection in middle-income countries like South Africa reveal that these countries tend to not only subsidize their wheat consumers but also subsidize their wheat producers. The source of this support for domestic wheat producers and consumers, therefore, lies outside their agricultural sectors, that is, the taxation of non-agricultural sector (Mabbs-Zeno and Dommen, 1989). The overall patterns of agricultural protection reveal taxation of producers and subsidization of consumers in developing countries. Farm producers in industrialized countries are generally subsidized while consumer protection tends to be negative indicating income transfers away from consumers to producers (Blandford; Mabbs-Zeno and Dommen) .

These contrasted patterns of agricultural protection are also clearly evident from Table 2. While countries with higher per capita GNP tend to subsidize their agricultural sector, low income countries, on the other hand, tax their farmers. The



Note: The protection levels are averages for all commodities for 1982-87 and the commodity bundle may vary across countries.
Source: USDA, ERS (1990) "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87."

Figure 4: International comparisons of agricultural producer protection levels

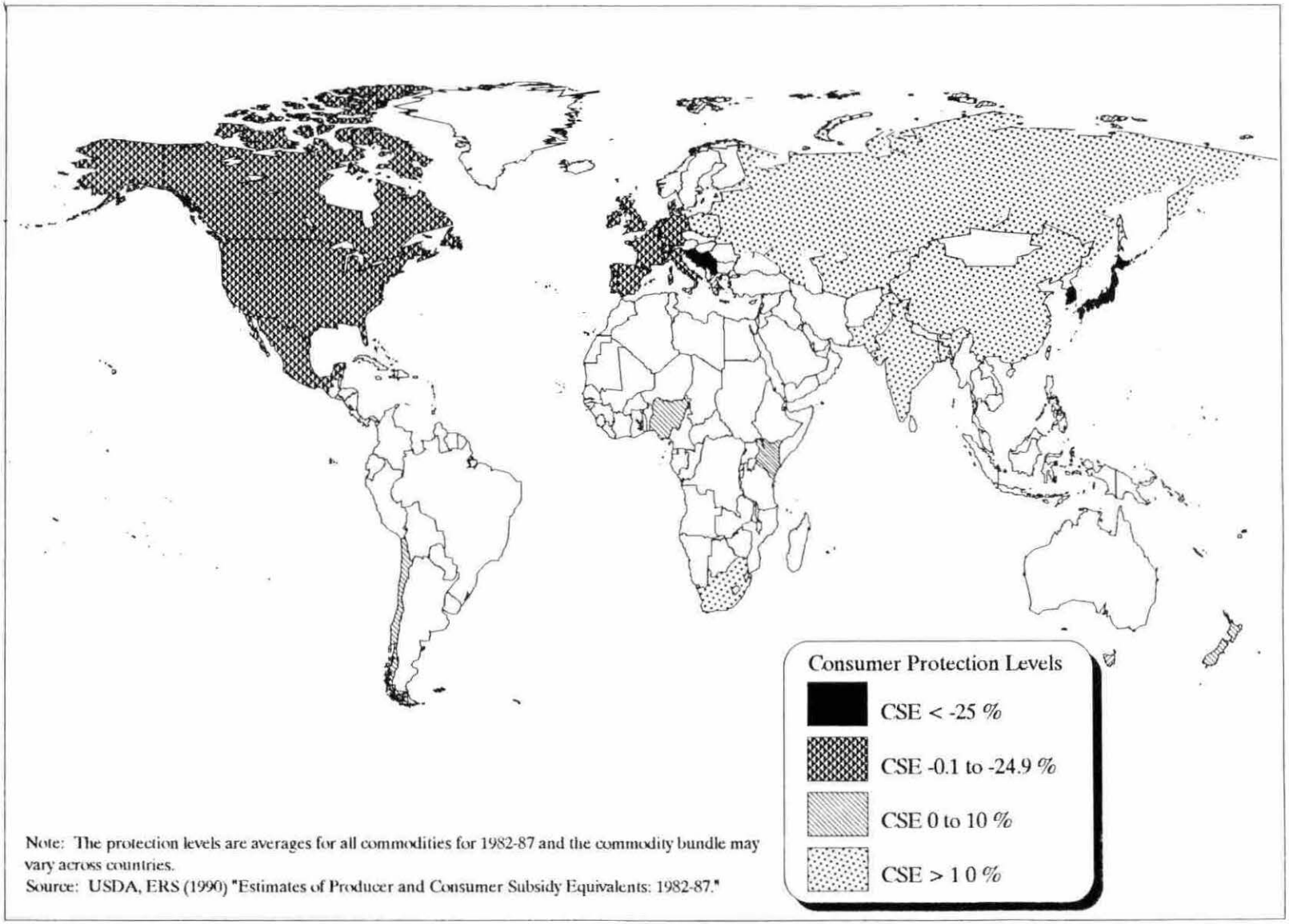


Figure 5: International comparisons of agricultural consumer protection levels

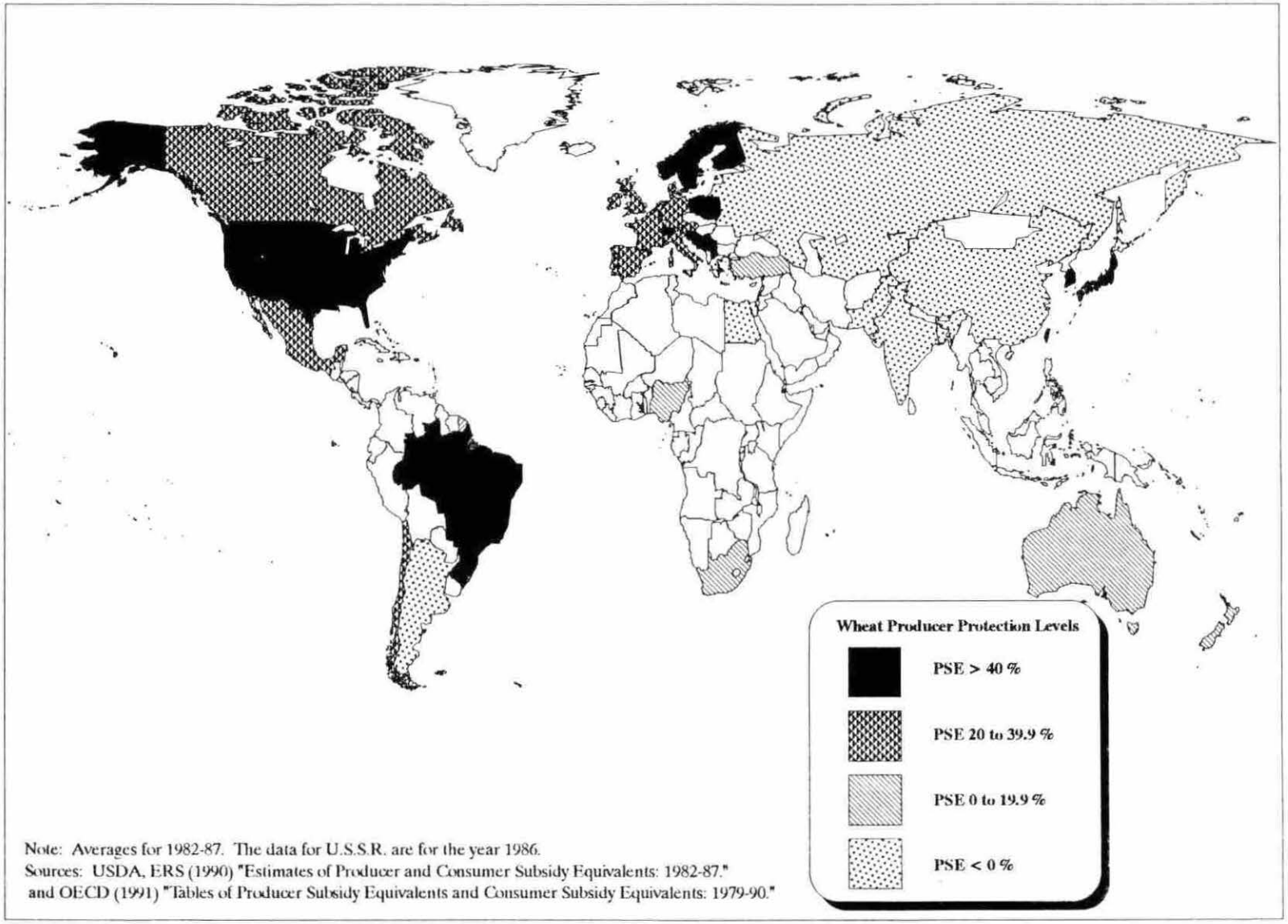


Figure 6: International comparisons of wheat producer protection levels

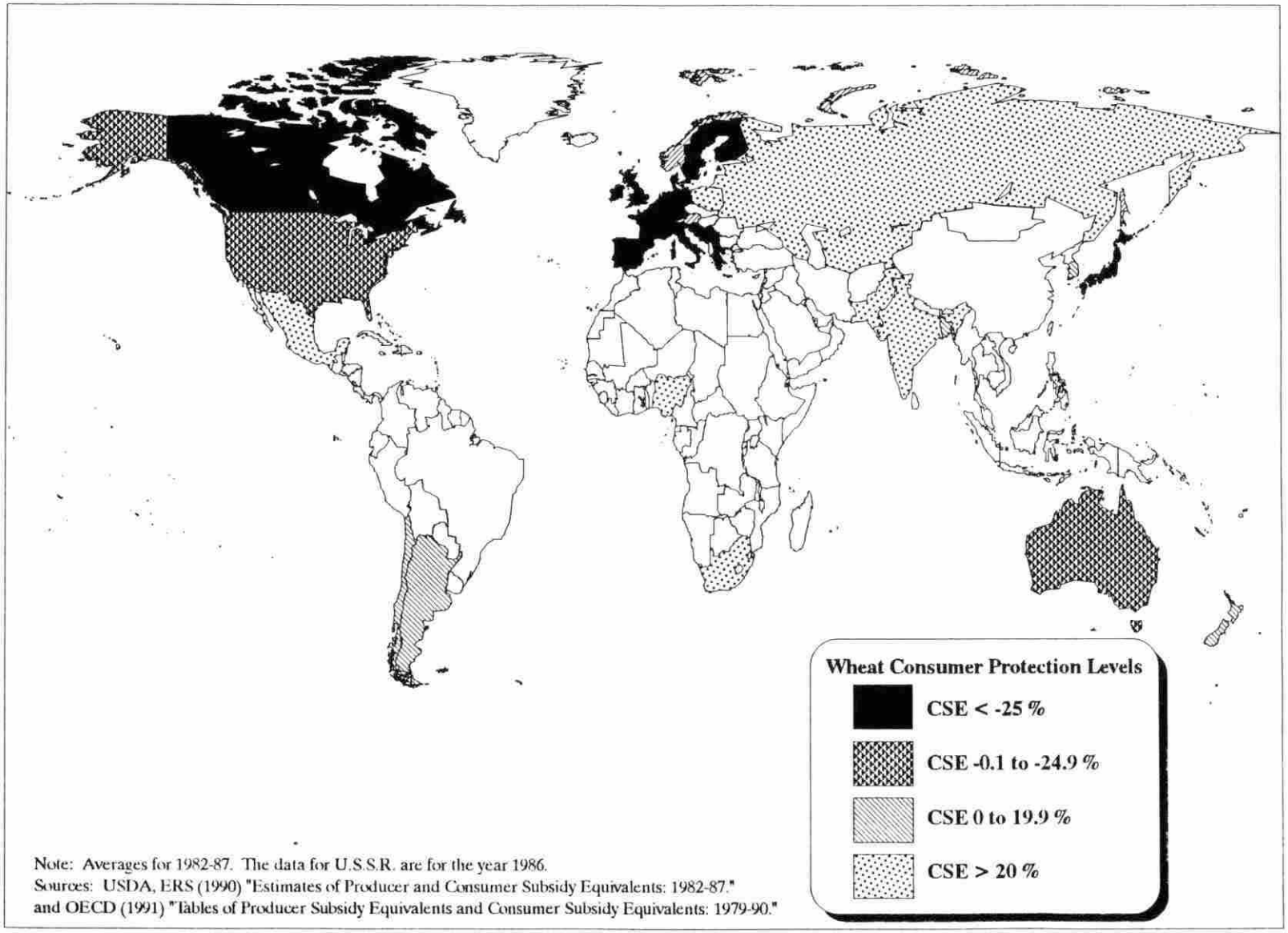


Figure 7: International comparisons of wheat consumer protection levels

reverse is true in the case of consumers. The share of agriculture in GDP and in employment, consumption expenditures, import dependency, self-sufficiency and dietary patterns are evidently correlated with the producer and consumer protection levels. These patterns are analyzed further in the rest of this study.

II.3 Regional Patterns and Cross-Commodity Policy Effects of Agricultural Protection

The information provided above in Figures 4 through 7 and Table 2 also exhibit some regional patterns in agricultural protection across contiguous countries. For example, countries in South Asia including India, Pakistan and Bangladesh with similar growing conditions, usually tend to pursue similar policies with regard to their agricultural sector. Similarly, newly industrialized countries of South Korea and Taiwan; Northern European countries of Norway, Finland and Sweden; and North American countries like U.S. and Canada seem to follow policies that depict comparable patterns of protection.

To further examine these patterns and to determine the extent of intra-regional similarity in agricultural protection rates, a multiple regression analysis was performed using qualitative variables for regions with contiguous countries of South Asia (SASIA) -- which includes India, Pakistan and Bangladesh; East Asia (EASIA) -- including Japan and South Korea; Northern Europe (NEURO) -- including Finland, Norway, Switzerland and Sweden; North America (NAMER) -- including United States and Canada; South America (SAMER) -- including Argentina, Brazil and Chile; Australasia (AUSTRAL) -- including Australia and New Zealand; and Eastern Europe (EEURO) -- including Poland and Yugoslavia.

The results for explaining wheat producer protection levels show negative regional patterns of protection in case of South Asia but positive patterns for the rest of the regions (Table 3). The countries included in the South Asian region are among the poorest nations and tend to generally tax their relatively larger agricultural

Table 2: Agricultural protection levels and selected economic indicators
Averages for 1982-87

Country	PSE All Commodities (%)	CSE All Commodities (%)	GNP per Capita ($)	Share of Ag. in GDP (%)	Share of Ag. in L.F. (%)	Engel Coefficient (%)	Total Calorie Intake/Capita (Calories/day)
Industrialized:							
Japan	72.36	-44.55	12,771	3.17	11.5	16	2805
U.S.A.	25.98	-10.23	16,122	2.17	2.0	13	3595
EC-10	36.83	-14.29	9,095	6.2	12.5	17	3498
Newly Industrialized:							
S. Korea	60.85	-37.89	2,289	13.5	34.0	35	2848
Middle-Income:							
Brazil	21.57	-	1,777	11.5	30.0	35	2667
Low-Income:							
India	-2.6	7.0	288	32.83	71.0	52	2143
Pakistan	-21.29	17.07	347	25.67	57.0	54	2214

Table 2 (contd.)

Country	PSE Wheat (%)	CSE Wheat (%)	Import Dependence (%)	Self-suff. Rate (%)	Self-suff. Ratio	Calories from Wheat/Capita (Calories/day)	Share of Wheat in Total Intake (Cal./day/capita)
Industrialized:							
Japan	99.52	-35.32	87.72	12.88	0.12	317	11.30
U.S.A.	40.85	-6.12	0.51	221.34	0.99	538	14.97
EC-10	36.33	-29.5	15.10	123.07	0.84	702	20.7
Newly Industrialized:							
S. Korea	58.08	14.72	99.61	1.40	0.01	294	10.32
Middle-Income:							
Brazil	6.57	-	46.72	53.42	0.53	351	13.16
Low-Income:							
India	-34.83	21.76	2.44	99.66	0.98	432	20.16
Pakistan	-29.93	44.65	6.13	95.58	0.94	1002	45.26

Sources: USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87;* USDA, ERS (1991) *PS&D View: Users Manual and Database*; World Bank, *World Development Report*; various issues; IMF, *International Financial Statistics*, various issues; FAO (1991), *Food Balance Sheets: Averages for 1984-86.*

sectors. India, Pakistan and Bangladesh follow similar policies in case of wheat with average Producer Subsidy Equivalents of -34.8, -30.0 and -28.3, respectively. Wheat consumer policies in these countries also follow similar pattern. The positive sign of South Asian regional dummy with respect to Consumer Subsidy Equivalents for wheat displays that these countries tend to subsidize their wheat consumers.

Similar regional patterns seem to be followed in other groups of countries as

Table 3: Regional patterns of wheat producer and consumer protection

Dependent Variable	Estimated Equations
PSE Wheat	
	11.5158 - 42.5292 SASIA* + 63.0478 EASIA* + 51.1092 NEURO* + 33.7308 EEURO*
	(-7.0538) (10.4570) (9.3327) (4.8150)
	+ 26.9900 NAMER* + 23.5800 SAMER* + 2.0675 AUSTRAL
	(3.8528) (3.9109) (0.2951)
	$R^2 = 0.69$
	12.2717 - 43.2850 SASIA* + 62.2920 EASIA* + 24.0617 EC** + 50.3533 NEURO*
	(-6.9063) (9.9390) (2.3809) (8.9824)
	+ 32.9749 EEURO* + 26.2345 NAMER*
	(4.4464) (3.5377)
	$R^2 = 0.64$
CSE Wheat	
	24.7300 + 6.4411 SASIA - 37.7956 EASIA* - 54.2300 EC** - 67.6050 NEURO*
	(0.4500) (-2.6404) (-2.4181) (-5.2213)
	- 3.8750 EEURO - 42.5392 NAMER**
	(-0.2318) (-2.5449)
	$R^2 = 0.23$
	25.6203 - 38.6858 EASIA* - 55.1203 EC** - 68.4953 NEURO* - 43.4294 NAMER*
	(-2.8747) (-2.5281) (-5.7017) (-2.7214)
	$R^2 = 0.23$

Note: Figures in parentheses are *t* - values.
*,** Statistically different from zero at the 1% and 5% level of significance.
Sources: The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.*
Variables: SASIA, EASIA, EC, NEURO, EEURO, NAMER, SAMER and AUSTRAL are dummy variables representing group of countries belonging to South Asia, East Asia, European Community, Northern Europe, Eastern Europe, North America, South America and Australasia, respectively.

well. Traditional wheat exporting countries like United States and Canada tend to subsidize their wheat producers and, on the other hand, tax their wheat consumers. For example, the level of Producer Subsidy Equivalents in case of these countries is 40.9 and 36.2, respectively. Strong regional patterns for wheat producer protection are also displayed in case of East Asian and EC countries. The models explaining producer protection levels are very robust in that the coefficient of determination values obtained are very high (0.64 to 0.69). However, the models explaining consumer protection levels do not exhibit similar robustness due to some intra-regional disparities. For example, while wheat consumers in Japan are taxed at a rate of 35.3 percent, the newly industrialized countries like South Korea still protect their wheat consumers as well, with wheat Consumer Subsidy Equivalents at 14.7 percent.

Nonetheless, it is worth noting that regional patterns of protection are also able to explain the variation in consumer protection levels - something that has been ignored in much of the literature so far. The results above show that it may be important to specify analytical models incorporating regional characteristics wherever appropriate. The cross-country patterns within developing countries are also influenced by specific government programs that render these governments an important arbitrator role in setting prices of important foodgrains through buying and selling.

In many developing countries, the government enjoys monopoly and monopsony powers to an extent in buying and selling of staple agricultural commodities like wheat. Government agencies control trade in these commodities as well as procure these at government regulated market prices through marketing boards. For example, the state control of buying wheat at cheaper than the market prices in India resulted in an annual loss of $2.28 billion on an average to the wheat producers during 1982-86. The marketing boards in Nigeria affect the producer prices for many agricultural crops including wheat, cotton and cocoa. The annual

cost to the coca farmers of the intervention was to the tune of $23.41 million during the same period. Such policies are also followed in some middle income countries. Brazil, for example has marketing boards to conduct the buying and selling of various crops while in Mexico, the government purchasing and marketing agency (CONASUPO) buys a portion of major crop outputs at prespecified guaranteed prices costing wheat producers $11.55 million annually during 1982-86. These polices affect both producer and consumer prices of various crops. However, a subsidy to one commodity also constitutes an indirect tax on its substitute commodities. Consequently, the support provided to one commodity may distort production and consumption patterns of not only that crop but also those of its close substitutes.

