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243

Manfred Wiebelt et al.

Discrimination Against Agriculture in Developing Countries?

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Abbreviations and Acronyms

ADB	Asian Development Bank
ACSE	absolute value of the consumer subsidy equivalent
acse	consumer subsidy equivalent per consumed unit
APSE	absolute value of the producer subsidy equivalent
apse	producer subsidy equivalent per produced unit
BAE	bias against exports
BML	Bundesministerium für Ernährung, Landwirtschaft und Forsten
BOT	balance of trade
cif	cost, insurance, freight
CNAC	consumer nominal assistance coefficient
CPI	consumer price index
CSE	consumer subsidy equivalent
CV	coefficient of variation
DC	developed country, industrialized country
DRC	domestic resource cost
drc	domestic resource cost per unit
EC	European Community
ECLA	Economic Commission for Latin America
(net) EPC	(net) effective protection coefficient
(net) ERP	(net) effective rate of protection
FAO	Food and Agriculture Organization of the United Nations
fob	free on board
GATT	General Agreement on Tariffs and Trade
GDP	gross domestic product
GMP	garanteed minimum price
IMF	International Monetary Fund
IRRI	International Rice Research Institute
kg	kilogram
LDC	less developed country, developing country
mt	metric ton
NAC	nominal assistance coefficient
NEP	nominal economic policy
(gross, net) NPC	(gross, net) nominal protection coefficient
(gross, net) NRP	(gross, net) nominal rate of protection
OECD	Organisation for Economic Co-Operation and Development
OLS	ordinary least square
PEG	producer entitlement guarantee
PNAC	producer nominal assistance coefficient
PSE	producer subsidy equivalent
Ringgit	Malaysian currency (Malaysian dollar, M\$)
SAFER	Southern African Foundation for Economic Research
SMU	support measurement unit
t	ton
TDE	trade distortion equivalent
TU	Theil's inequality coefficient
UDI	Unilateral Declaration of Independence
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development

UNIDO
USA
USAID
USDA
USSR

United Nations Industrial Development Organization
United States of America
US Agency for International Development
US Department of Agriculture
Union of Soviet Socialist Republics

Preface

With the increasing importance of structural adjustment programs in developing countries, more attention has been paid to the effects that macroeconomic policies have on the structure of incentives for different sectors of the economy. In this context, the domestic agricultural terms of trade that result from industrial protection and from exchange rate, fiscal and monetary policies emerge as a key issue, as they affect the composition of agricultural output and trade as well as the balance of payments and growth. A major consideration in structural adjustment programs is, therefore, the degree of discrimination that has to be offset in order to assure the long-run viability of the sector.

It is the purpose of this study to analyze how macroeconomic policies and agricultural pricing policies have affected the magnitude and structure of agricultural incentives in developing countries. From a methodological point of view, this involves an up-to-date review of various protection concepts and a discussion of the pros and cons of these concepts for measuring overall agricultural incentives. Empirically, the study follows a dual approach that combines new cross-country and time series evidence on agricultural protection for two important food crops, wheat and rice, and one important cash crop, coffee, with additional evidence on agricultural protection in three developing countries, Malaysia, Peru and Zimbabwe. In each case, the overall level of agricultural protection is measured and decomposed in order to quantify the relative importance of macroeconomic and agricultural policies.

This study is an outcome of a research project entitled "Discrimination against Agriculture in Developing Countries? Magnitude, Structure and the Role of General Economic Policy", which was financed by the Volkswagen-Stiftung. Its financial support is gratefully acknowledged. The study is a joint effort of the Kiel Institute of World Economics (Manfred Wiebelt, Rainer Thiele) and the Institute of Agricultural Policy and Market Research at the University of Gießen (Roland Herrmann, Patricia Schenck). The study also benefitted from preparatory work by partners in Malaysia and Zimbabwe.

The partner in Malaysia was Dr. Abdul Aziz Abdul Rahman from the Faculty of Economics and Management, Agricultural University of Malay-

sia, Serdang. He prepared two highly appreciated analyses on agricultural protection in Malaysia which influenced the chapter on Malaysia in this study significantly. The partners in Zimbabwe were Dr. Norman Reynolds, Southern Africa Foundation for Economic Research (SAFER) and Andrew Rukovo and Tobias Takavarasha, both at the Ministry of Lands, Agriculture and Rural Resettlement, Harare. The Zimbabwean component of this study benefitted from their joint investigation of agricultural protection in Zimbabwe. At the Kiel Institute of World Economics, Angela Husfeld, Michaela Rank and Christine Schulte assisted in the computations, Marlies Thiessen carefully typed successive drafts, and Bernhard Klein and Susanne Rademacher made many helpful suggestions when preparing the text for publication. Thanks are due to all of them.

Kiel, February 1992

Horst Siebert

A. Background and Objectives of the Study

For more than three decades, it has been a central issue in development economics which role agriculture plays in economic development and which role it should play. With regard to the actual incentives for the sector, it is a stylized fact that many developing countries (less developed countries, LDCs) discriminate against agriculture, whereas the industrialized countries (developed countries, DCs) favor their farmers [World Bank, 1986]. Concerning the desired treatment of agriculture, there was and still is severe dissension on the appropriate strategy of development policy. The first view is in line with the economic theory of distortions and stresses that it is crucial to reverse existing distortions. Consequently, the proposal is to change the existing price ratio between agriculture and nonagriculture in favor of the agricultural sector [Valdés, 1986; World Bank, 1986]. The second and opposite view is in the tradition of dualistic development models¹ as presented by Lewis [1954], Fei and Ranis [1964] and others. According to this view, it is necessary to foster a transition from agriculture to industry in order to stimulate the long-run economic growth of a country. Agriculture is regarded here as the traditional and more static sector of an economy, whereas industry is seen as the modern and more dynamic sector. Hence, a taxation of agriculture in the early stages of development is regarded as necessary for restructuring the economy. A core parameter within this view is the price elasticity of supply in agriculture. If it is very low, and proponents of the second view argue along these lines, taxation of agriculture can be realized with relatively low costs for the economy as a whole.