Cross-commodity policy effects of government intervention for wheat and rice are studied in Table 4. Producer Subsidy Equivalents for rice are regressed against those for wheat to determine the correlation between rice and wheat producer support policies. The regression results across countries suggest that the protection levels for these two commodities move in the same direction. For example, rice producers are taxed in India and so are wheat producers while they are both subsidized in Japan. The results suggest that rice and wheat policies are significantly positively correlated across countries and, hence, it might be difficult to isolate cross commodity effects for these two commodities.

Protection awarded to wheat producers is shown to discourage wheat consumption. This may also explain why low-income countries usually keep low producer prices of staple food commodities to provide accessibility to people with low purchasing-power. However, the wheat producer protection levels are also shown to discourage consumption of rice. Since the producer protection levels for wheat and rice producers move in the same direction, as discussed above, the decrease in the consumption of rice might be explained by the higher producer protection levels which result in higher prices of rice.

The rest of the study makes an attempt to identify and isolate some of these

individual patterns of agricultural protection using Producer and Consumer Subsidy Equivalents for measuring the levels of producer and consumer protection, respectively, across industrialized and developing countries.

Table 4: Cross-commodity policy effects of producer protection levels across industrialized and developing countries

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE Wheat	17.0760 + 0.5442 PSERICE* (10.3736)	0.59	76	13
Wheat Consumption	15642.92 - 137.37 PSEWHEAT* (-3.2610)	0.06	160	27
Rice Consumption	19870.19 - 217.8290 PSEWHEAT* (-2.9538)	0.09	94	16

Note: Figures in parentheses are *t* - values.
* Statistically different from zero at the 1% level of significance.
Sources: The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.*
Variables: PSERICE: PSE for Rice; and PSEWHEAT: PSE for Wheat.

CHAPTER III. NATIONAL INCOME AND PATTERNS OF AGRICULTURAL PROTECTION

III.1 GNP per Capita and Protection Patterns

The patterns of agricultural protection discussed in the previous section highlight the issue of relationship between industrialization and protection. The level of protection awarded to farmers increases as the country gets richer. Anderson and Hayami also observed that countries in South-East Asia and Europe shifted from taxing to subsidizing their agricultural sectors in the course of economic development and industrialization. Anderson and Tyers also reported a correlation between agricultural protection and per capita national income and concluded that the society has an income elastic demand for assisting farmers. It has been reported that subsidies to farmers increase in countries with higher levels of gross national product (GNP) per capita or industrialization while developing countries tend to tax farmers (de Gorter and Tsur).

In trying to understand why poor countries tend to tax agriculture relative to manufacturing while rich countries tend to assist farmers, Anderson (1986) stresses the need to examine the structural changes that take place in an economy as it grows. In a developing country, most of the labor-force is employed in the agricultural sector which provides for the imports needed by their fledgling manufacturing sectors by providing exportable goods. Taxing the relatively larger agricultural sectors in these economies constitutes the main source o revenue for the government. This exploitation of agriculture has also been justified to finance industrialization and economic development (ed Gorter and Tsur, 1991). In the process of economic development, the comparative advantage shifts away from agriculture to the industrial sector, thus resulting in growing demands by farmers in industrialized countries for protection (Honma and Hayami).

Tables 5 and 6 provide income-wise classification of countries according to

level of producer and consumer protection for all commodities and wheat, respectively. The categorization of protection coefficients into three divisions, high, medium and low, is subjective, based upon the income differentials. The diagonalization of the tables reveal that the high income countries generally have

Table 5: Classification of countries according to agricultural producer and consumer protection levels : Averages for 1982-87

	Classification of Countries According to GNP/Capita		
	High Income (>$7000)	Middle Income ($1001-6999)	Low Income (<$1000)
PSE All Commodities			
More than 35.0 %	EC, Japan	S. Korea, Mexico, Yugoslavia	-
0.0 to 34.9 %	Australia, Canada U.S.A., New Zealand	Brazil, Poland, Chile S. Africa, Turkey, Taiwan	-
Less than 0.0 %	-	Argentina	India, B'Desh, Egypt Nigeria, Kenya, China, Pakistan
CSE All Commodities			
Less than -35 %	Japan	S. Korea	-
0.0 to -34.9 %	U.S.A., Canada, EC	Mexico, Taiwan Yugoslavia	-
More than 0.0 %	-	S. Africa, Poland	India, Nigeria, Kenya, China, Pakistan

Source: USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87.*

Table 6: Classification of countries according to wheat producer and consumer protection levels: Averages for 1982-87

	Classification of Countries According to GNP/Capita		
	High Income (>$7000)	Middle Income ($1001-6999)	Low Income (<$1000)
PSE			
More than 35.0 %	U.S.A., Canada, EC Japan, Austria, Norway, Finland Switzerland,Sweden	S. Korea, Taiwan Yugoslavia, Poland Brazil	-
0.0 to 34.9 %	Australia, New Zealand	Chile, Mexico S. Africa, Turkey,	Nigeria (0.6)
Less than 0.0 %	-	Argentina	India, B'Desh, Egypt China, Pakistan
CSE			
Less than -35 %	Japan, Sweden Switzerland, Finland	-	-
0.0 to -34.9 %	U.S.A., Norway Austria, Australia EC, Canada	Taiwan Yugoslavia	-
More than 0.0 %	New Zealand (0.2)	Chile, S. Korea Argentina, S. Africa Poland	India, B'desh, Nigeria, Pakistan

Sources: USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87*; OECD (1991) *Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.*

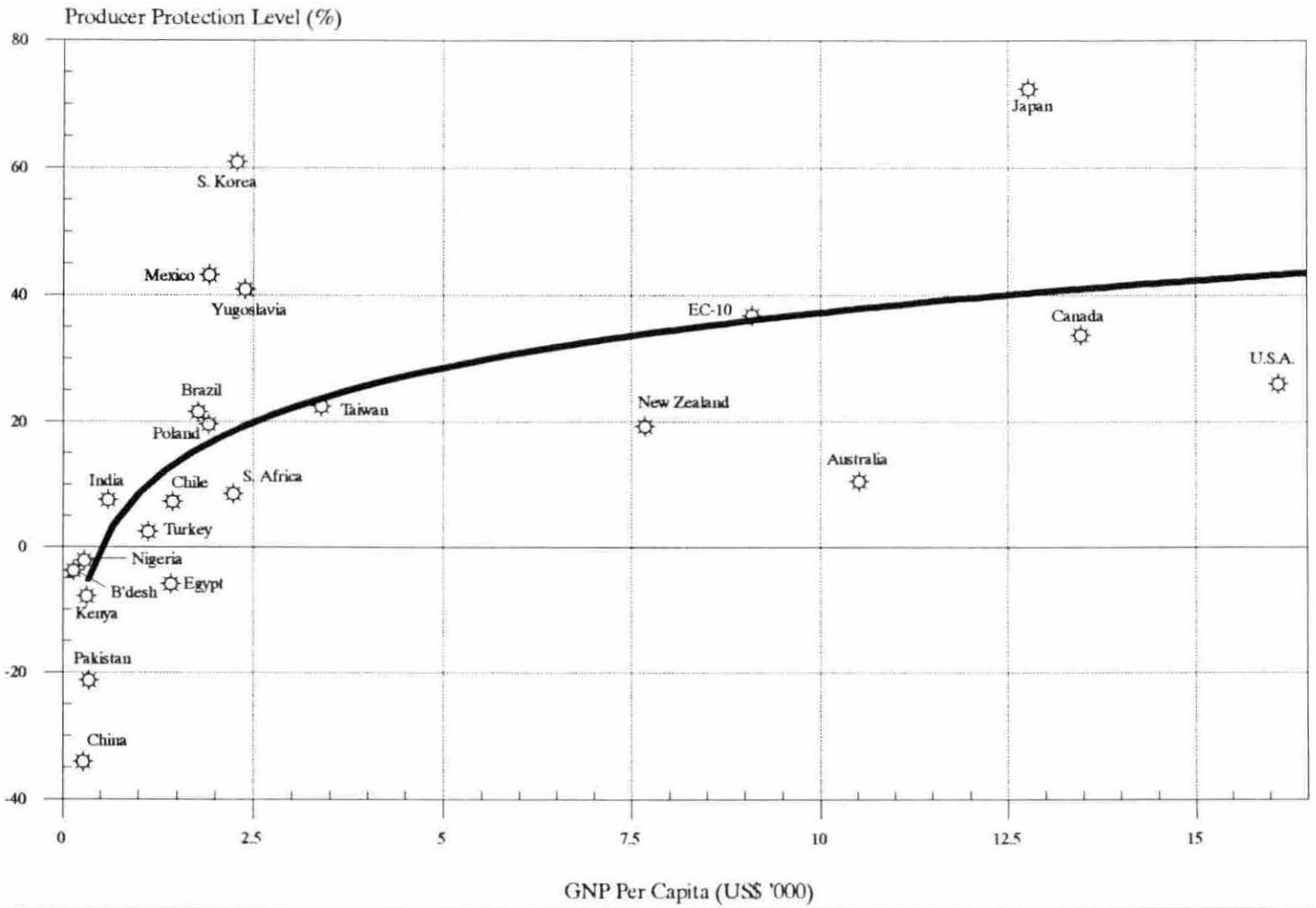
higher levels of producer protection levels and lower (negative) levels of consumer protection while the situation is reverse in case of lower income countries. Developing countries with a higher GNP per capita (like Brazil, Mexico, Poland, Yugoslavia, S. Africa, Turkey, and Chile) tend to have also positive producer support overall as well as for wheat as compared to other developing countries with lower

GNP per capita (like India, Bangladesh, Pakistan, Egypt, China Kenya and Nigeria). An exception to this is Argentina, a middle income developing country, that tends to tax its overall agricultural sector as well as its wheat sector. One probable explanation of this divergence may be that there is a strong tendency among developing countries to tax their exportable commodities, and to tax them rather heavily (Krueger, pp. 165). Such effects of the export/import nature of the commodity are analyzed in more detail in Section IV.

The graphical depiction of the relationship between the producer protection levels and GNP per capita exhibits a positive logarithmic correlation (Figure 8). The exhibit reveals that the protection awarded to the agricultural producers increases at a decreasing rate with the increase in GNP per capita. Countries like Japan and South Korea, which are outliers, tend to heavily subsidize their agricultural sector with average protection levels for the period 1982-87 at 61% and 72%, respectively. The consumer support levels (Figure 9), on the other hand, reveal a negative correlation with the level of GNP per capita. Rich countries tend to tax their food consumers while low-income countries subsidize their consumers. Apart from the GNP per capita, the share of agriculture in the national income is also instrumental in defining the patterns of agricultural protection across countries as discussed below.

III.2 Importance of Agricultural Sector in National Income

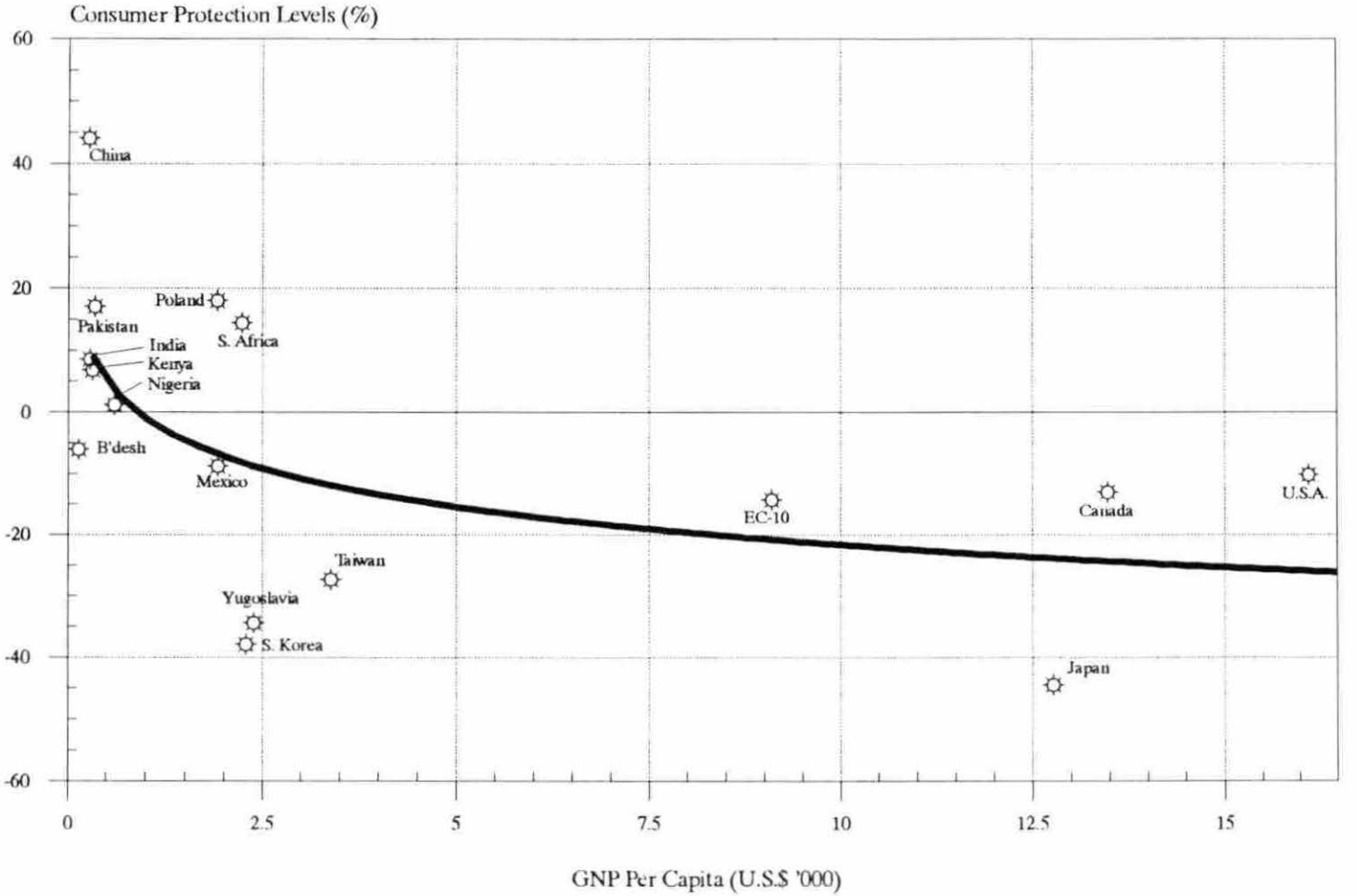
The importance of agriculture in the national income is another factor influencing the level of agricultural protection. The level rises as the share of agriculture in the gross domestic product (GDP) declines (Honma and Hayami). A simple graphical representation of the relationship between the share of agriculture in GDP and the level of producer support reveals a negative correlation (Figure 10). Countries where income from agriculture constitutes substantially lower proportion of the GDP tend to highly protect their agricultural sector. For example, Japan, where the agricultural sector contributes about 3.7% of the total GDP, the subsidy provided



Note: Log form is specified for GNP Per Capita. Producer protection levels are measured by PSE All that represent averages for all commodities. The commodity bundles may vary across countries.

Sources: IMF, "International Financial Statistics," various issues; and USDA, ERS (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87."

Figure 8: Relationship between GNP per capita and producer protection levels



Note: Log form is specified for GNP Per Capita. Consumer protection levels are measured by CSE All that represents average for all commodities. Commodity bundles may vary across countries.
Sources: IMF, "International Financial Statistics," various issues; USDA, ERS (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87."

Figure 9: Relationship between GNP per capita and consumer protection levels

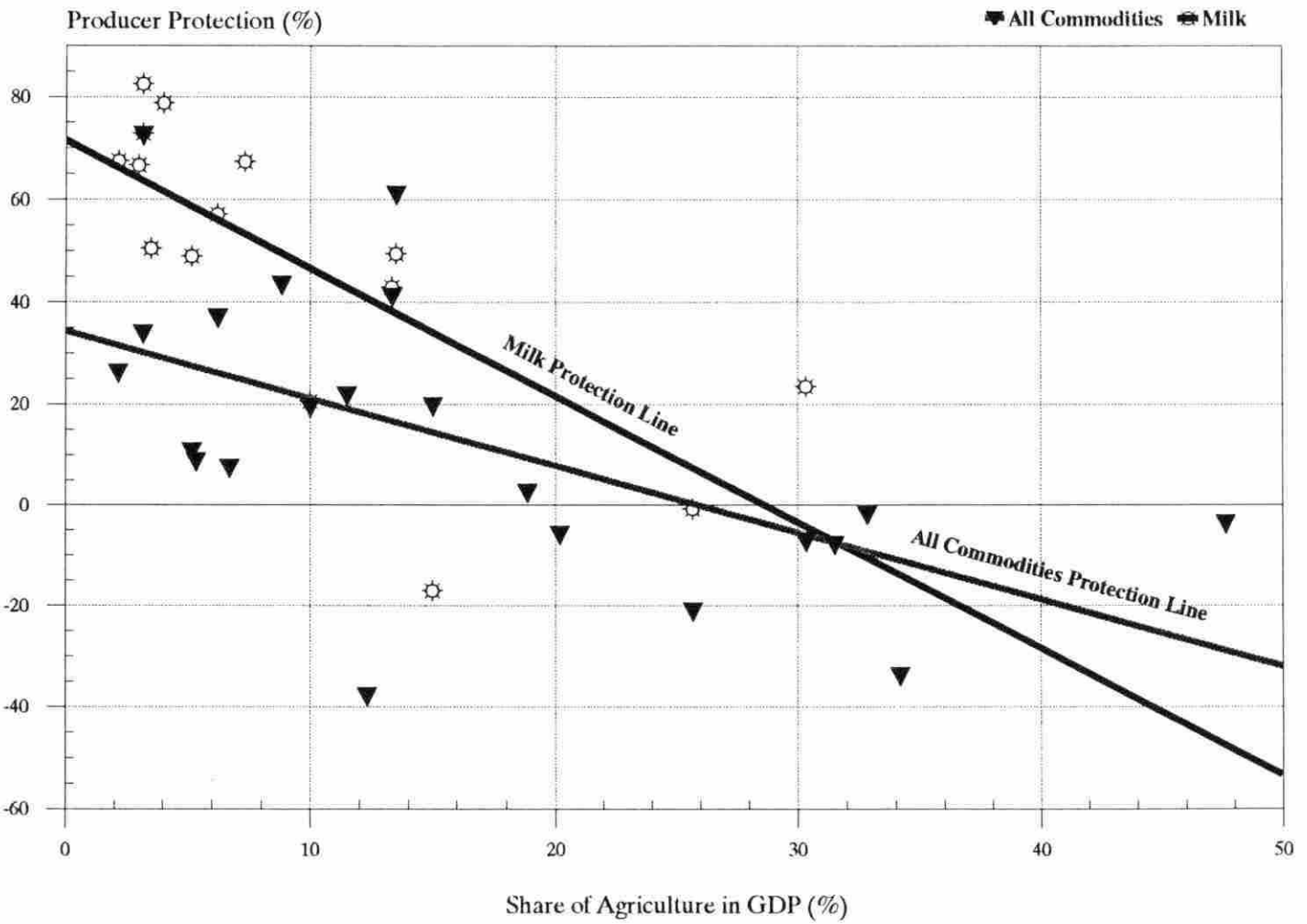
to the agricultural sector is about 72 %. In countries like the U.S. and Canada, where share of agriculture in GDP accounts for only 2-3%, the protection level varies between 25-35%. As the share of agriculture increases to roughly above 25%, the countries tend to start taxing their domestic agricultural producers. The low-income countries, like Nigeria, where GDP from agriculture is about 30%, the agricultural sector is taxed at an average of 8%.

The negativity of the relationship between the share of agriculture in GDP and producer protection levels is more accentuated in case of some individual commodities like milk. Industrialized countries tend to heavily subsidize their milk producers while the opposite is true for developing countries.

III.3 The Regression Analysis

Tables 7 through 11 present the results of regression analysis aimed at determining the explanatory power of the GNP per capita and the share of agriculture in GDP in relation to the overall and commodity-wise protection levels across countries. The casual observations from the tables and graphs presented above are supported by empirical analysis that policy regimes of advanced economies tend to assist agriculture relative to other sectors while poor countries tend to discriminate against agriculture. For the purpose of identifying patterns across homogeneous groups of countries, the analysis was performed at three levels: for all industrialized as well as developing countries; industrialized countries; and developing countries. However, the data limitations did not allow such classification throughout the analysis for milk and rice.

The PSE and CSE levels for all commodities were regressed against GNP per capita (GNPC) and the share of agriculture in GDP (GDPAG) as well as the share of agriculture relative to the share of industry (RGDPAG) in the GDP (Table 7). As is shown in the table, the regression coefficients for GNP per capita were statisticallysignificant in all the models and had the correct signs for explaining the



Note: Producer protection levels for all commodities and milk are measured by PSE for all commodities and milk, respectively. Commodity bundle may vary across countries.
Sources: World Bank, "World Development Reports," various issues; USDA, ERS (1990) "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87"; and OECD (1991) "Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90."

Figure 10: Relationship between share of agriculture in GDP and producer protection levels

producer protection levels. Moreover, the explanatory power of the model increased (from 20% to 25%) with the logarithmic specification of the regression model. Second, the regressions using share of agriculture in GDP as the explanatory variable also had the statistically significant and correct negative sign. The explanatory power of the model was also improved when both GNP per capita and the share of agriculture in GDP were used as independent variables. The model specification with relative share of agriculture also had the expected negative sign with an explanatory power of 11%. As the importance of agriculture relative to industry in GDP declines, agriculture sector tends to be able to obtain more protection.

Regression models were also specified separately for industrialized and developing countries. The model for developing countries seems to perform better than the industrialized countries in that the coefficient of determination is considerably higher as well as the regression coefficient is significant at 1% level of significance. The intercept term in the model specified for developing countries turns out to be negative, as expected, while that for industrialized countries is positive, again, as expected.

On the side of consumers, the level of consumer support drops significantly as GNP per capita increases. In this case too, the model with logarithmic specification performs better in terms of the explanatory power of the model. The results support the hypotheses that the consumers in developing countries are subsidized while they are taxed in the case of industrialized countries (Byerlee and Sain). Table 8 provides the results for the regression models using GDP per capita as an explanatory variable instead of GNP per capita. As is evident from the table, the results obtained are similar to those for GNP per capita. However, some qualitative variables, for industrial (DIND), East Asian (DEASIA) and Northern European (DNEURO) countries were introduced to isolate the effects of their country-group characteristics. A slope dummy variable was also specified for industrialized countries (DIND x GDPC). The results are very robust in that the explanatory power of the models

Table 7: The influence of GNP per capita and share of agriculture in national economy on the level of agricultural protection across industrialized and developing countries: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE (All Commodities) [a]				
All Countries:	1.1733 + 0.0028 GNPC* (5.6)	0.20	130	22
	-64.5337 + 10.324 lnGNPC* (6.6375)	0.25	130	22
	33.2620 - 1.2618 GDPAG* (-6.4977)	0.25	130	22
	21.0558 - 13.8730 RGDPAG* (-4.0977)	0.11	130	22
	21.3095 + 0.0014 GNPC** - 0.8870 GDPAG* (2.3370) (-3.5570)	0.28	129	22
Industrial Countries:	13.5110 + 0.0017 GNPC** (1.7627)	0.08	34	6
Developing Countries:	-14.2038 + 0.0151 GNPC* (4.4484)	0.17	94	16
CSE (All Commodities) [a]				
All Countries:	4.0334 - 0.0019 GNPC* (-3.6600)	0.13	88	15
	46.8970 - 7.001 ln GNPC* (-4.2800)	0.17	88	15
	-5.2474 - 0.0013 GNPC** + 0.3613 GDPAG (-1.7587) (1.2728)	0.15	87	15

Note: Figures in parentheses are *t* - values.

a PSE and CSE averages are for all commodities and the commodity bundles may differ across countries.

*,** Statistically different from zero at the 1% and 5 % level of significance, respectively.

Sources: GNP figures are from *IMF, International Financial Statistics*, various issues. GDPAG figures are from various issues of *World Development Report, World Bank.* The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.*

Variables: GNPC: GNP Per Capita (US $); GDPAG: Share of Agriculture in GDP; RGDPAG: Relative Share of Agriculture in GDP to Industrial Sector.

Table 8: The influence of GDP per capita and qualitative variables on the level of agricultural protection across industrialized and developing countries: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE (All Commodities)[a]				
All Countries:	1.4855 + 0.0027 GDPC* (5.6704)	0.20	130	22
	-13.6129 + 0.0142 GDPC* + 30.4271DIND** - 0.0129 DIND x GDPC* (4.6406) (4.9954) (-3.9315)	0.29	128	22
Industrialized	13.0811 + 0.0010 GDPC* + 45.7564 DEASIA* (3.0348) (12.3160)	0.80	39	7
Developing	-13.6129 + 0.0142 GDPC* (4.3284)	0.17	94	16
CSE (All Commodities)[a]				
All Countries:	3.7630 - 0.0018 GDPC* (-3.5780)	0.13	88	15
PSE Wheat				
Industrialized	2.5123 + 0.0031 GDPC** (2.4958)	0.15	34	6
	-3.4452 + 0.0027 GDPC* + 62.1119 DEASIA* + 25.3006 DNEURO* (7.3623) (12.6200) (6.4066)	0.77	62	11

Note: Figures in parentheses are *t* - values.

a PSE and CSE for all commodities are weighted averages and the commodity bundles may differ across countries.

*,** Statistically different from zero at the 1% and 5 % level of significance, respectively.

Sources: GDP figures are from *IMF, International Financial Statistics*, various issues. PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.*

Variables: GDPC: Gross Domestic Product per capita in U.S. $; DIND, DEASIA, and DNEURO are qualitative variables for industrialized, East Asian and Northern European countries, respectively.

increased significantly- the coefficient of determination values obtained were as high as 0.80.

In the case of wheat, the regression coefficients for GNP per capita as well as for share of agriculture in GDP and a combination thereof are highly significant (Table 9). The explanatory power of all models increases substantially (up to 44%) over the models prescribed for the overall protection levels, given in the previous table. This highlights the significance of studying individual commodities separately rather than the study of agricultural sector as a whole. Again, the intercept terms turn negative in case of developing countries in comparison to that for industrialized countries, as expected. The model for explaining the consumer protection levels indicated a negative relationship between the GNP per capita and consumer subsidy. As GNP per capita increases, the wheat consumers tend to be taxed more heavily as compared to the overall agricultural sector.

The regression results for milk and rice, given in Tables 10 and 11, respectively, also support the previous findings about the relationship between the level of producer and consumer protection and the wealth of the country. In both cases, improvement in results is observed in terms of the coefficient of determination with the logarithmic functional form. However, in the comparison of the results of the analysis for individual commodities as well as the overall agricultural sector, it is revealed that industrialized countries tend to highly subsidize their dairy sector, followed by wheat and rice sectors, respectively. The model specification for milk sector turns out to be surprisingly robust in that the R^2 coefficient ranges from 44% to 61%. Also, as shown graphically in Figure 10, the protection levels for milk are substantially more sensitive to the changes in the share of agriculture than the protection levels for the agricultural sector as a whole, as indicated by the steeper slope of the milk protection line. This signifies that producer protection for milk is elastic with respect to the importance of agriculture in national income.

Table 9: The influence of income on the level of protection for wheat producers and consumers across industrialized and developing countries: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE				
All Countries:	3.3110 + 0.0036 GNPC* (9.3300)	0.36	154	26
	-97.3770 + 15.5485 ln GNPC* (10.2020)	0.40	154	26
	49.5790 - 1.8900 GDPAG* (-8.9100)	0.35	148	25
	28.2000 + 0.0021 GNPC* - 1.2066 GDPAG* (3.7700) (-4.4300)	0.41	147	25
	11.9096 + 0.0032 GNPC* - 15.0990 RGDPAG* (6.7340) (-3.9860)	0.44	135	23
Industrial Countries:	4.6470 + 0.0034 GNPC* (5.3000)	0.31	64	11
Developing Countries:	-20.8291 + 0.0222 GNPC* (5.6700)	0.27	88	15
CSE				
All Countries:	36.5183 - 0.0047 GNPC* (-7.0100)	0.27	130	22

Note: Figures in parentheses are *t* - values.
* Statistically different from zero at 1% level of significance.
Variables: GNPC: GNP Per Capita (US $); GDPAG: Share of Agriculture in GDP; and RGDPAG: Relative Share of Agriculture in GDP to Industrial Sector.
Sources: GNP figures are from *IMF, International Financial Statistics*, various issues. GDPAG figures are from various issues of *World Development Report, World Bank.* The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.*

Table 10: The influence of income on the level of protection for rice producers and consumers across industrialized and developing countries: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE				
All Countries:	-19.4750 + 0.0061 GNPC* (6.4890)	0.32	88	15
	-143.4550 + 20.8600 ln GNPC* (7.4250)	0.39	88	15
	57.8260 - 2.6300 GDPAG* (-7.1600)	0.37	88	15
	21.9450 - 22.6720 RGDPAG* (-3.3900)	0.12	88	15
	30.4730 + 0.0027 GNPC** - 1.7962 GDPAG* (1.9130) (-3.1680)	0.39	87	15
CSE				
All Countries:	3.5990 - 0.0041 GNPC* (-4.5110)	0.21	76	13
	100.6700 - 16.1301 ln GNPC* (-5.9510)	0.32	76	13
	-54.9140 + 1.9581 GDPAG* (5.1216)	0.26	76	13
	-32.4846 + 18.7833 RGDPAG* (2.9900)	0.11	76	13

Note: Figures in parentheses are *t* - values.
*,** Statistically different from zero at the 1% and 5 % level of significance, respectively.
Sources: GNP figures are from *IMF, International Financial Statistics*, various issues. GDPAG figures are from various issues of *World Development Report, World Bank.* The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.*
Variables: GNPC: GNP Per Capita (US $); GDPAG: Share of Agriculture in GDP; RGDPAG: Relative Share of Agriculture in GDP to Industrial Sector.

Table 11: The influence of income on the level of protection for milk producers and consumers across industrialized and developing countries: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE				
All Countries:	17.3967 + 0.0034 GNPC* (11.0012)	0.56	94	16
	-65.6012 + 13.3369 ln GNPC* (8.5792)	0.44	94	16
	70.6891 - 2.4022 GDPAG* (-8.9449)	0.48	88	15
	25.0492 + 0.0033 GNPC* - 0.5972 GDPAG*** (5.5769) (-1.4999)	0.61	87	15
	65.8128 - 64.3237 RGDPAG* (-7.2773)	0.38	88	15
CSE				
All Countries:	-10.7949 - 0.0026 GNPC* (-4.0612)	0.16	88	15
	108.1288 - 16.3695 ln GNPC* (-4.5443)	0.19	88	15
	-34.6362 - 0.0016 GNPC + 1.6958 GDPAG*** (-1.1681) (1.4392)	0.21	81	14

Note: Figures in parentheses are *t* - values.
*,*** Statistically different from zero at the 1% and 10 % level of significance, respectively.
Sources: GNP figures are from *IMF, International Financial Statistics*, various issues. GDPAG figures are from various issues of *World Development Report, World Bank.* The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.*
Variables: GNPC: GNP Per Capita (US $); GDPAG: Share of Agriculture in GDP; RGDPAG: Relative Share of Agriculture in GDP to Industrial Sector.

In conclusion, there seems to be a strong evidence of a positive correlation between GNP per capita and GDP per capita and the protection awarded to theoverall agricultural sector. This relationship is even more pronounced when we consider protection levels for individual commodities. This analysis explains that the society has an income elastic demand for assisting milk and wheat farmers over and above the aggregate agricultural sector. Moreover, the nature of relationship does not seem to be linear in that the logarithmic regression line outperforms the linear models as specified in the regression analysis. This contradicts earlier findings that GNP per capita and the level of protection are linearly correlated (Herrmann). The logarithmic fit reveals that the level of protection generally increases at a decreasing rate as a country gets richer. An exception to this observation might be for food importing countries which is discussed in the next section. Overall, the performance of the models suffered when only the relative share of agriculture to industry in the GDP was included as a regression variable.

CHAPTER IV. TRADE NATURE OF COMMODITIES AND THE LEVEL OF PROTECTION

Although it seems plausible to assume that the import/export nature of a particular commodity would also be influential in the determination of its protection level, most quantitative studies so far have ignored this aspect altogether (Gardner; Balisacan and Roumasset; Anderson, Hayami and Honma; Honma and Hayami). In this section, import dependence (IMPDEPW) and self-sufficiency ratios (SSRATIOW) are used to determine the effects of the import/export nature of the wheat commodity on the protection levels awarded across 26 industrialized and developing countries.

IV.1 Import Dependence of Wheat

Import dependence is defined as the percentage share of wheat imports in the sum of domestic wheat production and wheat imports.[4] Table 12 classifies the selected countries according to the extent of wheat import dependence and the level of producer protection for wheat. Industrialized countries with high level of wheat import dependence, like Japan and Northern European countries of Norway, Finland, and Switzerland heavily subsidize their wheat farmers. The traditional wheat exporter countries like Canada, U.S.A., Australia, Austria, Sweden and EC-10, where import dependence coefficient for wheat is either zero or substantially low, have positive albeit lower levels of wheat protection rate. The newly industrializ̀ed countries of South Korea and Taiwan, where the wheat import dependence is above 99%, the wheat producers are highly protected with wheat PSE levels at 58% and 66%, respectively.

This pattern also holds true in the case of middle income countries. While

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[4] The domestic production data used includes exports.

Table 12: The influence of wheat import dependence upon wheat protection levels: 1982-87

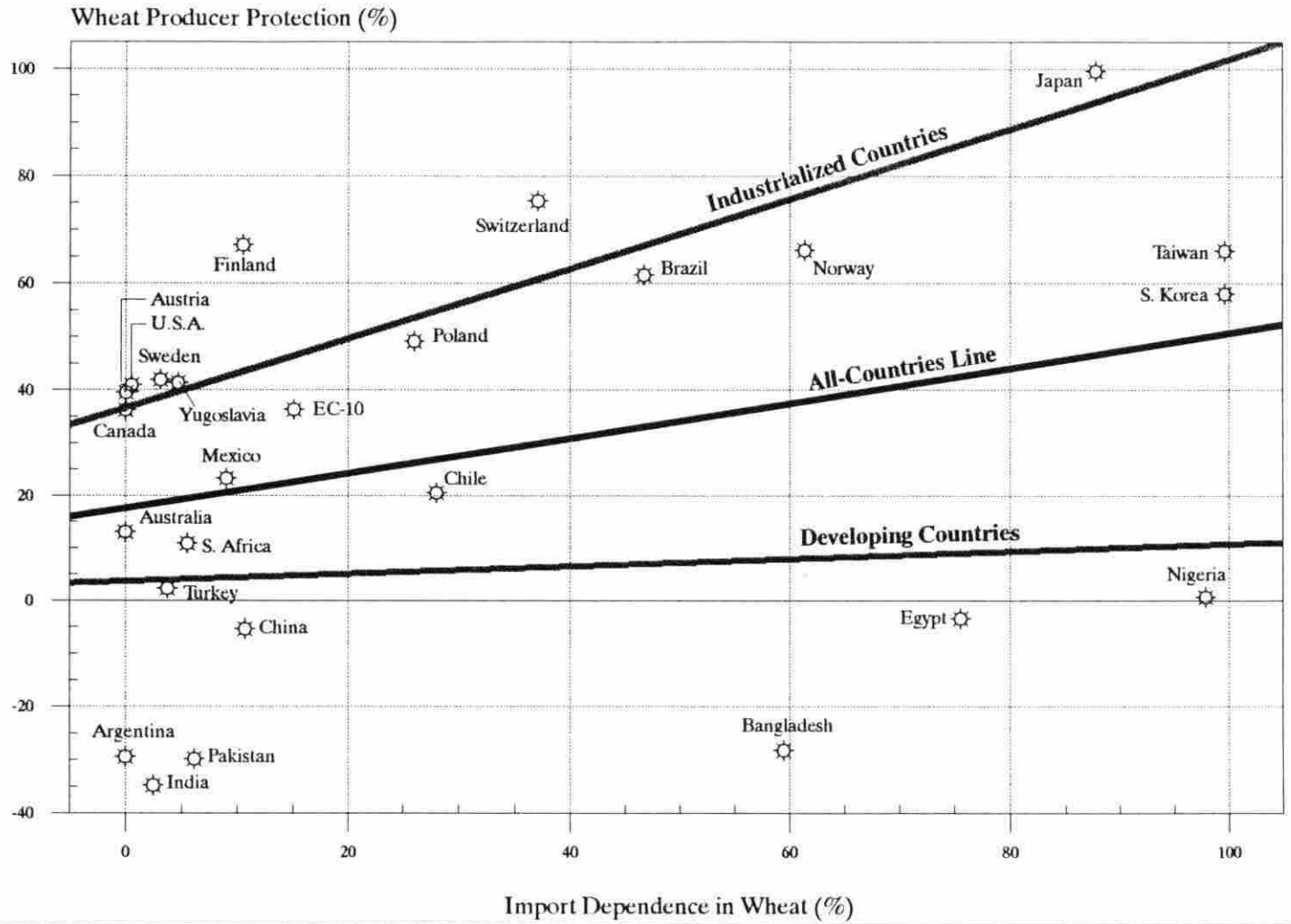
Level of Import Dependence[a]	Wheat Protection Level		
	High (PSE > 45%)	Low (PSE 0 to 44.9%)	Negative (PSE < 0%)
Industrialized Countries			
High Dependence (Above 20 %)	Finland, Japan Norway, Switzerland	-	-
Low Dependence (Below 20 %)	-	Australia, Austria Canada, EC-10 U.S.A., Sweden	-
Newly Industrialized Countries			
High Dependence (Above 20 %)	Taiwan S. Korea	-	-
Low Dependence (Below 20 %)	-	-	-
Middle Income Countries			
High Dependence (Above 20 %)	Poland Brazil	Chile	-
Low Dependence (Below 20 %)	-	S. Africa, Mexico Turkey, Yugoslavia	Argentina
Low Income Countries			
High Dependence (Above 20 %)	-	-	B'desh
Low Dependence (Below 20 %)	-	-	India, China Pakistan

a Import dependence is defined as the percentage share of wheat imports in the sum of domestic wheat production and imports.