Recent economic contributions and policy actions have stimulated the discussion on the desired as well as the actual role of agriculture in economic development. In an often cited theoretical contribution, Sah and Stiglitz [1984] have utilized a dual-economy model to derive that governments can increase economic growth by setting the terms of trade between agriculture and industry in favor of the industrial sector. Similarly, Rodrik [1986] argues that overvalued exchange rates in LDCs

¹ For a survey of the role of agriculture in dualistic development models, see Ghatak and Ingersent [1984, Chapter 5].

may be a welfare-increasing device by promoting structural change from agriculture towards the more dynamic manufacturing sector.

Quite differently, Adelman [1984, p. 26] concluded from an analysis of world income distribution and its determinants that "an agriculture-driven, open-development strategy, is preferable to an industrial export-driven strategy" for most LDCs. This is valid, according to Adelman, under redistribution and growth aspects. Moreover, quantitative studies on the agricultural supply elasticity have challenged the view that agriculture is a relatively static sector. Peterson [1979] came up with the finding that the long-run supply elasticity and the social costs of low agricultural prices are much higher than previously expected. Similarly, but with a different methodology, Mundlak et al. [1989] showed that agriculture clearly does respond to price changes when agricultural supply is properly modelled and that a positive climate for investment in agriculture leads to more investment in the nonagricultural sector, too. This may explain the empirical observation that countries with a relatively high growth rate in agriculture have a relatively prosperous general economy, too [Hwa, 1988]. Actual incentive policies as contained in the development strategies of the International Monetary Fund (IMF) and the World Bank stress the important role of agriculture for development. Crucial elements of structural adjustment programs are to reduce food subsidies, to increase agricultural output prices and to rely upon outward orientation, i.e., by reducing disincentives against agricultural and nonagricultural exports [Commander, 1989].

New evidence has also appeared in recent years on the actual incentives for agriculture in LDCs. Quantitative studies indicate that many LDCs discriminate against agriculture compared with the nonagricultural sector [e.g., Bale, Lutz, 1981; Scandizzo, Bruce, 1980; Bale, 1985]. They suggest further that agricultural producer prices in LDCs are much lower than in DCs [Peterson, 1979]. However, there seem to be major differences within agriculture as a deeper analysis on the structure of incentives shows. From an analysis of gross-domestic-product-based and agricultural output-based purchasing power parity estimates for the years 1975 and 1980, Prasada Rao et al. [1990] conclude that agricultural output prices have not been held as low in LDCs as has been commonly believed but that distinct trends indicate a faster rate of growth of nonagricultural prices relative to agricultural

prices. From a regional perspective, agricultural price levels are relatively higher in Asia than in Africa. Over the 1975-1980 review period, agricultural prices declined in Asia but rose marginally in Africa. In a market study for wheat based on cross-country data, it is also argued by Byerlee and Sain (1986) that producer prices in LDCs are not as low as is often argued. They conclude that there is no systematic discrimination against food producers, although consumer prices are clearly subsidized compared with world market conditions. Recent results of the World Bank's project on the "Political Economy of Agricultural Pricing Policy" show on the basis of country studies that disincentives tend to be much larger for export crops than for food crops. Additionally, they show that disincentives induced by general economic and commercial policies are mostly larger than those generated by direct agricultural policies (Krueger et al., 1988).

The previous discussion is the background of our study. It is the objective of our analysis to deepen the knowledge on the magnitude, the structure and the variability of agricultural protection in LDCs. Based on this broadened information on agricultural protection, policy implications of the measured levels of protection will be elaborated. Major questions to be answered in this study are the following:

- (1) How do LDCs treat their agricultural sectors?
- (2) Do they treat different sub-sectors differently? In particular: are export crops favored or disfavored compared with food crops?
- (3) Do policymakers stabilize agricultural producer prices in the presence of volatile world market prices?
- (4) Do general economic policies, in particular trade restrictions and macroeconomic policies, matter for the measured degree of protection?
- (5) What are the transmission mechanisms by which general economic policies might affect agricultural incentives?
- (6) Does the empirical evidence suggest a reorientation of agricultural policy as opposed to policies towards the manufacturing sector?
- (7) Does the empirical evidence suggest a resetting of agricultural price ratios, especially between food crops and export crops?

The study is organized as follows. In Chapter B, an up-to-date survey of the economic literature on measurement concepts and on the extent of agricultural protection is aimed at. Traditional and non-

traditional concepts to measuring agricultural protection will be reviewed, and their advantages and disadvantages will be investigated. The empirical literature on the magnitude and structure of agricultural protection in LDCs will be presented and evaluated. It will be one result of the review that a comprehensive cross-country information on protection levels for important food and export crops is lacking, whereas an impressive number of quantitative country studies on agricultural protection has become available in recent years. Another result that follows from the review is that economy-wide policies have usually been neglected in these country studies.