Sources: Import dependence variable is based upon own calculations using the USDA, ERS (1991) *PS&D View '91: Users Manual and Database*. For protection levels, the data were obtained from USDA, ERS (1990), *Estimates of Producer Subsidy Equivalents and Consumer Subsidy Equivalents:1982-87*"; OECD (1991), *Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents:1979-90.*

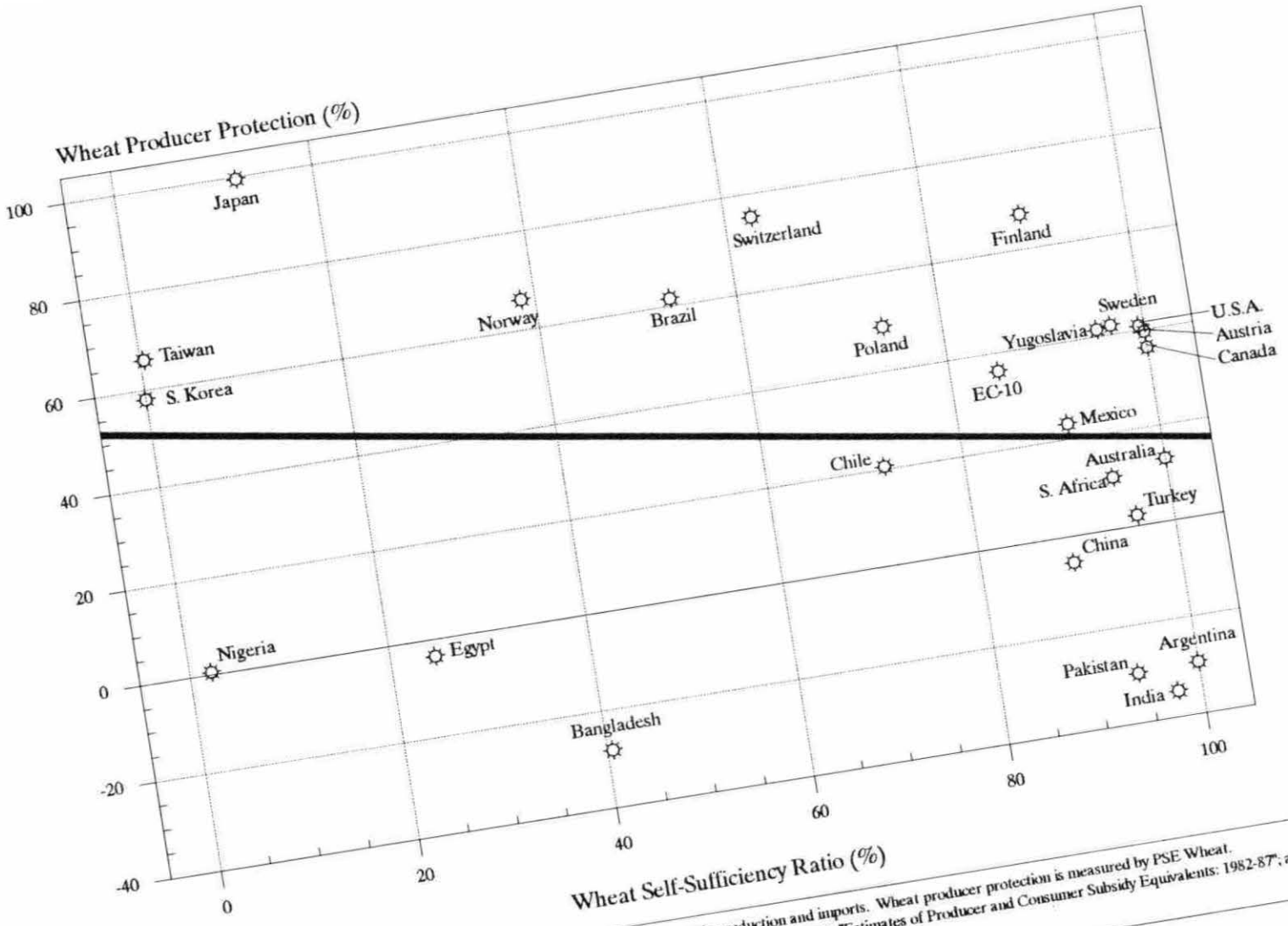
countries like Poland and Brazil, with high levels of import dependence for wheat, heavily protect their wheat producers (PSE ranging from about 50% to 62%), countries with lower wheat import dependence have relatively lower levels of protection. A major wheat exporting country like Argentina heavily taxes its wheat sector (PSE at -30%). Krueger (1989) and Krueger, Schiff and Valdes (1988) also found that there is a strong tendency to tax the exportable commodities and to tax them rather heavily. Analyzing protection patterns across 18 developing countries, the authors argue that direct intervention in exportable commodities by way of export taxes etc. points to a strong trend towards heavily taxing exportable commodities. Similar results are also reported in de Gorter and Tsur (1991). An explanation of this pattern might be found in the importance of these commodities in revenue generation and also has a dampening effect on domestic consumer prices, thus facilitating accessibility to food for poor consumers in these countries. All low income countries included in the present study with low levels of import dependence (India, Pakistan and China) tax their wheat producers. The lowest producer rates are reported to occur in countries where most of the wheat commodity is domestically supplied (Byerlee and Sain). In countries like India, Pakistan, China and Argentina where wheat import dependence is about less than 10%, the wheat producers are invariably taxed since their wheat protection levels range from -5% to -35%.

Countries with a high import dependence (>50%) that lie above the import dependence line protect their wheat farmers heavily while those below the import dependence line tax theirs (Figure 11). This result also supports the findings reported by Herrmann. The countries lying above the line also happen to be industrialized countries while those below are mostly low-income countries. The slope of the trend lines fitted for industrialized economies indicates relatively greater emphasis put on this variable in their domestic policies. This observation is also supported by the empirical analysis the results for which are discussed next.



Note: Import dependence is defined as the percentage share of wheat imports in the sum of wheat production and imports. Wheat protection levels are measured by PSE Wheat.
Sources: USDA, ERS (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87"; OECD (1991), "Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90"; and USDA, ERS (1991), "PS&D View '91: Users Manual and Database."

Figure 11: Pattern of wheat producer protection vis-a-vis wheat import dependence: Averages for 1982-87



Note: Self-sufficiency ratio is defined as domestic production divided by the sum of domestic production and imports. Wheat producer protection is measured by PSE Wheat.
Sources: The self-sufficiency ratios are based upon own computations using the data from USDA, ERS (1990) "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87"; and OECD (1991), "Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90."

Figure 12: Wheat self-sufficiency ratio and the level of wheat producer protection

IV.2 The Regression Analysis

The regression results for all models have the correct anticipated positive signs and regression coefficients for import dependence are significant at the 1% level of significance. However, the results are more robust for industrialized countries as compared to the results for the group of all countries or developing countries; the coefficient of determination increases dramatically from 7% to 55%. This highlights the fact mentioned above that the wheat import dependence variable is highly influential in the determination of protection levels for wheat in industrialized countries. Also, it seems that food security concerns are also overriding in case of these countries- an issue that requires further research. The results for developing countries also have the correct signs and are statistically significant at the 1% level, but the R^2 drops to 0.10. The intercept terms in all three regressions show the relative average level of wheat producer protection in case of all, industrialized, and developing countries at zero level of import dependence.

When the wheat import dependence variable is regressed against wheat consumer protection levels, the correlation interestingly is also positive, highlighting the fact that import dependent countries like South Korea, Bangladesh, Nigeria, Chile and Poland not only subsidize their wheat farmers but also their wheat consumers. One plausible explanation for this result may be found in the analysis of relationship of the per capita calorie intake from wheat as well as percentage expenditures on food with the protection levels which is the focus of next section.

The second multiple regression model specification in Table 13 uses, along with import dependence in wheat, the GNP per capita and share of agriculture in GDP. Protection awarded to wheat increases in countries with higher GNP per capita, share of non-agricultural sector in GDP and the import dependence. The results substantiate the observed patterns of protection in industrialized countries. For example, Japan, with high per capita incomes, high level of import dependence in wheat and relatively small share of agricultural sector in the total economy, has

producer protection levels as high as 100% for wheat.

IV.3 Self-Sufficiency in Wheat

Another substitute for the import dependence variable in the study of the trade nature of commodity is the self-sufficiency ratio of that commodity (Herrmann). Self-sufficiency ratio for wheat is defined as the ratio of domestic production of wheat to the sum of imports and domestic production. Thus, the self-sufficiency ratio seems to be inversely correlated to the import dependence variable and hence the results in this section merely corroborate the findings given above. The wheat sector will be protected more, the lower the degree of self-sufficiency (Herrmann),

Table 13: The influence of the extent of import dependence[a] of wheat on producer and consumer protection levels: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE Wheat				
All Countries	18.6310 + 0.2955 IMPDEPW* (3.4592)	0.07	154	26
	23.5984 + 0.3988 IMPDEPW* + 0.0020 GNPC* - 1.5340 GDPAG* (6.0656) (4.5044) (-6.3828)	0.56	146	25
Industrialized	37.0549 + 0.6738 IMPDEPW* (8.3263)	0.55	58	10
Developing	1.2596 + 0.3166 IMPDEPW* (3.2070)	0.10	94	16
CSE Wheat				
All Countries	-8.8561 + 0.3785 IMPDEPW* (2.7369)	0.05	130	22

Note: Figures in parentheses are *t* - values.

a Import dependence is defined as the percentage share of imports in the sum of domestic production and imports of that commodity.

* Statistically different from zero at the 1% level of significance.

Variables: IMPEDW: Import Dependence of Wheat.

Sources: The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.* Import dependence figures are based upon own computations using the data from USDA, ERS (1991) *"PS&D View '91: Users Manual and Database".*

thus depicting a negative correlation as shown in Figure 12. Countries that are self-sufficient in wheat tend to protect their wheat farmers less than the countries with lower self-sufficiency ratios (Japan, S. Korea, Taiwan, Norway, Brazil, Switzerland etc.). The regression results in Table 14 are similar to those presented in Table 13 for import dependence although the coefficient sign for self-sufficiency ratios turns opposite, as expected. The notion of self-sufficiency seems to carry more weight for industrialized countries ($R^2 = 0.55$). This issue warrants further investigation, specially with respect to consumer food security issues; as further discussed in Section VII.

The majority of quantitative studies aimed at explaining the patterns of agricultural protection levels have so far ignored the importance of the trade nature

Table 14: The influence of self-sufficiency ratio of wheat[a] on producer and consumer protection levels: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE Wheat				
All Countries	48.1816 - 29.5506 SSRATIOW* (-3.4592)	0.07	154	26
Industrialized	104.4350 - 67.3801 SSRATIOW* (-8.3263)	0.55	58	10
Developing	32.9178 - 31.6582 SSRATIOW* (-3.2070)	0.10	94	16
CSE Wheat				
All Countries	28.9948 - 37.8509 SSRATIOW* (-2.7369)	0.05	130	22

Note: Figures in parentheses are *t* - values.

a The Self-sufficiency ratio of wheat (SSRATIOW) is defined as domestic wheat production divided by the sum of domestic wheat production and imports.

* Statistically different from zero at 1% level of significance.

Variables: SSRATIOW: Wheat Self-Sufficiency Ratio.

Sources: The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.* Self-sufficiency figures are based upon own computations using the data from USDA, ERS (1991) *PS&D View '91: Users Manual and Database.*

of the commodity in question. It might not have had been possible to include trade characteristics in majority of these studies since the focus there was mainly on the aggregate agricultural sector and not on individual commodities like wheat as attempted in this section. The results presented in this section show that the countries with high level of wheat import dependency tend to protect their wheat sectors heavily. This pattern is even more accentuated when only industrialized countries are considered. These results hold even when the import dependency variable is substituted by the self-sufficiency ratios highlighting the national food security concerns, especially in industrialized countries.

CHAPTER V. CONSUMER CHARACTERISTICSOF THE COMMODITY

Most of the earlier work on the determination of agricultural protection patterns has not concentrated on a product-specific approach but has rather focused on an aggregate approach - total agricultural protection. However, as the data reveal, protection levels vary significantly across agricultural commodities for any given country (Herrmann) - producers of rice and wheat are taxed in India, while rapeseed and peanut growers are provided subsidies (USDA). Aggregating protection levels across commodities, therefore, would render the results less meaningful (Gautam et al.). Also, it has been reported that the lowest producer prices occur in countries where wheat is a staple food and vice-versa (Byerlee and Sain). In this section, therefore, an attempt is made to determine the impact of characteristics of individual food commodities on the level of protection awarded to them. These characteristics are exhibited by variables such as the per capita calorie intake from the commodity, its share in total calorie intake (the indicator of the staple food nature of the commodity) as well as the percentage expenditure on food (the Engel Coefficient). It has been shown by Balisacan and Roumasset that as per capita income grows and budget share for the food expenditures falls, the sensitivity of consumer welfare decreases with respect to changes in the price of food.

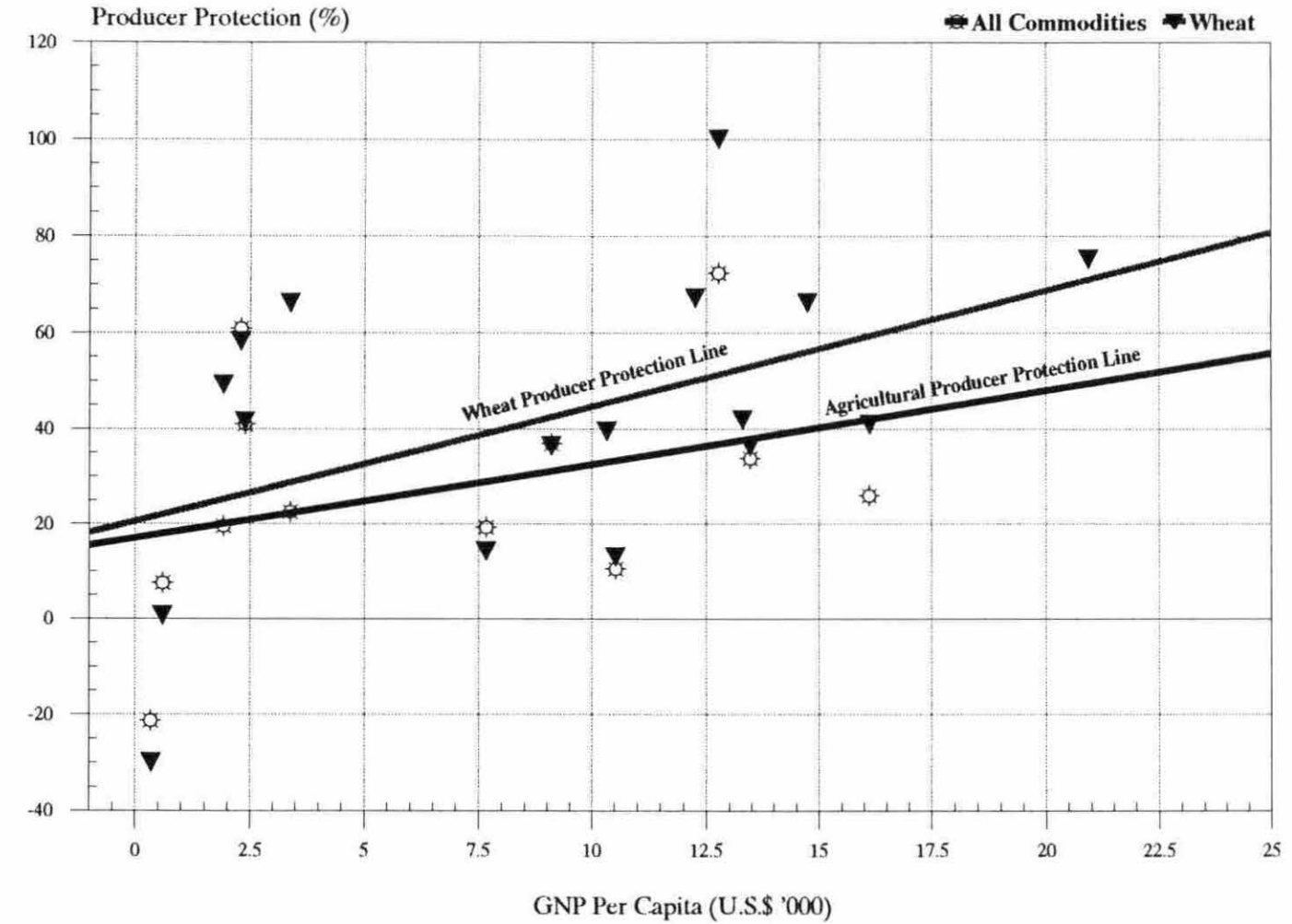
The farm policy in the United States has consistently supported some commodities such as wheat, sugar, rice and dairy products, while, at the same time, important commodities such as soybeans, poultry and hogs have received little protection (Gardner, 1990). Similarly, in India, while wheat producers and oilseed consumers are taxed, wheat consumers and oilseed producers, on the other hand, are subsidized. These differences in protection levels may be due to various factors like importance of the commodity in the food consumption of the people, export/import nature of the commodity, group size of producers of the commodity as well as their geographical dispersion etc. The next section concentrates on one of these plausible

factors, namely, the importance of the commodity in people's diet.

V.1 Importance of Commodity in Food Intake

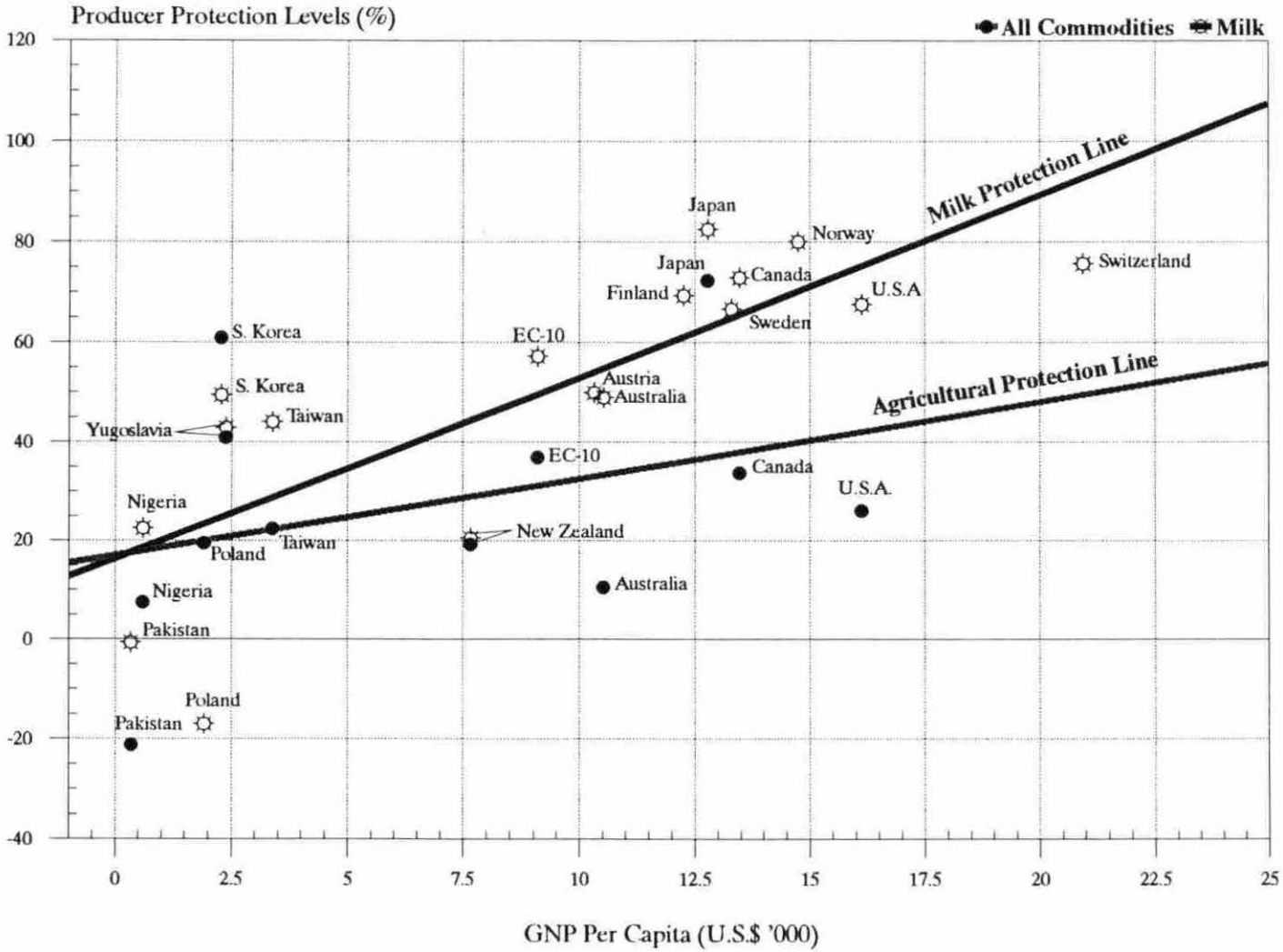
Olson (1988) stresses that the extent of price distortion varies from one agricultural commodity to another - there is more distortion in dairying than in beef production and more in rice production than in soybeans. This pattern is discernible in exhibits throughout this study that compare overall agricultural protection rates with individual commodities like wheat, milk and rice. Figure 13 and 14 show that the protection levels for individual commodities like wheat and milk tend to be significantly highly sensitive to the changes in per capita income of consumers. This also reveals that not all commodities would receive the same level of protection and, hence, studying the agricultural sector as a unit would obscure the results and the sensitivity analysis would be less meaningful. Further, the protection levels for commodities that form the important food group in a country (for example wheat and milk in the U.S.) tend to be different than for the commodities that do not (for example, hogs, poultry or oats).