After having identified the neglected areas in the literature on agricultural protection, the main focus of Chapter C will be a quantitative analysis of the magnitude, structure and instability of protection for two important food crops, wheat and rice, and one major export crop, coffee. This quantitative analysis will be rather comprehensive country- and period-wise. As DCs are important suppliers on the world markets in wheat and rice, protection levels in LDCs and DCs will be considered on those markets. In any case, a relatively large number of LDCs will be covered for each commodity, and the protection levels will be computed for a rather long period of time: 1969-1985. Important measurement issues like exchange rate overvaluation and transport costs will explicitly be taken into account. The measurement concept that is implementable and most suitable for the problem at hand will be explained first. Then, the magnitude and the time series behavior of protection levels for the three important commodities will be investigated in detail. Finally, conclusions on incentives for food crops as opposed to export crops in LDCs will be drawn.

Whereas the cross-country studies in Chapter C concentrate on agricultural protection vis-à-vis foreign competitors, Chapter D focuses on domestic agricultural protection vis-à-vis the rest of the economy. Based on the general finding of Chapter C that economy-wide policies have a tremendous influence on agricultural incentives in LDCs, we will investigate how and to what extent these policies affect the relative profitability of agricultural production in three LDCs - Malaysia, Peru and Zimbabwe. After a short survey of the economic situation and the policy environment, we will elaborate the link between industrial import protection and agricultural incentives for the most important export

crops in the respective countries. In addition, a more comprehensive analysis of indirect effects, covering trade policy as well as macro-economic measures, will be conducted for Malaysia's major agricultural commodities. Finally, we take up again the "food-crop protection versus cash-crop discrimination" question, but now based on a broader commodity basis.

In Chapter E, the major findings of the study are summarized and policy conclusions are drawn.

B. Measurement of Agricultural Protection: A Survey of the Concepts and the Empirical Literature

I. Introduction

This chapter sets the stage for the empirical analysis of agricultural protection in LDCs that follows in Chapters C and D. In Section B.II, major concepts for measuring agricultural protection are surveyed and their strengths and weaknesses are elaborated. It is discussed there which problems can be treated with the measurement concepts selected and which issues cannot. After this, empirical results based on the discussed measurement concepts are presented. An overview of quantitative studies on agricultural protection and their major findings are also given. The content of Section B.III is as follows. Important results concerning the degree of agricultural protection in LDCs as opposed to DCs are summarized there. Additionally, findings on the magnitude of protection of food versus export crops in LDCs are discussed. The survey will also stress where the empirical literature on agricultural protection has been insufficient and where the additional benefit of our quantitative analysis is located.

II. Concepts to Measuring Agricultural Protection

Synoptical Table 1 lists the measurement concepts of agricultural protection to be discussed in this section.¹ It shows, too, which policies are typically covered by those concepts and at which economic variables they are oriented.

There are three traditional measurement concepts arising from international trade theory and policy which are discussed in all standard

¹ Surveys of the methodology to measure agricultural protection and its impacts include Scandizzo and Bruce [1980], Scandizzo [1989] and Tsakok [1990, Chapters 3 and 4]. The traditional concepts of measuring agricultural protection are also surveyed in Strak [1982]. An unconventional approach to measuring protection, or openness, is presented by Leamer [1988]. Openness is derived by comparing actual trade as modelled on the basis of the Heckscher/Ohlin theory. The approach is an interesting alternative to the mainstream approach to be discussed below.

Synoptical Table 1 - Measurement Concepts of Agricultural Protection, Their Orientation and Typical Policy Coverage (a)

Orientation	Concept	Policy coverage
Output price	- Nominal protection	- Support policy on output markets
Producer earnings	- Producer subsidy equivalent policies	- Various direct agricultural policies
Value added	- Effective protection	- Output and input market policies
Comparative advantage	- Domestic resource costs	- No policy; modelling of the free market case
Relative prices between sectors	- True protection	- Trade policies in the nonagricultural sector
Relative prices between sectors	- Nominal protection of the price ratio between agriculture and nonagriculture	- Direct and indirect agricultural policies

(a) Direct agricultural policies are economic policies which are targeted at the agricultural sector. Indirect agricultural policies are those economic policies which affect agriculture without being targeted at the sector.

studies on protection [Corden, 1971; Balassa et al., 1971; Michaely, 1977; Krueger, 1984]: nominal protection, effective protection and domestic resource costs (DRCs). The relationship between these concepts and important theorems of trade theory is well-elaborated, and all these standard approaches have been extensively used in quantitative studies on agricultural protection.

Apart from these standard approaches, additional concepts have gained importance in the recent past. There are, in particular, three concepts which either originated from agricultural economics research or have been primarily applied to the agricultural sector. The first one is the producer subsidy equivalent (PSE) which is now widely used in comparative studies on agricultural protection done by international organizations and the US Department of Agriculture (USDA) [OECD, a, 1991;

b; USDA, 1990]. The basic idea of the PSE concept is to introduce more governmental agricultural policies than in typical nominal protection studies and to stress producer earnings rather than producer prices. The second and the third of the new concepts emphasize the fact that a comparative analysis of incentives for agriculture in LDCs has to incorporate direct and indirect agricultural policies arising from the general macroeconomic policy. The concept of true protection is built upon general equilibrium analysis and stresses the importance of measures in one sector for the relative prices in an economy. Although not being necessarily related to agriculture, this concept was applied in many empirical studies to the implicit taxation of agricultural exports in LDCs arising from nonagricultural import protection [Greenaway, Milner, 1987]. The third new concept may be defined as the measurement of nominal protection of the price ratio between agriculture and non-agriculture. It was created as the common measure of policy impacts on relative output prices within the World Bank's project on "The Political Economy of Agricultural Pricing Policy" [Krueger et al., 1988; Schiff, 1989].

We survey all six concepts in the following sections. The basic theory behind the concepts is presented, the definitions for the measurement approaches are given, and their past applications in the measurement of agricultural protection or agricultural protection effects are indicated. Additionally, we discuss how far they can be utilized for quantitative inter-country comparisons of agricultural protection.

1. Nominal Protection

In many cases, the policy discussion on protectionism in agriculture has concentrated on the question how policy affects prices compared with a free-market situation without policy. The nominal rate of protection (NRP) measures this aspect. It expresses the absolute difference between the domestic price (p_i) and the world price (p_w) as a percentage of the world price:

$$[1] \text{ NRP} = 100 \cdot (p_i - p_w) / p_w$$

A NRP of 20 percent indicates, e.g., that domestic prices exceed the world market price by 20 percent.¹ The nominal protection coefficient (NPC) is often used, too, and is defined as

$$[2] \text{ NPC} = p_i / p_w.$$

If the NRP is positive or the NPC is above unity, one concludes that agricultural prices are supported compared with a situation without national policy interventions. A taxation of agriculture, on the other hand, is inferred from a negative NRP or a NPC below unity.

NPCs or NRPs are often used in cross-country analyses on agricultural protection showing how differently countries insulate agriculture from free-trade conditions [FAO, a; Byerlee, Sain, 1986; Taylor, 1989]. It is a major reason for the use of nominal protection measures in cross-section analyses that information on producer prices and on border prices is often available on a comparative basis and even over time. Hence, nominal protection measures are much easier to quantify for a large country sample than alternative measures of protection such as a PSE or measures of effective protection.

Although there are weaknesses of the concept of nominal protection, there is no doubt that nominal protection covers one central issue of agricultural protection, i.e., the policy impact on agricultural output prices. The ingredients of the NRP or the NPC are crucial for more advanced measures of protection as well as for policy evaluation. First, domestic and border prices enter into the PSE and the effective protection, too. Second, the comparison between domestic and world prices underlies virtually all welfare-economic analyses on agricultural pro-

¹ It has to be considered, however, that the NRP must be distinguished from the nominal tariff rate. The reason is that the NRP does not only cover tariff-induced price differences between the domestic and the world price. Those price differences that are caused by quotas or other nontariff barriers can also be taken into account. For the measurement of tariff equivalents of nontariff trade barriers, see Milner [1985, pp. 131 ff.] and Deardorff and Stern [1984, pp. 23 ff.]. How a tariffication of nontariff barriers can occur within agricultural trade liberalization is discussed in Riethmuller et al. [1990, Section 4.1]. Moschini [1991] elaborates, however, that nontariff barriers and tariffs are nonequivalent in many cases and that the measurement of an equivalent tariff is then not straightforward.

tection and all normative approaches to agricultural policy [Just et al., 1982; Houck, 1986; Gardner, 1987; Monke, Pearson, 1989].

The computation of solid NRPs is difficult. In particular, it has been shown that the following aspects have to be taken into account [Westlake, 1987]:

- (1) When price distortions are to be measured via NRPs, it is essential that those rates are measured at one point of the marketing channel.
- (2) The computation of NRPs implies that prices are compared which are denominated in differential currencies. Shadow exchange rates have to be utilized for an undistorted comparison.
- (3) An additional argument that is frequently put forward refers to the price volatility observed in international agricultural markets. It is argued that NRPs should be computed on the basis of "normal" rather than actual world prices. Actual world prices are seen as being too unstable for a rational planning of domestic economic and agricultural policies.

Westlake's first argument means that marketing costs have to be considered in order to present undistorted levels of protection. Transport costs must be introduced for the computation of the free-trade price at a specified point of the marketing chain, whereas it is often possible to observe the domestic price including transport costs at the relevant point. In several of the earlier empirical studies, rather crude protection levels were calculated and transport costs were ignored. Often, producer prices at the farm level were related to international prices at the border, because both series were readily available. International prices were then measured as fob (free on board) unit values for exportables and as cif (cost, insurance, freight) unit values for importables. This procedure is inappropriate, however, since a bias is introduced in the measurement of distortions. Export parity prices have to be computed for export goods and import parity prices for import goods in order to receive "correct" NRPs taking transport costs into consideration. The export parity price is the free-trade price of an exportable at any point of the marketing channel. Or, put differently: the export parity price is the price at which the export good would be available at a certain point of the marketing chain in the hypothetical situation without policy. It can be defined as the fob export price less the total marketing and processing cost occurring between the defined

point of the marketing channel and the border. The NPC of an exportable X at the farmgate (NPC_F^X) is then computed as

$$[3] \quad NPC_F^X = p_F^X / (p_B^X - C_{FB})$$

with p_F^X = producer price of the exportable at the farmgate; p_B^X = fob export price; C_{FB} = marketing cost between the farmgate and the border. Analogously, one can calculate the NPC at the border (NPC_B^X) by introducing the fob export price for p_w and by recalculating the domestic price p_i at the border. Marketing cost C_{FB} have to be added then to the farmgate price. The NPC of the exportable at the border (NPC_B^X) is thus defined as