When the relationship between the share of wheat in total calorie intake per day per capita is plotted against wheat producer protection, the log-regression trend line tends to be downward sloping indicating that as the percentage of calorie intake from wheat increases, protection awarded to wheat producers tends to decline (Figure 15). However, the results are less meaningful intuitively when the regression line includes all industrialized and developing countries since, as is shown in the figure, the percentage intake from wheat is similar for India and Norway, Japan and Bangladesh etc. although their wheat protection levels differ by about 100% and 130%, respectively. An implication for further research might be to include some qualitative variables for the countries according to their GNP per capita etc. or to look at the relationship for industrialized and developing countries in isolation.



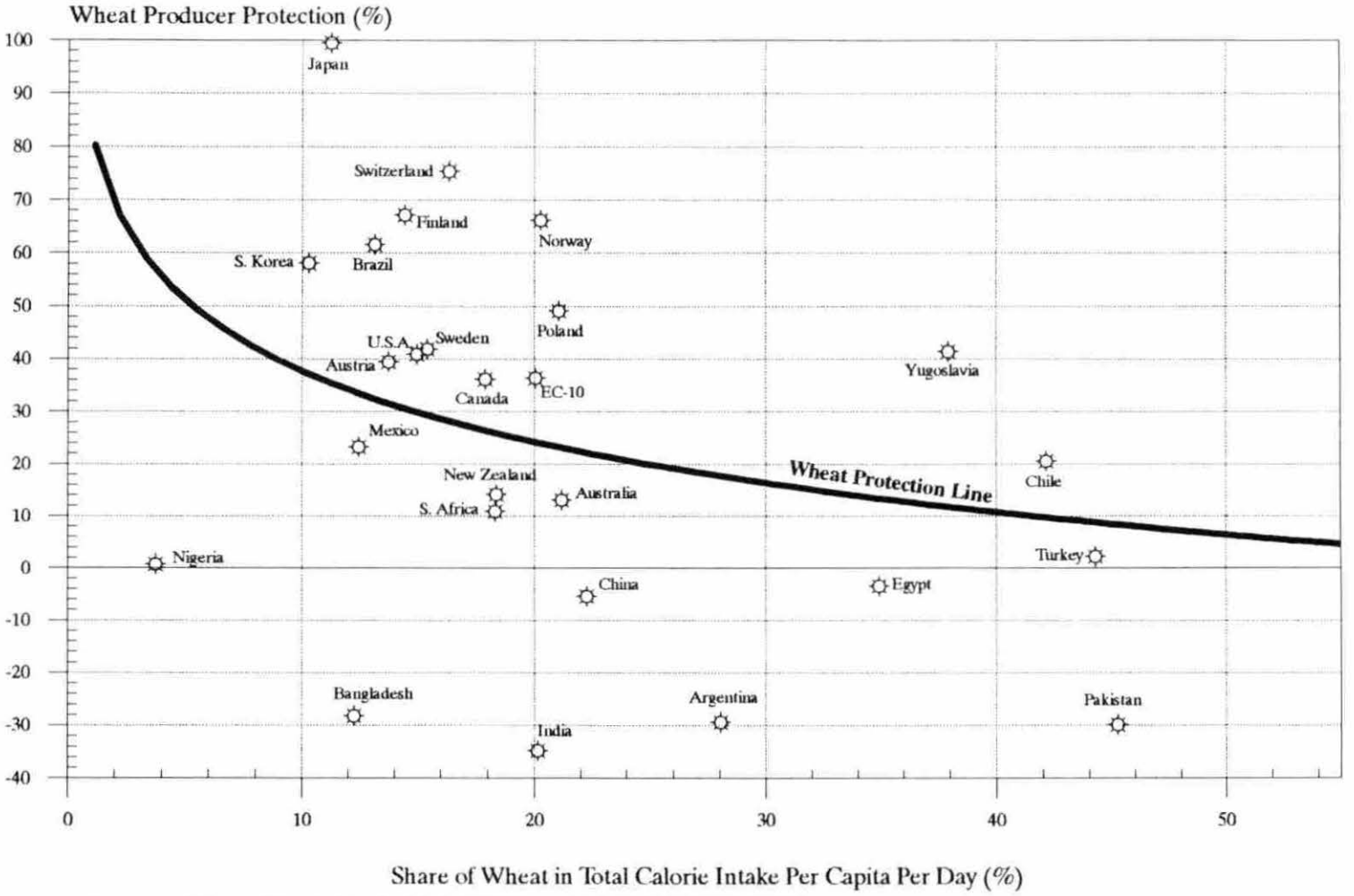
Note: Overall and wheat producer protection levels are measured by PSE All and PSE Wheat, respectively. The commodity bundle may vary across countries
Sources: GNP figures are from the IMF, "International Financial Statistics," various issues. The PSEs are from USDA, ERS (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87."

Figure 13: Influence of commodity characteristics on the producer protection levels: Wheat



Note: Producer protection levels for milk and all commodities are measured by PSE Milk and PSE All, respectively. The commodity bundle may vary across countries.
Sources: IMF, "International Financial Statistics," various issues; USDA, ERS (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87"; and OECD (1991), "Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90."

Figure 14: Influence of commodity characteristics on the producer protection levels: Milk



Note: Log form is specified for the share of wheat in total calorie intake. Wheat producer protection level is measured by PSE Wheat.
Sources: Calorie intake data are from FAO, "Food Balance Sheets: Averages 1984-86"; PSE data are from USDA, ERS (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87"; and OECD (1991), "Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90."

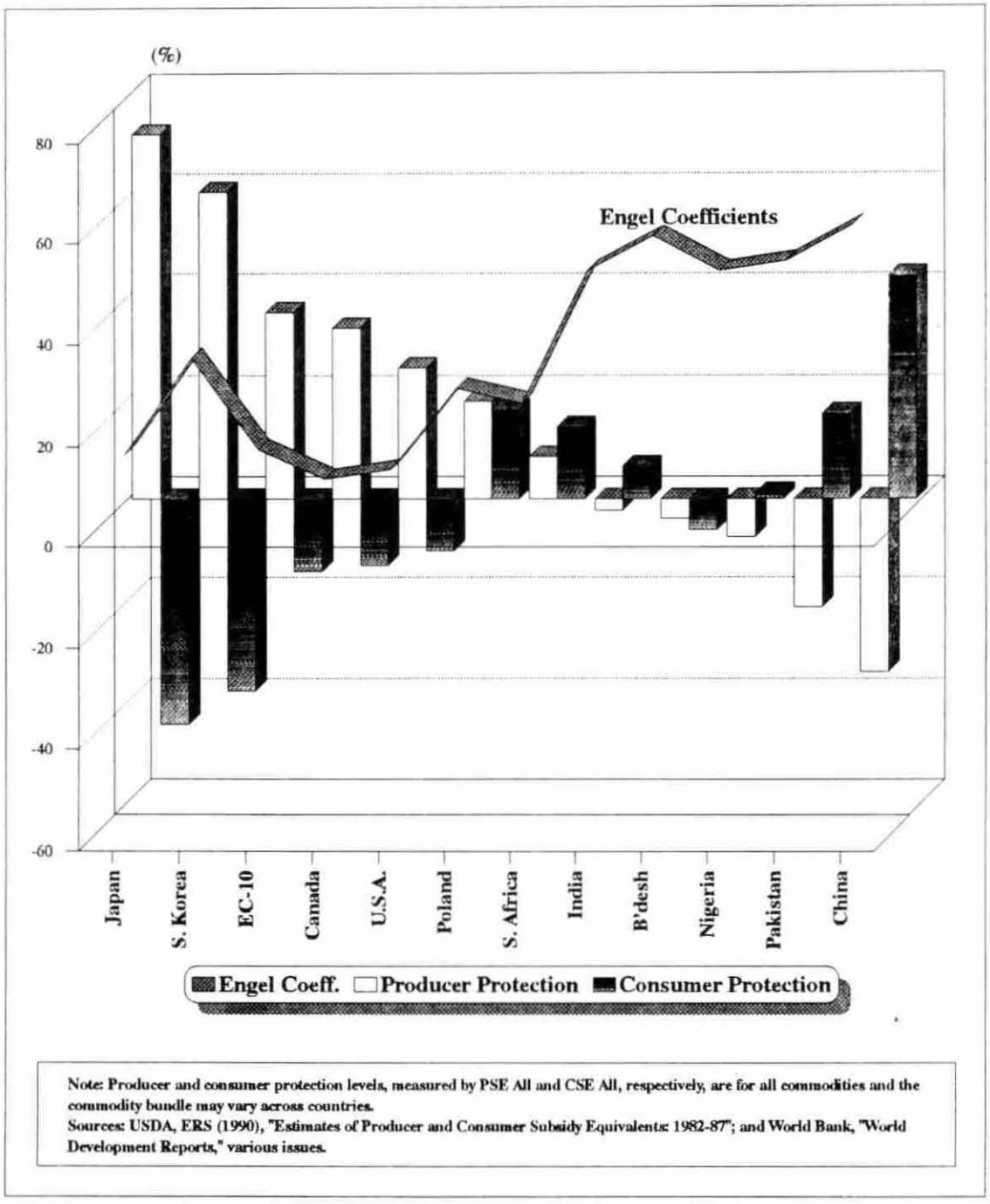
Figure 15: Agricultural protection levels and staple food characteristics of wheat

V.2 Engel Coefficients

It has been noted that as the proportion of personal disposable income spent on food decreases, the protection awarded to agriculture increases. "The reduction in resistance against agricultural protectionism would be reinforced by the Engel's law. As the share of food in total consumption expenditure declines, the effect of high food prices on the cost of living becomes smaller. Therefore, agricultural protectionism becomes more tolerable to consumers as their income rises. 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 labor wage rate declines" (Hayami, 1972). One of the primary determinants of benefits of investment in opposing agricultural protection to the urban consumers is the share of food in total consumption expenditure (Balisacan and Roumasset, 1987; Honma and Hayami, 1986). As this share increases, the stakes for consumers and industrialists in developing countries become higher in cheap-food policies where food is a "wage-good" and constitutes a sizeable proportion of total expenditures. Thus, it can be reasonably be argued that as the share of food in total expenditures decline, as in the case of industrialized countries, the political pressure from urban consumers and industrialists dissipates, resulting in higher support for the agricultural sector. These observations are explicitly visible from Figure 16 which shows that agricultural producer protection tends to be lower for countries where consumption expenditure on food is low. When trend lines are fitted for depicting the nature of the relationship across industrialized and developing countries between the Engel Coefficient and producer and consumer protection levels (Figure 17), a further point of interest, largely ignored in studies thus far, is revealed that the consumer protection level is positively correlated with the Engel Coefficient.

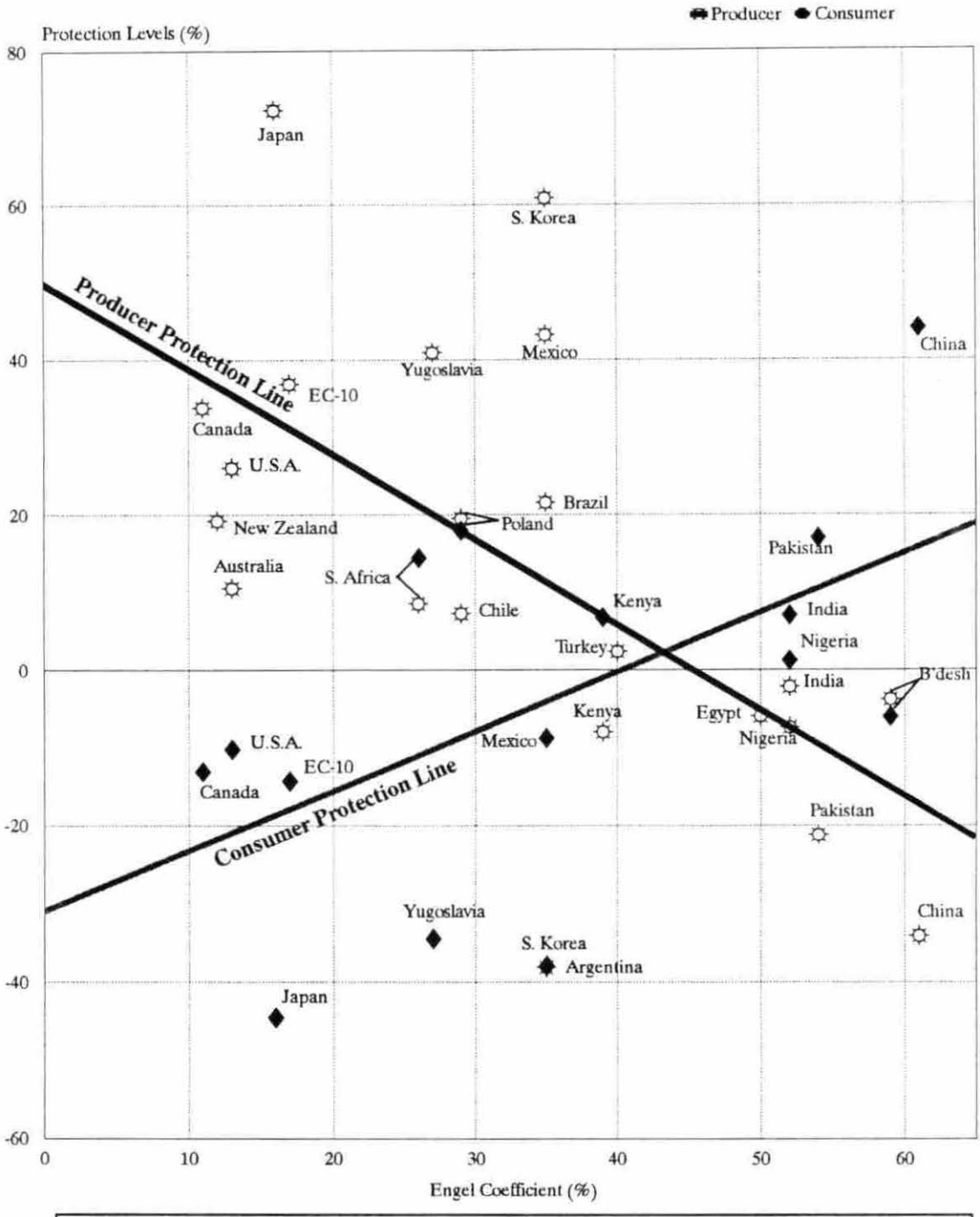
V.3 The Regression Analysis

Tables 15, 16 and 17 present the regression results treating percentage



Note: Producer and consumer protection levels, measured by PSE All and CSE All, respectively, are for all commodities and the commodity bundle may vary across countries.
Sources: USDA, ERS (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87"; and World Bank, "World Development Reports," various issues.

Figure 16: Producer and consumer protection levels for all commodities and the Engel Coefficients



Note: Producer and consumer protection levels are measured by PSE and CSE for all commodities, respectively. The commodity bundles may vary across countries.
Sources: USDA, ERS (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87," and World Bank, "World Development Report," various issues.

Figure 17: Relationship of producer and consumer protection levels with Engel Coefficients

expenditure on food - the Engel coefficient (ENGELCF); total calorie intake per capita per day (TOTALCAL); and the share of wheat in total calorie intake per capita per day (WHEATCAL) as explanatory variables for explaining the overall as well as wheat protection levels. The results for explaining overall agricultural producer protection (Figure 17) show that as the percentage of expenditure on food increases, the protection levels tend to decrease. The parameter estimates for the Engel coefficient are statistically significant at 1% level (Table 15). This implies that in poor countries, where a large proportion of income is spent on food, the governments try to keep the prices of foodlow by taxing their agricultural producers. The results also hold when only developing countries are included in the model although the R^2 decreases to 0.23. However, in the model for industrialized countries, the sign on the coefficient changes to positive. Nonetheless, this result seems to be consistent with the pattern of protection among industrialized countries. For example, the share of food in total consumer expenditures is about 13% in the U.S. and the overall producer protection level is around 26% whereas the same figures are at 16% and 72%, respectively, in case of Japan. Similarly, in case of Switzerland where the Engel coefficient is 17%, the wheat protection level is more than 75%. Hence, the positive sign on the Engel coefficient seems to reflect these patterns correctly.

The coefficients with the total calorie intake also had the correct signs for all the three groups of countries and were statistically significant at the 1% level. As the total calorie intake increases in the diets of the people, they seem to acquiesce to higher levels of farm protection. However, within industrialized countries, the higher the total calorie intake in the diet of individuals, the lower the protection awarded to the agricultural sector and vice-versa. Moreover, for this group, the R^2 improves to 0.56. This seems to significantly explain the facts as mentioned above since countries like Japan where total calorie intake is much lower than, say, the U.S., the level of protection is much higher. A further point of research interest would be to explore

Table 15: Relationship of Engel Coefficients and calorie intakes with producer and consumer protection levels: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE All Commodities[a]				
All Countries	48.8099 - 1.1005 ENGELCF* (-7.4842)	0.30	130	22
	-49.1464 + 0.0213 TOTALCAL* (4.3565)	0.13	130	22
Industrialized	-39.5749 + 5.3176 ENGELCF* (3.8065)	0.30	34	6
	237.4293 - 0.0610 TOTALCAL* (-6.6065)	0.56	34	6
Developing	59.3763 - 1.3178 ENGELCF* (-5.2913)	0.23	94	16
	-48.1077 + 0.0195 TOTALCAL* (3.1916)	0.10	94	16
CSE All Commodities[a]				
All Countries	-30.9926 + 0.7680 ENGELCF* (4.6054)	0.19	88	15
	32.4206 - 0.0129 TOTALCAL** (-2.5190)	0.07	88	15

Note: Figures in parentheses are *t* - values.

a PSE and CSE are averages for all commodities and the commodity bundle may differ across countries.

*,** Statistically different from zero at 1% and 5% level of significance, respectively.

Variables: ENGELCF: Engel Coefficients -- Defined as the share of food consumption in total private consumption expenditure; and TOTALCAL: Total Calorie Intake Per Capita Per Day.

Sources: The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.* ENGELCF are from The World Bank, *World Development Report*, various issues; TOTALCAL are from FAO, *Food Balance Sheets: 1984-86 Average.*

the relationship by introducing a binary variable for Japan.

Another aspect of agricultural protection that has received scant attention so far is the impact of these variables on the protection received by the consumers, rather than producers alone (Binswanger and Scandizzo; Honma and Hayami). In case of consumer protection levels, the parameter estimates obtained for the percentage expenditure on food have the correct sign which is statistically significant at the 1% level and the model explains about 19% of the variation. As expenditure on food increases, subsidies provided to consumers increase, as is the case for most developing countries. Also, as the total calorie intake in the diet increases, consumers are less likely to be supported, as is the case for most industrialized countries.

In order to examine the effects of other nutrient measures such as protein intakes per day per capita, regression analysis was done to determine any differences in their explanation of protection awarded. Table 16 presents the results form these regressions using protein intakes from cereals (PROTEINCR), from wheat (PROTEINWH) and from meat (PROTEINMT) as the explanatory variables. Since dietary habits in East Asian countries like Japan and South Korea differ significantly from other industrialized countries, qualitative variables such as intercept dummy (DEASIA) and slope dummies (DEASIA x PROTEINCR and DEASIAx PROTEINMT) were also used.

As the protein intake from cereals increases, the protection awarded to the agricultural sector as a whole declines, as depicted by the first model in the table. Intuitively, protein intake from cereals is higher in developing countries as compared to industrialized countries. In industrialized countries, the main source of protein are animal products, whereas, in developing countries, protein from cereals accounts for a major portion in the daily diet. Therefore, since protection levels are generally higher in industrialized countries, the PSE and protein intake from cereals would be negatively correlated across countries.

Table 16: Relationship of protein intakes with producer protection levels: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE All Commodities[a]				
All Countries	28.5969 - 0.4573 PROTEINCR** (-2.0750)	0.03	130	22
	22.9764 - 0.4574 PROTEINWH** (-2.0050)	0.03	130	22
	29.0555-0.5398PROTEINCR** + 53.4177 DEASIA* (-2.4796) (7.0710)	0.34	117	20
Industrialized	-20.4305 + 2.3660 PROTEINCR* (3.9518)	0.28	40	7
	91.5208 - 3.2778 PROTEINWH* (-8.2564)	0.63	40	7
	77.7962 - 1.5589 PROTEINMT* (-10.1624)	0.72	40	7
	26.3971 + 1.2698 PROTEINCR* + 44.2858 DEASIA x PROTEINCR* (8.6372) (8.7284)	0.65	39	7
	50.3350 - 0.7554 PROTEINMT* + 2.7601 DEASIA x PROTEINMT* (-2.8052) (3.4563)	0.79	39	7
PSE Wheat				
All Countries	27.6272 - 0.4823 PROTEINWH*** (-1.6129)	0.02	124	21
	42.2117-0.8409 PROTEINCR* + 61.3108 DEASIA* (3.1254) (6.5671)	0.34	117	20
Industrialized	111.3753 - 4.1403 PROTEINWH* (-6.7352)	0.53	40	7

Note: Figures in parentheses are *t* - values.

a PSE are averages for all commodities and the commodity bundle may differ across countries.

*,**,*** Statistically different from zero at 1% , 5% and 10% level of significance, respectively.

Variables: PROTEINCR, PROTEINWH and PROTEINMT are protein intakes/day/capita from cereals, wheat and meat, respectively. DEASIA is the dummy for East Asian countries.

Sources: The PSE figures are from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.* Data on protein intakes are from FAO, *Food Balance Sheets: 1984-86 Averages.*

In developing countries, food policies that ensure accessibility to food for consumers with low purchasing power, generally result in lower average prices received by farmers (Bigman, 1985; Chisholm and Tyers, 1982). Since, wheat and other cereals are the main source of protein in the daily diets of people in developing countries, growers of these receive substantially lower protection as compared to farmers in industrialized countries.

The dietary patterns in East Asian countries reveal a higher protein intake level from cereals including rice and lower intakes from wheat and meats, and the significance of qualitative variables used for these countries in the analysis for industrialized countries reaffirms these patterns. Given the relatively higher level of protection in case of these countries, a negative correlation is observed with protein intake from wheat and meat but positive correlation with protein from cereals. These results also substantiate the results presented in table 15.

Table 17 presents the results for all industrialized and developing countries for an individual commodity: wheat. As expected, an increase in the percentage expenditure on food is associated with a decrease in the protection level awarded to wheat producers. This corroborates the data for countries like India, Pakistan, Nigeria etc. where wheat producer prices are kept at relatively lower levels in order to subsidize their wheat consumers. This finding further implies that there should be a positive correlation between the Engel coefficient and the level of subsidy to wheat consumers. This in fact is confirmed from the regression equation explaining the consumer protection levels where the coefficient is highly significant with an R^2 value of 0.30. The relationships between the wheat protection levels and total calorie intake; total calorie intake from wheat; and the percentage share of wheat in total calorie intake also have the expected signs and are statistically significant.

This section further highlights the importance of studying individual commodities in the determination of agricultural protection levels. Important food commodities, like milk and wheat, are highly sensitive to changes in per capita

Table 17: Relationship of Engel Coefficients and calorie intakes with protection levels for wheat producers and consumers: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE Wheat				
All Countries	70.5544 - 1.5016 ENGELCF* (-9.9306)	0.39	154	26
	-81.1771 + 0.0355 TOTALCAL* (6.1154)	0.20	154	26
	41.3129 - 0.0246 TOTALWHT** (-2.5888)	0.04	154	26
	51.5998 - 1.2264 WHEATCAL* (-4.5513)	0.12	154	26
CSE Wheat				
All Countries	-54.5610 + 2.1472 ENGELCF* (7.5035)	0.30	130	22
	152..2260 - 0.0492 TOTALCAL* (-5.3212)	0.18	130	22
	25.5327 - 0.0372 TOTALWHT** (-2.0986)	0.03	130	22

Note: Figures in parentheses are *t* - values.
*,** Statistically different from zero at 1% and 5% level of significance, respectively.
Variables: ENGELCF: Engel Coefficients -- Defined as the share of food consumption in total private consumption expenditure; TOTALCAL: Total Calorie Intake Per Capita Per Day; TOTALWHT: Total Calorie Intake From Wheat Per Capita Per Day; WHEATCAL: Percentage of Calories From Wheat in Total Calorie Intake Per Capita Per Day.
Sources: The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.* ENGELCF are from The World Bank, *World Development Report*, various issues; TOTALCAL, WHEATCAL and TOTALWHT are taken from FAO, *Food Balance Sheets: 1984-86 Average.*

incomes of consumers. Moreover, the cross-commodity differences in protection levels tend be associated with the importance of the commodity in the food basket of the consumers. Another significant contribution of the analysis, which has largely been ignored in studies thus far, is that the consumer protection level is positively correlated with the Engel coefficient and is negatively correlated with the total calorie intake. As the total calorie intake in the diet of people increases, and as their percentage expenditure on food decreases, consumers seem to acquiesce to higher levels of farm protection.

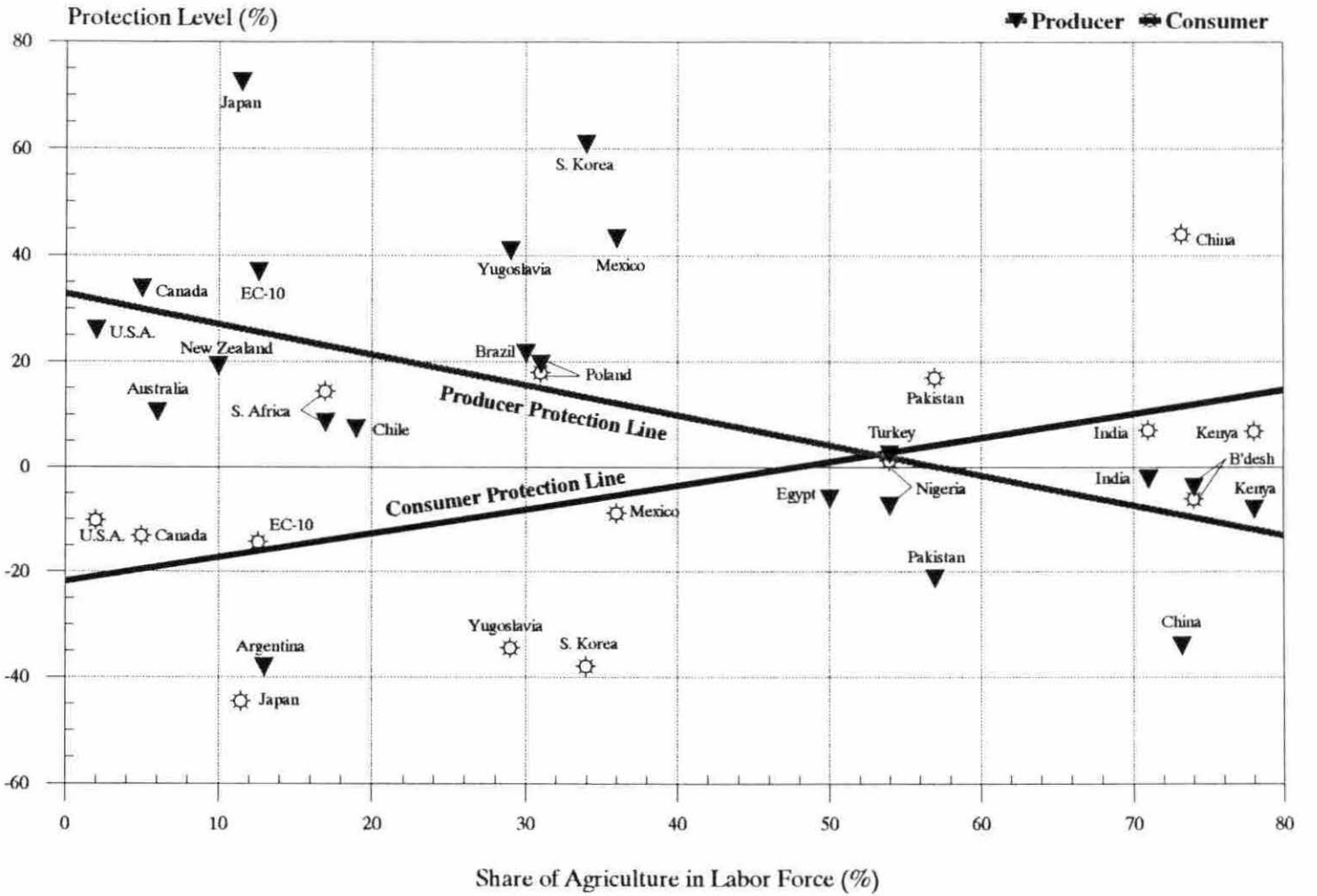
CHAPTER VI. GROUP SIZE EFFECTS ON AGRICULTURAL PROTECTION

VI.1 Share of Agriculture in Labor Force

Olson highlights the importance of the physical size of the group as well as the collective action by the group in the determination of agricultural protection. The agricultural sector in many developing countries has been persistently taxed even though the rural population is substantially larger than the urban consumers which have consistently been subsidized (de Gorter and Tsur). The situation is just the opposite in case of industrialized countries where less than 3% of the population is successful in securing farm policies that redistribute income to farmers from the other 97% (Gardner). Olson (1986) argues that rural sector in low-income countries is exploited because the large and dispersed members of this sector can neither organize themselves adequately nor exercise sufficient pressure on the government to act on their behalf. While, on the other hand, in industrial countries, it is the urban sector that is large and dispersed and, hence, is exploited to benefit the more organized, and smaller, rural sector.

Politically successful groups tend to be small relative to the size of the groups taxed to pay their subsidies. The opposition of taxpayers to subsidies decreases as the number of taxpayers increases and this may well explain why farmers in rich countries and urban dwellers in poor countries are politically successful (Becker, 1983). Gardner, while contesting the influence of group size on the protection levels, cites examples of farm groups of various sizes in the U.S. that have been successful in obtaining protection (sugar, dairy, peanut, wheat etc.). He emphasizes the decline in farm incomes as a more pressing factor in the determination of protection levels than the group size alone.

This pattern of protection is also substantiated graphically by Figures 18 and 19. The producer protection line shows that as the share of agriculture in total labor force increases, the protection awarded to this sector declines (Figure 18). In most



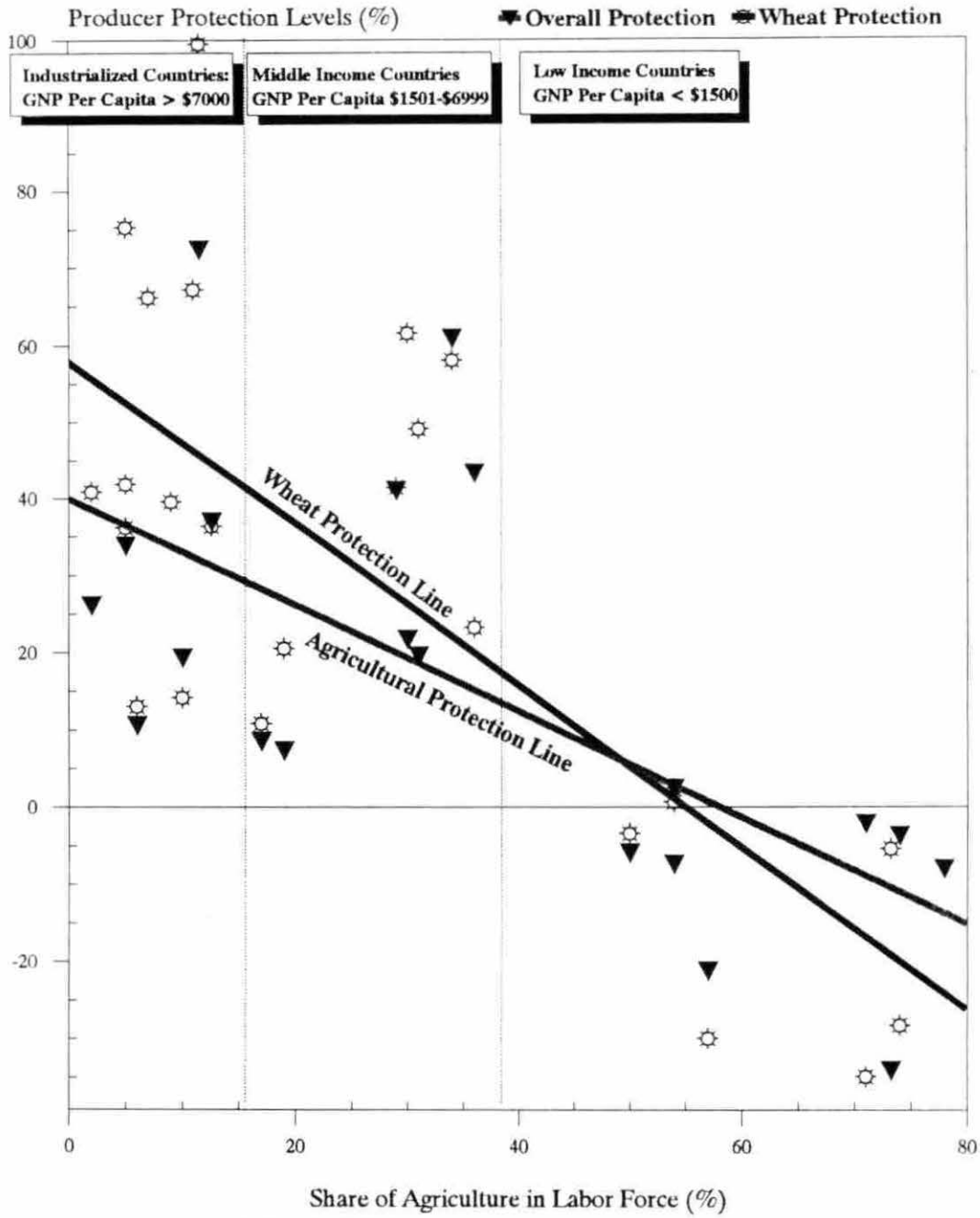
Producer and consumer protection levels are measured by PSE All and CSE All, respectively. The commodity bundles may vary across countries.
Sources: USDA, ERS, (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87:; and World Bank, "World Development Report," various issues.

Figure 18: Patterns of producer and consumer protection vis-a-vis share of agriculture in labor force

industrialized countries,where agricultural protection levels are relatively higher, the agricultural sector constitutes only about 2-13% of the total labor force; with Japan and EC-10 at 11.5% and 12.5%, respectively. These results are consistent with Honma and Hayami's proposed hypothesis that as the share of agriculture in the total economy declines, the level of agricultural protection tends to rise. Demand from farmers for agricultural protection increases markedly once an economy has reached a point where "the incentives for inter-sectoral adjustment are such that the absolute number of farmers begins to fall" (Anderson and Hayami, p. 3).

On the other hand, protection awarded to consumers shows a positive relationship with the share of agriculture in the labor force. This relationship has so far been ignored in the studies of the patterns of agricultural protection. In developing countries, where the rural population is much larger, taxing agriculture becomes the main source of government resources (Byerlee and Sain). On the other hand, the disproportionate political power wielded by urban consumers is instrumental in keeping the food prices at a relatively lower level as the urban consumers and industries demand cheap food and the political market place tends to favor them at the expense of the rural people (Schultz; Anderson and Tyers).

Figure 19, on the other hand, compares the overall protection levels with those for wheat and shows higher sensitivity of wheat protection in comparison to overall agricultural protection. Wheat producer's group seems to be more effective in obtaining protection in industrialized countries while in low-income countries it loses out to the general agricultural sector. A subjective division of countries reveals that in industrialized countries, the share of agriculture in total labor force tends to be less than 13%, while middle-income and low-income countries range from 13-35% and above 35%, respectively. The industrial countries, thus, tend to lie on the upper extreme of the protection lines while low-income countries are spread along the lower half. The results substantiate the earlier findings that as the agricultural group size decreases, countries tend to subsidize their farming sector (Honma and Hayami,



Note: Agricultural and wheat producer protection levels are measured by PSE All and PSE Wheat, respectively. Commodity bundle for PSE All may vary across countries.
Sources: USDA, ERS, (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87," and World Bank, "World Development Report," various issues.

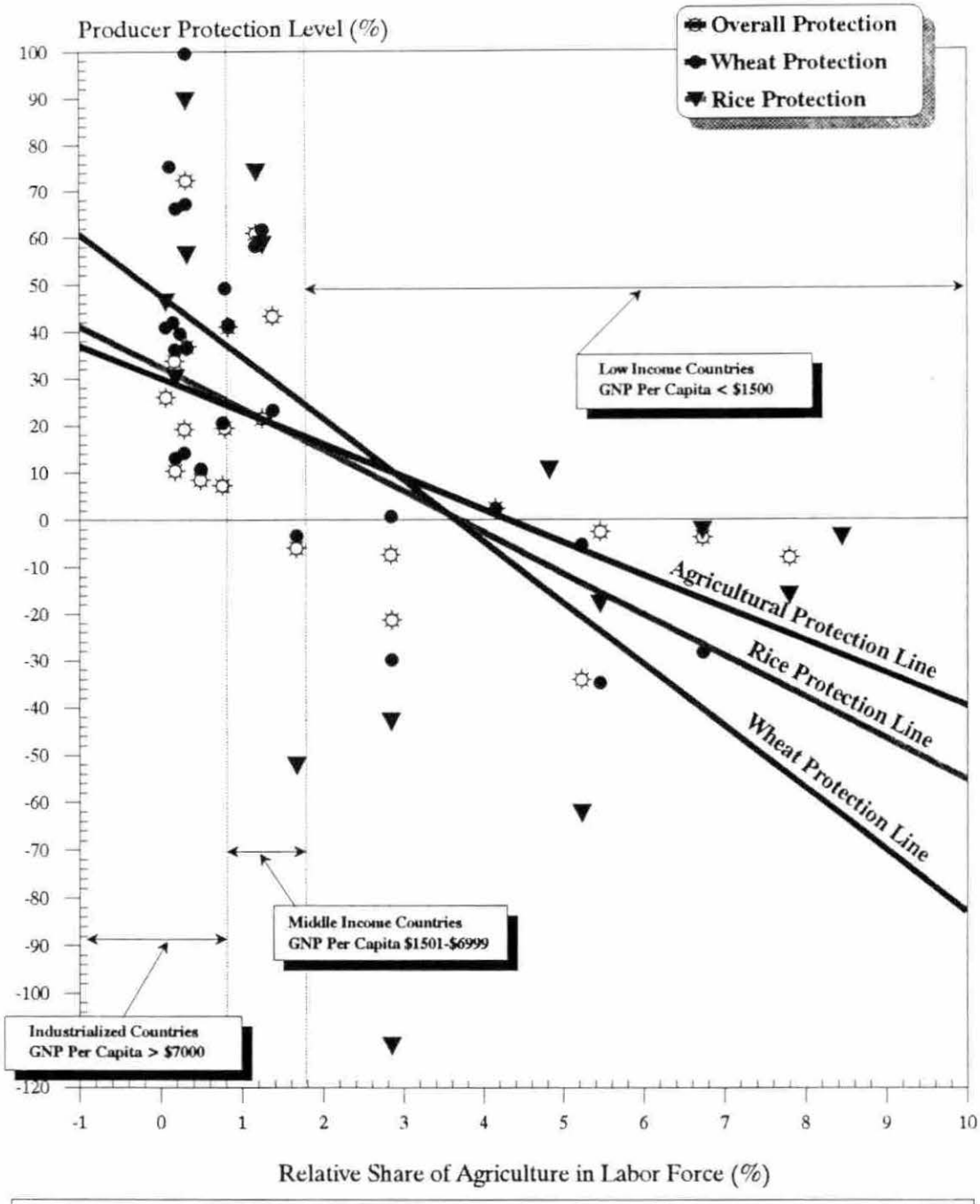
Figure 19: Influence of commodity group characteristics on agricultural protection

Olson).