$$[4] \quad NPC_B^X = (p_F^X + C_{FB}) / p_B^X.$$

Suppose now that nominal protection is to be computed for an importable. The self-sufficiency ratio is not zero, i.e., the product is produced domestically, too. An undistorted computation of nominal protection necessitates introducing import parity price into Equations [1] or [2] for p_w . The import parity price is the free-trade price of an importable at any point of the marketing channel. Or, put differently: the import parity price is the price at which the import good would be available at a certain point of the marketing chain in the hypothetical situation without policy. It is equal to the cif import price plus the total marketing cost between the border and the defined point of the marketing channel. The NPC of the importable M at the retail level is then measured as

$$[5] \quad NPC_R^M = p_R^M / (p_B^M + C_{BR})$$

with p_R^M = domestic price of the importable at the retail level; p_B^M = cif import price at the border; C_{BR} = marketing cost between the border and the retail level.

An undistorted measurement of nominal protection affords that equations like [3] or [4] replace Equation [2] for agricultural exportables and that an equation like [5] replaces Equation [2] for an agricultural importable. Additional care has to be taken if agricultural protection

affects a country's trade status or if the trade status changes over time. Then, the use of either the export or import parity price based on the actual or the usual trade status may give misleading results [Byerlee, Morris, 1990]. In the past, crude protection levels were often shown based on a direct comparison of p_F and p_B ignoring marketing costs. It has been convincingly shown in recent studies that transport costs matter for the measured level of protection, in particular in LDCs. Westlake [1987], e.g., shows that uncorrected protection coefficients of the type $NPC = p_F/p_B$ indicate that domestic maize prices in Kenya were clearly below the international level. An improved computation including transport and marketing costs revealed the reverse at all important points in the marketing channel. Westlake's results suggest that the measurement of price distortions on the basis of uncorrected coefficients of protection are highly misleading for LDCs. Transport facilities are often underdeveloped, so that uncorrected protection levels underestimate the true level of protection or overestimate the true level of price discrimination against the producers. Furthermore, Westlake's findings indicate that protection levels vary strongly between the different points in the marketing chain. It might be helpful, therefore, to compute and to compare protection levels at more than one point of the marketing channel in order to identify price distortions.

Westlake's second argument stresses that a solid computation of protection levels has to be based on **shadow exchange rates**. What is the rationale for this argument? In Equations [1] and [2], nominal protection has been defined without reference to an exchange rate. In empirical applications of the equations, however, it is necessary to utilize an exchange rate in order to express domestic prices and world prices in one currency. This is so because official statistics exhibit domestic prices in a country's domestic currency (say A) and world prices in an international currency (say B), which is most often the US dollar. The easiest way to solve the problem is to use official exchange rates for the price comparison. Then, the NPC according to Equation [2] is implemented as a **gross nominal protection coefficient** (gross NPC). It is defined as

$$[2'] \text{ gross NPC} = p_i^A / (p_w^B \cdot e)$$

or

$$[2''] \text{ gross NPC} = (p_i^A \cdot (1/e)) / p_w^B$$

depending on whether prices are expressed in the domestic or the international currency. e is the official exchange rate, defined as the price of one unit of the international currency in domestic currency units. The argument that the use of a shadow exchange rate or an equilibrium exchange rate is superior to the official exchange rate is based on the following reasoning. Protection measurement aims at a comparison of the existing situation with protection and the hypothetical free-trade situation. Under free trade, however, it might well be that the equilibrium exchange rate would differ from the actual exchange rate. This could be due to macroeconomic policies like an import substitution strategy for the manufacturing sector leading to an overvaluation of the domestic currencies in LDCs. Hence, the measurement of net protection, which takes overvaluation or undervaluation of exchange rates into account, is superior to the measurement of gross protection. It pictures the free-trade situation more completely and provides a more solid concept for measuring the actual policy incentives or disincentives for producers. In the practical implementation, the **net nominal protection coefficient** (net NPC) would use the equilibrium exchange rate (e^*) to express world market prices in terms of the domestic currency, i.e.,

$$[6] \text{ net NPC} = p_i^A / (p_w^B \cdot e^*),$$

or to express domestic prices in terms of the international currency, i.e.,

$$[6'] \text{ net NPC} = (p_i^A \cdot (1/e^*)) / p_w^B.$$

Obviously, the relationship between the net NPC and the gross NPC is

$$[7] \text{ net NPC} = \text{gross NPC} \cdot (e/e^*).$$

A gross versus a net approach to measuring the NRP may be distinguished, too. When Equation [1] is implemented by the use of the official

exchange rate, the gross nominal rate of protection (gross NRP) can be measured as

$$[8] \text{ gross NRP} = \left(\frac{p_i^A - p_w^B \cdot e}{p_w^B \cdot e} \right) \cdot 100$$

or

$$[8'] \text{ gross NRP} = (\text{gross NPC} - 1) \cdot 100.$$

When the free-trade situation is modelled properly with the free-trade exchange rate, e^* rather than e has to be introduced. The net nominal rate of protection (net NRP) is then defined as

$$[9] \text{ net NRP} = \left(\frac{p_i^A - p_w^B \cdot e^*}{p_w^B \cdot e^*} \right) \cdot 100$$

or

$$[9'] \text{ net NRP} = (\text{net NPC} - 1) \cdot 100.$$

The net NRP can also be reformulated as a function of the world price, the tariff equivalent of the agricultural policy measures related to the product and the ratio between the official and equilibrium exchange rate. The actual domestic price, p_i^A , can be defined as

$$[10] p_i^A = p_w^B \cdot e \cdot (1 + t)$$

where t stands for the tariff equivalent of tariff and nontariff measures separating the domestic from the international price. Introducing Equation [10] into Equation [9] yields¹