VI.2 Relative Size of Agriculture to Industrial Sector

As the share of agriculture in terms of employment falls, relative to the industrial sector, it makes it easier for the government to acquiesce to farmers' demands increased protection (Anderson and Hayami; p. 3). These patterns have been analyzed graphically in case of wheat, rice and overall agricultural protection in Figure 20. The figure plots these producer protection levels against the relative share of agriculture in employment. Country names are not provided to facilitate clarity since three data points refer to each country. All countries are subjectively divided into three groups according to their GNP per capita: industrial countries with GNP per capita exceeding $7000, middle-income from $1501 to $6999, and low-income countries with GNP per capita below $1500. A perusal of the figure reveals that industrialized countries are contained within 0-0.4% range of the relative share of agriculture in labor force while the middle-income countries lie between 0.5 to 1.6% range. The agriculture sector in low-income countries has about 1.6 to 9% share of the labor force relative to their industrial sector. Moreover, industrial countries lie at the upper left-hand extremes of the protection lines with low-income countries on the lower half.

The figure shows that the protection levels for individual commodities like wheat and rice are more sensitive to changes in this variable. Industrialized countries tend to protect their wheat farmers more as compared to their overall agricultural sector. On the other hand, developing countries tend to tax their wheat sector more heavily than their overall agricultural sector. As the share of agricultural sector declines in the national labor force relative to the industrial sector, the incomes of urban consumers tend to rise and their opposition to raising food prices dissipates, as in the case of industrialized countries. The overall agricultural protection levels also tend to increase with the industrial development since, as the number of farmers



Note: Country names are not given to avoid congestion since each country would appear for all three commodity groups.
Producer protection levels for overall agriculture, wheat and rice are measured by PSE All, PSE Wheat and PSE Rice, respectively.
Commodity bundle in PSE All may vary across countries.
Sources: USDA, ERS, (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87"; World Bank, "World Development Report," various issues; and OECD, (1991), "Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90."

Figure 20: Influence of relative share of agricultural labor force on producer protection levels

decreases, it becomes easier for them to organize political lobbying. As per capita incomes of the non-farm sector increases with the relative expansion of the industrial sector, the per capita burden of assisting the farming sector declines, thereby reducingresistance to agricultural protectionism (Honma and Hayami).

VI.3 The Regression Analysis

The regression results explaining the effects of the relative share of agriculture to total and industrial labor force on the protection levels for overall agricultural producers and consumers as well as wheat producers and consumers are presented in Table 18. In the models for overall protection levels, the results are also provided for industrial and developing countries separately.

All regression coefficients for explanatory variables are significant at 1% level and the models reveal a good fit in that the R^2 varied between 0.10 to 0.35. This indicates that the share of agriculture to total and industrial labor force is an important determinant of the overall and commodity-specific protection levels.

The coefficients for overall agricultural protection have the correct signs, are significant and account for about 20% of the variation in protection levels. As the share of agricultural to total and industrial labor force declines, the level of protection awarded to agriculture increases indicating the effect of differences in the relative group size across countries. This relationship is also exhibited in reality as the share of agriculture in Australia is about 5 percent with its overall protection rate at 34% while in case of Pakistan, the figures are 57% and -21%, respectivèly.

In the case of industrial countries, the sign on the explanatory variables changes to positive reflecting the characteristics of this group of countries. For example, in Japan, where the agricultural labor force is about 11.5% of the total, its protection level is about 72%, while the figures are 2% and 26%, respectively, in case of the U.S. Moreover, the coefficient of determination stays at the 0.20 level. The results for developing countries are in conjunction with the results for all countries in

Table 18: Group-size impacts on agricultural protection: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE All Commodities[a]				
All Countries	32.7771 - 0.5730 LFAG* (-5.7022)	0.20	130	22
	25.2814 - 6.0609 LFAG/LFIN* (-5.6250)	0.20	130	22
Industrialized	13.8585 + 2.4539 LFAG* (2.9175)	0.20	34	6
	11.3462 + 97.8330 LFAG/LFIN* (2.8211)	0.19	34	6
Developing	25.8125 - 0.4584 LFAG* (-3.1416)	0.10	94	16
	17.6504 - 4.5355 LFAG/LFIN* (-3.4922)	0.12	94	16
CSE All Commodities				
All Countries	-21.9157 + 0.4577 LFAG* (4.2366)	0.17	88	15
	-14.2628 + 4.1854 LFAG/LFIN* (3.7181)	0.14	88	15
PSE Wheat				
All Countries	52.7691 - 0.9720 LFAG* (-8.9174)	0.34	154	26
	43.6198 - 12.1461 LFAG/LFIN* (-9.0849)	0.35	154	26
CSE Wheat				
All Countries	-28.2431 + 1.3336 LFAG* (6.4121)	0.24	130	22
	-11.0477 + 12.0222 LFAG/LFIN* (4.3397)	0.13	130	22

Note: Figures in parentheses are *t* - values.

a PSE for all commodities represents average commodity bundle which may vary across countries.

* Statistically different from zero at 1% level of significance.

Variables: LFAG: Percentage of Total Labor Force in Agriculture; and LFIN: Percentage of Total Labor Force in Industry.

Sources: The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.* Percentage shares of labor-force in agriculture (LFAG) and industry (LFIN) are from The World Bank, *World Development Report*, various issues.

that the coefficient signs are negative and are statistically significant, although the R^2 values drop somewhat.

Although it would have been more consistent to regress the protection level for wheat against the share of *wheat* farmers in the total labor force, but due to the lack of availability of such data across countries, the overall share of agriculture was used as a close approximation.[5] It is reasonable to believe that if the share of agricultural sector as a whole in the total economy declines, so would the number of wheat farmers.

Interestingly, the models for wheat sector are very robust in that the regression using this variable in isolation are able to explain about 34-35% of the variation in the wheat protection levels. This implies that wheat farmers are awarded higher protection levels relative to the overall agricultural sector as the share of agriculture in the total labor force declines.

Another distinguished feature from other studies is that the relative group size of agriculture in national economy is also capable of explaining the protection levels awarded to agricultural and wheat *consumers*. The models express that as the size of the farming group increases, the consumers are able to obtain higher levels of subsidies and vice versa. The coefficients are significant at 1% level . This is consistent with the earlier studies (Olson; Lutz and Scandizzo; Byerlee and Sain). Moreover, the models explaining protection levels for wheat consumers are even more robust in that the R^2 values are as high as 0.24 indicating significant differences in the level of subsidies received by consumers of specific commodities.

In short, the group size variations have significant effect not only on the level of producer protection but also on the level of protection awarded to consumers of agricultural commodities. Results show that as the share of agriculture in total labor force decreases, protection awarded to agricultural producers increases. On the other

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[5] Some other proxy variables like (Wheat Output/Aggregate Agricultural Output) may also be used, provided that variations in average output per farmer are small.

hand, protection awarded to consumers increases with a rise in the share of agriculture in labor force. Also, wheat producer group seems to be more efficient in obtaining protection in industrialized countries while that in low income countries, it loses out to the general agricultural sector. The results in case of individual commodities like wheat are much improved, signifying the commodity-specific differences in protection levels. This again highlights the need to study the determinants of agricultural protection in a commodity-specific framework.

CHAPTER VII. FOOD SECURITY ISSUES AND THE LEVEL OF PROTECTION

VII.1 Food Security: An Overview

Food security for consumers has three dimensions: availability of food at all times for all people; accessibility to food; and adequacy of food-supplies (Busch and Lacy, 1984). Attaining food security for consumers has been an important goal of agricultural protection policies in most of the industrial countries and this objective of guaranteeing stable food supplies to consumers has been achieved but at a substantial cost to consumers and taxpayers (Miller, 1986). Farm products in industrialized countries are generally overpriced and food is expensive (Schultz). Opposition to the raising of farm prices from urban workers and industrialists dissipates in developed countries for a number of reasons including their fondness towards farmers and their attachment to the farming business (Anderson and Tyres). For example, real farm prices received by Japanese farmers were more than 7 times greater than those received by Niger farmers in 1968-70 (Peterson). The consumers in industrialized countries pay prices much higher than would be the case if a free flow of world agricultural commodities were allowed (Miller).

Miller further reported that the overall cost to taxpayers, as consumers of the US farm programs in terms of paying higher food prices, range between $3-5 billion in the early 1980s to $17 billion in 1985 and up to $30.6 billion in 1986. It is pointed that aside from financing the stocks acquired at loan rates, US consumers and taxpayers provide direct payments for deficiency payment, acreage control, stock disposal programs, export promotion and subsidies. Taxpayer subsidies to US farmers represented a contribution of nearly $700 a year by each non-farming family in 1986 (Miller). He further reported that the total taxpayer and consumer transfers to EC farmers are equivalent to an annual contribution of more than $900 from each non-farming family in Europe. However, part of these costs is hidden in prices that

consumers pay in the grocery stores (Sanderson, 1990). In Japan, the aggregate cost of agricultural protection to taxpayers in 1985 was $10.5 billion and the cost of transfer from Japanese consumers was several orders of magnitude higher than the taxpayers' transfers.

Both Japan and EC have also sought to pursue food self-sufficiency. The Japanese have encouraged domestic self-sufficiency in order to decrease dependence on imported food and consumer prices of food are over 60% 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, as one of its goals. European consumers pay prices for ag. 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. EC consumers pay prices much higher than would be the case if a free flow of world ag commodities were allowed into the Community (Miller). Figure 21 provides the sources of producer support in six industrialized nations. In the U.S., the major portion of the cost of agricultural protection is borne by taxpayers (69%) whereas the opposite is true in case of Japan and EC. In Canada, Australia and New Zealand, the major bill is picked up by the taxpayers.

In the United States, the threat of food shortages is not so strong a political force as it seems to be in Japan and other food importing countries, but, food security is a concern nonetheless. There is a perception that an economically healthy agriculture is a kind of food-supply insurance for consumers, and this contributes to support for the protection of agriculture. An explanation of the consumer support for agricultural protection in industrialized countries might be found in the belief on the part of risk-averse consumers that farm programs guarantee stable food supplies at reasonable prices and thus constitute consumer insurance or stabilization programs (Gardner).

The goal of attaining food-security has also been a prominent one in the case

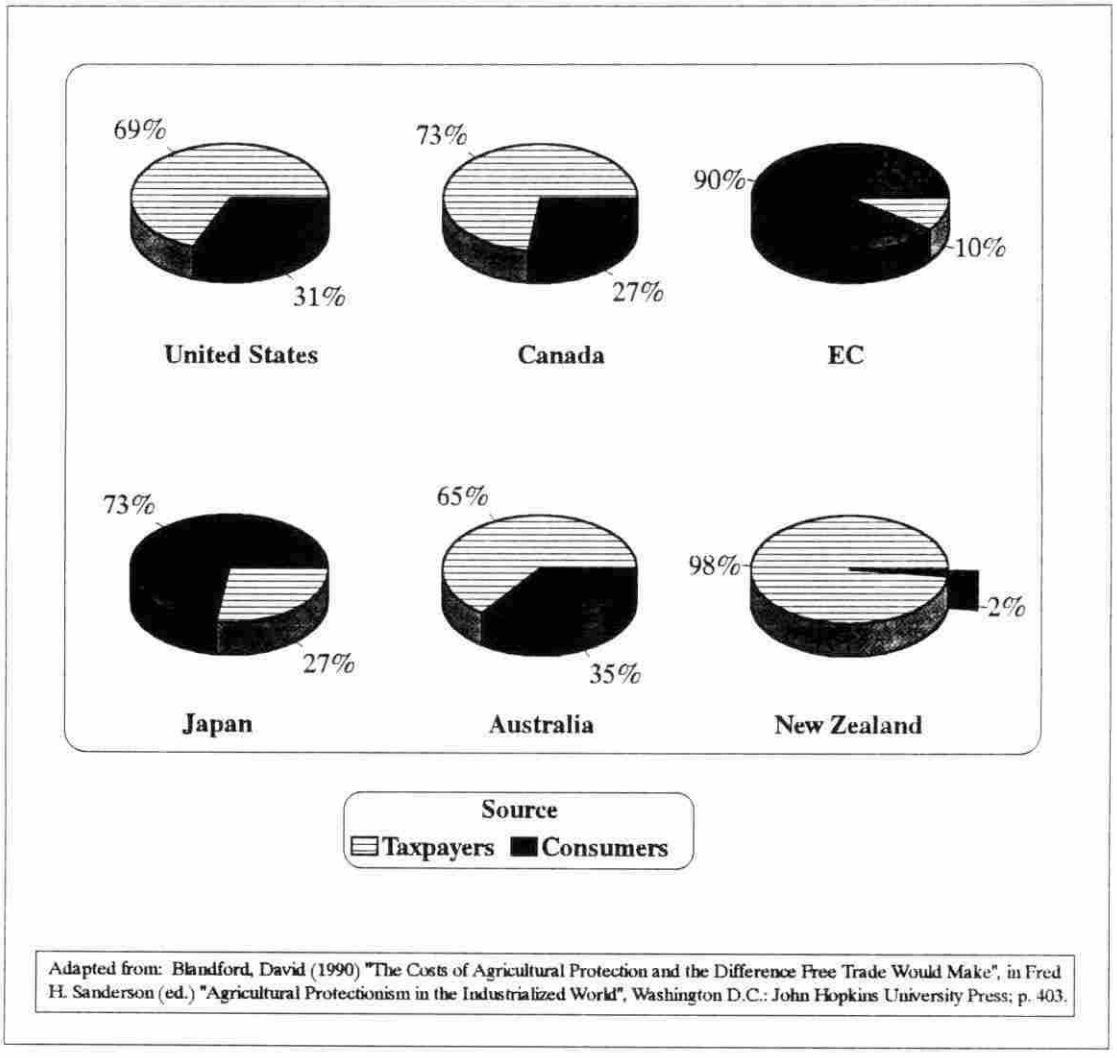
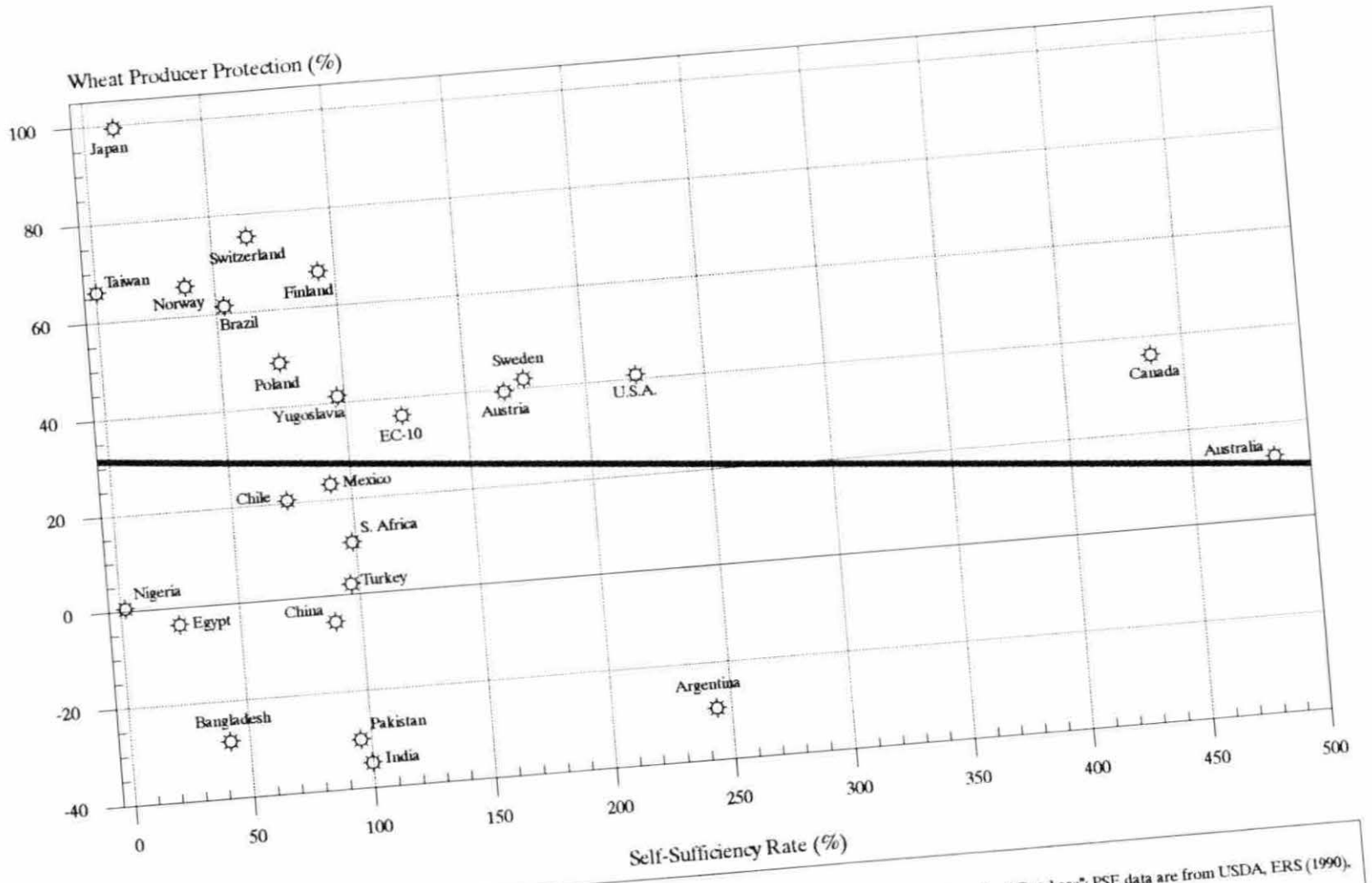


Figure 21: Sources of producer protection support in six industrialized countries

of developing and food importing countries. However, there is a close connection between food supplies and purchasing power and in industrialized countries where people have sufficient purchasing power, the food supplies have grown more rapidly than demand, while in developing countries, where purchasing power of the people is low, the reverse is true (Mellor, 1988). Improving food security in the developing countries requires both increasing the purchasing power of the poor and boosting the overall food production, both of which are intertwined and surplus of food provides the basis for establishing the food security programs. The stability of food production is essential for achieving security of food consumption, thus, providing the link between food security issues and domestic agricultural protection policies.

VII.2 Relationship of Wheat Protection and Self-Sufficiency in Wheat

In this section, therefore, an attempt is made to explore the link between the self-sufficiency rates and the level of protection for wheat. The self-sufficiency rate is defined as the domestic production as a percentage of consumption. Figure 22 is a graphical representation of this relationship. As the self-sufficiency rate for wheat increases, the protection awarded to wheat producers declines. This explains why the wheat protection levels are relatively low in case of wheat exporting countries like Australia, Canada and the U.S., while these are substantially higher in case of countries with lower self-sufficiency rates like Japan, Switzerland, Norway and Finland. A close perusal of the figure reveals that all industrialized countries lie above the wheat protection and self-sufficiency interaction line whereas all low-income countries, where wheat sector is generally taxed, lie below this line. However, within low-income countries, the countries with higher levels of sufficiency in wheat tax their wheat producers more than the countries with lower self-sufficiency rates.