¹ The computation of net protection as well as the possibilities to estimate the extent of overvaluation within a structural economic model are presented in Balassa et al. [1971, pp. 324 ff.].

$$[11] \text{ net NRP} = \left(\frac{e}{e^*}\right) \cdot (1 + t) - 1 \cdot 100.$$

There is no dissension in the economic literature that the measurement of net protection is superior to that of gross protection. There are considerable difficulties, however, in the modelling of equilibrium exchange rates, and very different approaches to the problem do exist. Basically, three different approaches have been used in the measurement of agricultural protection.¹

The first approach is based on purchasing power theory. According to that theory, the percentage change of the exchange rate is equal to the differential in the rates of inflation [Officer, 1976]. Inflation differentials have been used in the agricultural economics literature, too, in order to compute exchange-rate-adjusted NRPs [Byerlee, Sain, 1986]. There are some important objections against the modelling of equilibrium exchange rates via the purchasing power parity theory. In particular, it is argued that equilibrium exchange rates are not only determined by sales of goods and services, on which the purchasing power parity theory rests, but also by other transactions on the capital market. The second and the third approach implicitly or explicitly cover such additional transactions.

The second approach utilizes the widespread existence of parallel markets for foreign exchange in LDCs for the modelling of equilibrium exchange rates. It is argued that official exchange rates are strongly affected by restrictions on exports, imports and foreign exchange in many LDCs, thus leading to an overvalued exchange rate. Hence, black market exchange rates rather than official exchange rates are seen as a reliable indicator of the equilibrium exchange rates. Black market exchange rates are determined by actual transactions on the parallel and unregulated market for foreign exchange. In the agricultural economics literature, this approach has been used in the cross-country analysis of agricultural protection by Taylor [1989], and it will also be used in this study. There are counterarguments against this procedure, too. The

¹ Surveys on the theory of exchange rate determination are available in Krueger [1983], Jacque [1978] and Edwards [1989]. Measures of real exchange rate misalignments and the linkage between those misalignments and economic performance in 11 African countries are investigated in Schäfer [1989].

economics of parallel markets have shown that a black market exchange rate coincides with the free-trade exchange rate only in a special case. The unification of official and parallel markets for foreign exchange will often lead to an equilibrium exchange rate that lies somewhere between the official and the parallel rate.¹ Although this argument is valid, empirical observations have shown that black market exchange rates are often in the same order as equilibrium rates modelled with a structural economic model [Taylor, 1989, p. 40]. If this argument is valid, black market rates have the strong advantage that they are readily available for a rather large country sample as time series.

The third approach is to model equilibrium exchange rates within a structural model of the foreign exchange market.² This approach has often been adopted by the World Bank in detailed country studies. The method can be related directly to the protective measures of an individual country, more so than the purchasing power parity or the black market approach can. It may be used to model the changes in import demand and export supply resulting from a removal of trade barriers. Thus, the shifts in the demand and supply schedules for foreign exchange due to trade policy can be specified. Consequently, it is possible with this method to model the equilibrium exchange rate for the situation without trade barriers. This procedure has been extensively used within the 18 country studies of the World Bank's project on "The Political Economy of Agricultural Pricing Policy". Equilibrium exchange rates in the absence of trade and exchange rate policies are derived there along these lines [Krueger et al., 1988].

Westlake's third argument is that the measurement of agricultural price protection should employ longer term world prices instead of actual world prices. The rationale for this argument is that actual world prices of agricultural products fluctuate heavily and cannot serve as a reliable benchmark for policy decisions in LDCs. Consequently, the basic Equations [4] and [2] for the NRP should be altered to

¹ This point is made in Roemer [1986]. For a further discussion of important issues concerning parallel markets in LDCs, see Jones and Roemer [1989] and other contributions in the same issue of "World Development".

² Examples for such a structural analysis of the equilibrium exchange rate include Dornbusch [1982] and Stockman [1987].

$$[12] \text{ NRP} = 100 \cdot (p_i - p_w^*)/p_w^*$$

p_w^* measures a normal world price that takes longer term developments into account. It can be calculated on the basis of trend analysis or a structural model of the world price.¹ If Equation [12] is supposed to capture the way a decisionmaker forms his price expectations, one would wish to picture exactly these expectations in modelling p_w^* .²

It remains doubtful, however, whether long-term world prices are generally superior to actual world prices in measuring agricultural protection. It crucially depends on the objectives of the analysis. When the measurement of actual price protection or actual welfare effects due to protection in individual years is aimed at, p_w has to be used rather than p_w^* . If the goal is to show how price expectations are affected by policy measures, Westlake's argument is well taken, and normal instead of actual prices should be utilized. One might extend the argument, however, and introduce normal domestic prices (p_i^*), too. In many LDCs, especially in those with hyperinflation and without a full indexation of agricultural prices, income support policies are also not easy to predict.³ Discretionary agricultural policies may lead to a rather high volatility of domestic prices. With normal domestic prices, Equation [12] for the NRP can be substituted by

$$[13] \text{ NRP} = 100 \cdot (p_i^* - p_w^*)/p_w^*$$

When the measurement of protection serves descriptive purposes, it could also be argued that Equation [13] is superior to Equation [1]. This is a valid argument if an unbiased model of normal prices can be developed

¹ The study of Byerlee and Sain [1986] models normal world prices with a trend model and it is shown in Herrmann et al. [1991] how the way normal prices are modelled does affect the quantitative and qualitative results.

² This point is made in Herrmann and Kirschke [1987], where it is argued that the modelling of price uncertainty depends on the individual market participant's point of view on the determinants of price formation.

³ On domestic agricultural policies under high rates of inflation, see Goldin and de Rezende [1990, Chapter III] and Dias [1991].

and if the description focuses on one or very few years.¹ Within a description of the longer run time series pattern of agricultural protection, the argument is not valid. A possibility will exist in that case to elaborate representative means of protection levels on the basis of Equations [1] and [2]. Special features of protection in individual years will tend to balance out over time.

Even when NRPs are computed in an undistorted fashion, limitations of the concept certainly remain. One important limitation is that policy-induced changes in the NRP are only under specific circumstances an indicator for the resulting changes in producers' income. An introduction of a nominal protection level of 10 percent in agriculture leads to an increase of agricultural income by 10 percent only if

- the input share is zero and
- production does not respond to price changes, i.e., is absolutely price-inelastic.

This argument can be shown easily.² Under the specific assumptions indicated, it follows that agricultural income and earnings are identical ($Y=E$), and income can be decomposed into its price and quantity components:

$$[14] \quad Y = p \cdot q$$

Equation [14] can be rewritten in relative changes as

$$[15] \quad dY/Y = dp/p + dq/q$$

or, if the price elasticity of supply is supposed to be zero, as

$$[16] \quad dY/Y = dp/p.$$

¹ A similar argument is put forward by the EC Commission in saying that the use of PSEs on the basis of actual world prices cannot serve as an acceptable guideline for trade liberalization. The reason is that exogenous changes in world prices or exchange rates might affect the protection level without a change in agricultural policy measures. This leads to the EC's aggregate measurement of support which is presented in Section B. II. 7. See Christen [1990, Chapter VI] for details.

² The derivation of Equation [16'] follows Koester [1980].

Regarding the introduction of an agricultural price policy on an otherwise liberalized world market, Equation [16] can be reformulated to

$$[16'] \quad dY/Y = (P_i - P_w)/P_w.$$

Equation [16'] indicates that the change in the sectoral income due to a change in agricultural price policy is fully determined by the NRP in the no-input case and a zero price elasticity of supply. Obviously, the two assumptions are very unrealistic. First, the price elasticity of aggregate supply in agriculture is certainly not zero, and it is even doubtful whether it is relatively low [Peterson, 1979; 1988]. Second, the input share is definitely not zero in agriculture, although it is lower than in the manufacturing sector. There are two common ways of dealing with insufficiencies in the concept of nominal protection:

- (1) The underlying output price distortions are used within economic models to derive impacts of price policy on earnings, income, private and governmental expenditure, or economic welfare.
- (2) The measurement of protection concentrates more on value added and income than on output prices.

We will follow the second path now and introduce measures of protection that are more closely oriented at agricultural income.

2. Producer Subsidy Equivalents

The concept of PSEs is a measure of protection which came from agricultural economics research. Most other important approaches to measure protection originate from trade theory and trade policy and were applied to agricultural protection at a later stage.

The measurement of PSEs dates back to a study by Josling for the Food and Agricultural Organization of the United Nations (FAO) [FAO, b] and was applied again in later studies by the same author [Josling, 1979; 1980]. The PSE concept was revitalized during the last years and has been used extensively in order to observe and to compare agricultural policies across countries and over time [OECD, a, 1988, 1989, 1990, 1991; b; c; USDA, 1987; 1988a; 1988b; 1990]. Beyond the measurement of support for agriculture, PSEs have been advocated by

agricultural economists as a concept at which agricultural trade liberalization under the Uruguay Round could be oriented [Tangermann et al., 1987; Josling, Tangermann, 1989; Wissenschaftlicher Beirat beim BML, 1988]. Consequently, a debate was stimulated on the pros and cons of PSEs as measures of agricultural protection [Peters, 1988; Hertel, 1989a; 1989b; Christen, 1990].

A PSE indicates which part of producers' earnings is induced by agricultural policy. A PSE of 15 percent indicates that 15 percent of producers' earnings are caused by the instruments of agricultural policy. Hence, a positive value of the PSE stands for an income support for producers, whereas a negative PSE indicates a taxation of producers.

There is a consensus on the verbal definition of PSEs among the major users of the concept, i.e., the FAO, the Organisation for Economic Co-Operation and Development (OECD) and the USDA. However, various analytical definitions of the concept do exist. The major difference is which kinds of policies are considered. The FAO study of Josling referred to product-specific agricultural policies for which price equivalents could be calculated. Those policies are market price support, deficiency payments and subsidies of inputs, storage, and transport. A major advantage of recent definitions of the PSE is that additional policies were taken into account that are not product-specific. The OECD [b] extended the definition by introducing direct income transfers and indirect measures of income support like budgetary expenses for agricultural research, extension and structural policy. The USDA [1990] utilizes a similar and broad PSE definition which considers overvalued exchange rates in LDCs additionally. This reveals the main advantage of the concept: PSEs are an aggregate measure for the impact of a broad variety of agricultural policies on earnings in agriculture. They are not restricted to price policies but cover a whole range of other policies like factor market policies, trade restrictions, direct income transfers, and government outlays for total agriculture rather than for individual agricultural products.