Self-Sufficiency rate defines domestic production as a percentage of domestic consumption.
Sources: Self-sufficiency rates are based on own computations using the data from USDA, ERS (1991), "PS&D View '91: Users Manual and Database"; PSE data are from USDA, ERS (1990), "Estimates of Producer and Consumer Subsidy Equivalents: 1982-87."

Figure 22: Relationship of self-sufficiency rate and the level of wheat producer protection

VII.3 The Regression Analysis

The results of the empirical analysis of above observations are provided in Table 19. The results show that as the self-sufficiency rate increases, the protection awarded to wheat producers, on an average, falls. This result improves tremendously when the analysis is done for industrialized and developing countries on a separate basis. In the case of industrialized countries, the significance of the coefficient increases as the independent variable is able to explain about 49% of the variation in wheat protection levels. In case of developing countries, the results are equally encouraging with an increase in the parameter estimate. This implies that the policies of attaining self-sufficiency in wheat have been relatively more important in industrialized nations.

Fascinatingly, when wheat consumer protection levels are regressed against the self-sufficiency rate, the relationship again turns out to be negative. This highlights the fact that as self-sufficiency rate increases, the protection awarded to wheat consumers falls. For example, in India where self-sufficiency rate is about 100%, the consumer protection level is 22% (and wheat producers are taxed at 35% rate), while in case of Nigeria which is only about 2% self-sufficient in wheat, its consumer subsidies amount to about 156% (and wheat producers are subsidized at about 1% level). In case of industrialized countries, where self-sufficiency is extremely high (Canada, Australia, U.S.A.), wheat consumers are generally taxed.

To analyze the food security issue, it becomes imperative to look at the variance in domestic food production and the accompanying protectionistic policies followed to ensure food security. Table 20 highlights the relationship between the variation in wheat production and the protection awarded to wheat farmers. As expected, the sign with the variance of wheat production is positive and significant. The more uncertain the domestic production, the higher the level of protection awarded to the farmers to ensure adequate supplies and satisfy food security concerns. Food security notion undermines the agricultural sector's comparative

Table 19: The influence of self-sufficiency rate[a] of the commodity on the protection level awarded to its producers and consumers: 1982-87

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE Wheat				
All Countries	33.1095 - 0.0471 SSRATEW*** (-1.9059)	0.02	154	26
Industrialized	72.3585 - 0.1123 SSRATEW* (-7.4137)	0.49	58	10
Developing	31.6650 - 0.2575 SSRATEW* (-4.0215)	0.16	94	16
CSE Wheat				
All Countries	13.6100 - 0.0893 SSRATEW** (-2.3777)	0.04	130	22
CSE Rice				
All Countries	11.3206 - 0.2080 SSRATER* (-5.8678)	0.31	76	13

Note: Figures in parentheses are *t* - values.

a The Self-sufficiency rate (SSRATE *i*) defines domestic production of commodity *i* as a percentage of its domestic consumption.

*,**,*** Statistically different from zero at 1%, 5% and 10% level of significance, respectively.

Variables: SSRATEW: Self-Sufficiency Rate for Wheat; and SSRATER: Self-Sufficiency Rate for Rice.

Sources: The PSE and CSE figures are averages from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.* Self-sufficiency figures are based upon own computations using the data from USDA, ERS (1991) *PS&D View '91: Users Manual and Database.*

advantage. Honma and Hayami also report that agricultural protection is inversely associated with the comparative advantage of agriculture. They further report that protection levels are higher in the case of countries with low agricultural productivity and efficiency while countries with efficient agricultural sector tend to provide less protection to their agricultural sector. Countries like Japan, Sweden, Norway, Finland and Switzerland with declining comparative advantage in agriculture,tend to highly subsidize their agricultural sector in an aim to achieve self-sufficiency and

Table 20: Relationship between variance of production and producer protection levels for wheat

Dependent Variable	Estimated Equations	R^2	DF	No. of Countries
PSE Wheat				
All Countries	24.8807 + 30.4846 VARPROD2** (2.2350)	0.03	154	26
	7.2624 + 45.1599 VARPROD2* + 42.3807 DIND* (3.8324) (7.6757)	0.30	153	26
	9.9158 + 22.8367 VARPROD1* + 40.9875 DIND* (2.6614) (7.2820)	0.27	153	26

Note: Figures in parentheses are *t* - values.
*,** Statistically different from zero at 1% and 5% level of significance, respectively.
Variables: VARPROD1: Variance of Wheat Production = $\{(Y_t - \hat{Y})/ \hat{Y}\}^2$ where, Y_t is current output and $\hat{Y}$ is the average output for 1982-87; VARPROD2 = $\{(Y_t - \hat{Y}_{t-1})/ \hat{Y}_{t-1}\}^2$; and DIND is the dummy for industrialized countries.
Sources: The PSE figures are from USDA, ERS (1990) *Estimates of Producer and Consumer Subsidy Equivalents: 1982-87* and OECD (1991)*Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90.*

promote food security. However, the argument that industrial countries also strive to achieve the goals of self-sufficiency and food security through their farm programs is debatable. The World Development Report (1986) contends that production variability need not cause food shortages in industrialized countries since, given their resources, they can "always afford to buy enough [food] on world markets". Food security, therefore, would imply less specialization in domestic crop patterns and more emphasis on the production of staple food commodities.

The above analysis highlights that attaining self-sufficiency and food security have been important policy goals of both industrialized and developing countries. However, these concerns seem to be overriding in case of industrialized nations. The empirical analysis shows that as a country achieves higher levels of self-

sufficiency, the protection level awarded to the consumers as well as producers of the commodity declines. This result also holds for groups of industrialized and developing countries when analyzed separately. However, an interesting future research endeavor in this regard would be to analyze theoretically as well as empirically whether the risk-averse consumers in industrialized countries acquiesce to agricultural protection policies in order to achieve food insurance in terms of surplus food production at reasonable prices.

CHAPTER VIII. SUMMARY

The treatment of agriculture differs significantly across industrialized and developing countries. While agricultural producers in developing countries are typically taxed, industrialized countries commonly subsidize their agricultural sector. However, studies aimed at examining these patterns across industrialized and developing countries are relatively few and have been less satisfactory in their explanation of variation in protection levels. Moreover, most of the earlier work have not taken a product specific approach to the study of these patterns. Since protection rates vary from commodity to commodity, a commodity-specific approach seems pertinent. Also, the coverage of the determinants of the patterns of agricultural protection has been limited in earlier studies. Inasmuch as the protection awarded to the producers of an agricultural commodity is also the outcome of interaction of the demand characteristics of the commodity, the neglect of the role of consumers in the determination of protection levels in most of the earlier studies renders their results less comprehensive.

The present study attempts to identify some major consistent patterns of agricultural protection across industrialized and developing countries in a commodity-specific as well as an aggregative approach. The study is more comprehensive in terms of its coverage of the patterns of protection and also concentrates on the consumer characteristics of individual commodities like the importance of the commodity in daily diet, Engel coefficient and food security issues. However, the focus of this attempt is not an in-depth analysis of individual patterns but rather identification of some regular patterns especially on the consumer protection levels. Unlike earlier studies using nominal protection rates and coefficients for measuring the level of intervention, more comprehensive and aggregate measures, namely producer subsidy equivalents and consumer subsidy equivalents, are used, since these capture transfers from government expenditures as well as from price distortion. A

comparative analysis of differnet measures of protection has also been provided.

There appears to be a strong positive correlation between the GNP per capita and the level of agricultural protection for the overall agricultural sector. This relationship is more pronounced in case of individual commodities like wheat and milk and reflects that the society has an income elastic demand for assisting these commodities. On the other hand, the results show that as the level of GNP per capita increases, the protection awarded to consumers of agricultural commodities falls. The results also show that the agricultural sector is heavily protected in countries where income from agriculture constitutes substantially lower proportion of GDP.

The trade nature of individual agricultural commodities is also shown to influence their respective protection levels. Countries with high level of import dependency in wheat tend to protect their wheat sectors heavily. This pattern is accentuated when the group of industrialized countries is considered separately. These results hold even when the import dependency variable is substituted by the self-sufficiency ratios highlighting the national food security concerns. Wheat consumer protection, on the other hand, tends to rise with the increase in the import dependence of wheat and falls with the increase in self-sufficiency ratio of wheat.

The level of overall agricultural protection increases as the percentage of expenditure on food declines. In poor countries, where a large proportion of income is spent on food, the governments try to keep the food prices low and thus tax their agricultural producers. In case of consumer protection levels, as expenditure on food decreases, as is the case in industrialized countries, the protection awarded to consumers falls. It was also found that the consumer protection levels are negatively correlated with total calorie intake. These results improve significantly in the commodity-specific analysis.

Another distinguishable feature from earlier studies is the finding that the relative group size of agriculture in national economy is capable of explaining not

only the producer protection levels but also the protection level awarded to the consumers of agricultural products, especially wheat. The results point out that as size of farming group increases, consumers are able to obtain higher levels of subsidies and vice-versa. The results in case of individual commodities are much improved, signifying the commodity-specific differences in protection levels and highlighting the need to study the patterns of agricultural protection in a commodity-specific framework.

Food security issues are also incorporated in this study since the stability of food production is essential for achieving food security, thus necessitating the examination of the link between food security and food production policies. As the self-sufficiency rate for wheat increases, the protection awarded to wheat producers as well as consumers declines. These results improve when the analysis is performed separately for industrialized countries indicating their overriding food security concerns. The results also show a positive relationship between the variation in production and the protection awarded to wheat producers.

However, due to lack of data availability across countries, issues like geographical dispersion and its effect on protection could not be analyzed. An extension of this work would be to include qualitative variables for groups of countries as well as consumer characteristics of commodities; to study the patterns identified in this study simultaneously; and to theoretically and empirically analyze whether risk-averse consumers in industrialized countries submit to agricultural protection policies in order to achieve food insurance in terms of surplus production at reasonable prices.

REFERENCES

Agarwala, Ramgopal (1983). *Price Distortions and Growth in Developing Countries*, Washington D.C.: World Bank Staff Working Paper No. 575.

Anderson, Kym (1986). "Economic Growth, Structural Change and the Political Economy of Protection" in Kym Anderson and Yujiro Hayami (eds.) The political Economy of Agricultural Protection, Sydney: Allen & Unwin, pp. 7-16.

Anderson, Kym and Yujiro Hayami (1986). "Introduction" in Kym Anderson and Yujiro Hayami (eds.) The political Economy of Agricultural Protection, Sydney: Allen & Unwin, pp. 1-6.

Anderson, Kym, Yujiro Hayami and Masayoshi Honma (1986). "The Growth of Agricultural Protection" in Kym Anderson and Yujiro Hayami (eds.) The political Economy of Agricultural Protection, Sydney: Allen & Unwin, pp. 17-30.

Anderson, Kym and Rod Tyers (1989). "Agricultural Protection Growth in Advanced and Newly Industrialized Countries" in Allen Maunder and Alberto Valdés Agriculture and Governments in an Interdependent World, Brookfield, VT: Gower Publishing Co., pp. 175-188.

Bale, M.D. and E. Lutz (1981). "Price Distortions in Agriculture and Their Effects: An International Comparison," *American Journal of Agricultural Economics*, 63: 8-22.

Balisacan, Arsenio M. and James A. Roumasset (1987). "Public Choice of Economic Policy: The Growth of Agricultural Protection," *Weltwirtschaftiches Archiv*, 123: 232-248.

Becker, Gary S. (1983). "A Theory of Competition Among Pressure Groups for Political Influence," *Quarterly Journal of Economics*, 98 (3): 371-400.

Bigman, David (1985). Food Policies and Food Security Under Instability, Lexington, MA: D.C. Heath.

Binswanger, H. and P.L. Scandizzo (1983). "Patterns of Agricultural Protection," Report ARU-15, Washington D.C.: World Bank.

Blandford, David (1990). "The Costs of Agricultural Protection and the Difference Free Trade Would Make" in Fred H. Sanderson (ed.) Agricultural Protectionism in the Industrialized World, Washington D.C.: John Hopkins University Press, pp. 398-402.

Busch, Lawrence and William B. Lacy (1984). "Introduction: What Does Food Security Mean?" in Lawrence Busch and William B. Lacy (eds.) Food Security in the United States, Boulder, CO: Westview Press, p. 2.

Byerlee, Derek and Gustavo Sain (1986). "Food Pricing Policies in Developing Countries: Bias Against Agriculture or for Urban Consumers?" *American Journal of American Economics,* 68: 961-969.

Chattin, Barbara (1989). "Panel Discussion : Measuring Levels of Protection in Agriculture" in Allen Maunder and Alberto Valdés Agriculture and Governments in an Interdependent World, Brookfield, VT: Gower Publishing Co., p. 353.

Chisholm, Anthony H. and Rodney Tyers (1982), (eds.) Food Security: Theory, Policy and Perspectives from Asia and the Pacific Rim, Lexington, MA: D.C. Heath.

Collins, Keith (1989). "The Political Economy of U.S. Agricultural Policy: Discussion," *American Journal of American Economics,* 71: 1175-1177.

Corden, M. W. (1966). "The Structure of a Tariff System and Effective Protection Rate," *Journal of Political Economy,* 74 (3): 221-237.

de Gorter, Harry and Yacov Tsur (1991). "Explaining Price Policy Bias in Agriculture: The Calculus of Support-Maximizing Politicians," *American Journal of American Economics,* 73: 1244-1254.

_____ (1990). "The Political Economy of Agricultural Policy and Trade", in Colin A. Carter, Alex F. McCalla and Jerry A. Sharples (eds.) Imperfect Competition and the Political Economy: The New Trade Theory in Agricultural Trade Research, Boulder, CO: Westview Press, pp. 219-244.

_____ (1989). "The Political Economy of Agricultural Policy and Trade," preliminiary draft paper for IATRC Symposium "New Developments in Trade Theory: Implications for Agricultural Trade Research," Auberge Mount Gabriel, Quebec, July 7-8.

de Janvry, Alain (1983). "Why Do Governments Do What They Do? The Case of Food Price Policy" in D.G. Johnson and G.E. Schuh, (eds.) The Role of Markets in the World Food Economy, Boulder, CO: Westview Press, pp. 185-212.

FAO, (1991) Food Balance Sheets: 1984-86 Average, Rome.

Gardner, Bruce (1990). "The Why, How, and the Consequences of the Agricultural Policies: The United States" in Fred H. Sanderson (ed.) Agricultural Protectionism in the Industrialized World, Washington D.C.: John Hopkins University Press, pp. 19-63.

_____ (1989). "Economic Theory and Farm Politics," *American Journal of Agricultural Economics*, 71: 1165-71.

_____ (1987). "Causes of U.S. Farm Commodity Programs," *Journal of Political Economy*, 95(2): 290-310.

Gautam, Virender and Sudhir Chaudhary (1992). "A Theoretical and Empirical analysis of Demand Determined Agricultural Price Protection in a Cross-Country and Commodity Specific Framework," presented at Fifty-Sixth Annual Meeting of the Midwest Economics Association, Chicago, IL, March 26-28.

Gautam, Virender, Sudhir Chaudhary and Ramu Govindasamy (1991). "Government Intervention in the Rice Sector: A Cross-Country Study," *Quarterly Journal of International Agriculture*, 30 (4): 297-310.

Hayami, Yujiro (1972). "Rice Policy in Japan's Economic Development," *American Journal of Agricultural Economics,* 54: 19-31.

Herrmann, R. (1989). "Agricultural Price Protection, Import Dependence and Economic Development: The Case of Wheat," *Journal of Agricultural Economics,* 40 (2): 152-167.

Honma, Masayoshi and Yujiro Hayami (1986). "Structure of Agricultural Protection in Industrial Countries," *Journal of International Economics* , 20: 115-129.

IMF, *International Financial Statistics,* various issues.

Josling, Tim and Stefan Tangermann (1989). "Measuring Levels of Protection in Agriculture: A survey of Approaches and Results" in Allen Maunder and Alberto Valdés Agriculture and Governments in an Interdependent World, Brookfield, VT: Gower Publishing Co., pp. 343-360.

Krueger, Anne O. (1989). "Some Preliminary Findings From the World Bank's Project on the Political Economy of Agricultural Pricing" in Allen Maunder and Alberto Valdés Agriculture and Governments in an Interdependent World, Brookfield, VT: Gower Publishing Co., pp. 162-174.

Krueger, Anne O., M. Schiff and Alberto Valdes (1988). "Agricultural Incentives in Developing Countries: Measuring the Effect of Sectoral and Economywide Policies," *World Bank Economic Review,* 2: 255-72.

Lee, David R. (1989). "The Political Economy of Agricultural Policy: Discussion," *American Journal of Agricultural Economics,* 71: 1172-74.

Lutz, E. and P.L. Scandizzo (1980). "Price Distortions in Developing Countries: A Bias Against Agriculture," *European Review of Agricultural Economics,* 7: 25-27.

Mabbs-Zeno, Carl and Arthur Dommen (1989). "Subsidy Equivalents: Yardsticks of Government Intervention in Agriculture for the GATT," USDA, ERS, Agriculture Information Bulletin No. 558.

Mellor, John W. (1988). "Global Food Balances and Food Security," *World Development,* 16 (9): 997-1011.

Miller, Geoff (1986). The Political Economy of International Agricultural Policy Reform, Canberra: Canberra Publishing and Printing Company.

O.E.C.D. (1991). Tables of Producer Subsidy Equivalents and Consumer Subsidy Equivalents: 1979-90, OECD/GD (91)128, Paris.

Olson, Mancur (1988). "The Treatment of Agriculture in Developing and Developed Countries," *Journal of Economic Growth,* 3 (2): 10-15.

_____ (1986). "The Exploitation and Subsidization of Agriculture in Developing and Developed Countries," in Allen Maunder and Ulf Rengorg (eds) Agriculture in a Turbulent World Economy, Brookfield, VT: Gower Publishing Co., pp. 49-59.

_____ (1965). The Logic of Collective Action, Cambridge: Harvard University Press.

Paarlberg, Robert (1989). "The Political Economy of American Agricultural Policy: Three Approaches," *American Journal of Agricultural Economics,* 71: 1157-1164.

Peterson, W. L. (1979). "International Farm Prices and Social Cost of Cheap Food Policies," *American Journal of Agricultural Economics,* 61(1): 12-21.

Sanderson, Fred H. (1990). "Overview" in Fred H. Sanderson (ed.) Agricultural Protectionism in the Industrialized World, Washington D.C.: John Hopkins University Press, p. 4.

Schiff, Maurice (1989). "Panel Discussion: Measuring Levels of Protection in Agriculture" in Allen Maunder and Alberto Valdés Agriculture and Governments in an Interdependent World, Brookfield, VT: Gower Publishing Co., p. 355.

Schultz, T. W. (1978). "On Economics and Politics of Agriculture," in T.W. Schultz (ed.) Distortions of Agricultural Incentives, Bloomington: Indiana University.

Schwartz, Nancy E. and Stephen Parker (1988). "Measuring Government Intervention in Agriculture for the GATT Negotiations," *American Journal of American Economics,* 70 (5): 1137-1145.

U.S.D.A., Economic Research Service (1988). Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-86, Washington D.C.

U.S.D.A., Economic Research Service (1990). Estimates of Producer and Consumer Subsidy Equivalents: 1982-87, Washington, D.C.

U.S.D.A., Economic Research Service, (1991). PS&D View '91: User Manual and Database by Alan Webb and Karl Gudmunds.

Yamauchi Hiroshi and Yong Dae Kwon (1989). "Political Macroeconomy of Agricultural Policy Adjustments in East Asia," paper presented at the Workshp on Agricultural Policy, Trade and Development: Pacific Economic Cooperation Conference, Seoul, Korea, May 15-18, 1989.

World Bank, World Development Report, various issues.