The OECD distinguishes three different analytical versions of the PSE concept. First, the **absolute value of the producer subsidy equivalent (APSE)** is defined as

$$[17] \text{ APSE} = q_1^S \cdot (p_i - p_w) + D - L + B.$$

q_1^S indicates the quantity supplied, and p_i and p_w are again the domestic producer price and the world price, respectively. The first component on the right-hand side of Equation [17] is also called market price support. D stands for direct income transfers, L for producer levies and fees, and B indicates other budget payments to agriculture, either in direct or in implicit form.

Additionally, the OECD calculates a producer subsidy equivalent per produced unit (apse):

$$[18] \text{ apse} = \text{APSE}/q_1^S$$

as well as in percent of the producers' actual earnings including policy-induced income transfers (PSE):

$$[19] \text{ PSE} = (\text{APSE} \cdot 100)/(q_1^S \cdot p_i + D - L)$$

If Equation [19] is contrasted with Equation [1], it can be seen that PSEs cannot readily be compared with the NRP. Actual earnings of the producers enter into the denominator of Equation [19], and the hypothetical free-trade price is in the denominator of Equation [1]. In order to allow for a direct comparison between both concepts, Tangermann et al. [1987] have introduced a further PSE concept. It shows the PSE as a percentage of domestic production evaluated at world market prices. Equation [19] can then be modified to

$$[19'] \text{ PSE} = (\text{APSE} \cdot 100)/(q_1^S \cdot p_w + D - L).$$

This modified PSE concept includes the NRP as a special case. Like the USDA and OECD concepts, it starts from a given level of production.¹ The quantity supplied under the existing policy and under world market

¹ This is not the case, however, for the early Josling approach presented in FAO [b]. Josling stressed the impacts of agricultural policies on producers' earnings and used price elasticities of supply and demand for computing those impacts.

conditions is assumed to be equal ($q_i^S = q_w^S$), i.e., the price elasticity of supply is zero. Starting from this assumption and given that only price policies exist, the PSE according to Equation [19'] is identical with the NRP as defined in Equation [1].¹ It is also equal to the percentage policy impact on producers' earnings in this special case.

In several respects, the monitoring of PSEs by the OECD and the USDA has yielded further progress over time. Starting from Equations [17]-[19] in OECD [b], the difference between net PSEs and gross PSEs was introduced in OECD [a, 1988, Part III, Annex 1]. This distinction has nothing to do with exchange rate corrections which cause the difference between net and gross nominal protection.² Net PSEs and gross PSEs are computed for livestock products, since incentives are obviously affected in this sector by output-oriented as well as input-oriented policies. Gross PSEs, as shown in OECD [b], consider output-oriented policies alone. Net PSEs are calculated by subtracting the taxation of certain inputs from the gross PSEs of livestock production. The amount of input taxation or subsidization is called "farm feed adjustment". Net PSEs are computed along these lines for milk, beef and veal, pigmeat, poultry, sheepmeat, wool, eggs, and total livestock production. Analogous to Equations [17]-[19], net total PSEs, net unit PSEs and net percentage PSEs are exhibited. More recently, the monitoring of PSEs has included PSEs per farmer and PSEs per cropped area [OECD, a, 1989, Annex 2]. A further refinement of PSE calculations was introduced and explained in OECD [a, 1990, Part IV]. Components of PSEs and changes in PSEs were elaborated. PSEs were decomposed according to whether the assistance is due to transfers from consumers, transfers from taxpayers or budget revenues. Furthermore, net total PSEs were broken down into a production volume component and several unit value components: market price support, direct payments and farm feed adjustment. Further decompositions are applied to these unit value components. Additionally, individual researchers have tried to disaggregate the OECD's PSEs into PERTs and PESTs [Rausser, de Gorter,

¹ In the case that only agricultural price policies exist, it holds that $D = L = B = 0$. A zero price elasticity of supply yields $q_i^S = q_w^S$. Equation [19'] reduces then to $PSE = 100 \cdot (p_i - p_w)/p_w = NRP$.

² See Equations [6]-[11] in this chapter.

1991]. PERTs can be described as productive policies which are designed to provide public goods and PESTS as predatory policies which are primarily intended to affect redistribution [Rausser, 1982]. PSE estimates have also been introduced into the OECD's ministerial trade mandate model and a Walrasian general equilibrium model in order to compute the impacts of a removal of agricultural protection in DCs [Huff, Moreddu, 1990; Lienert, 1990; Burniaux et al., 1990].

A major change has been introduced by the OECD [a, 1991]. Analogous to the idea of NPCs, **nominal assistance coefficients** (NACs) have been introduced and computed. The purpose is to measure the price wedge explicitly that various agricultural policies drive between domestic and border prices. Although this seems like a return to nominal protection, the NAC concept incorporates as many policy instruments as does the OECD's PSE approach. Hence, due to a rather comprehensive policy coverage, the NAC concept can be regarded as an improvement compared with many traditional applications of nominal protection. The **producer nominal assistance coefficient** (PNAC) measures the price wedge for producers and is defined formally as

$$[20] \text{ PNAC} = (p_w + \text{apse})/p_w.$$

If the PSE per unit is positive, i.e., producers are supported, the PNAC is above unity. Analogously, the PNAC is below unity if the PSE per unit is negative.

The analysis of PSEs by the USDA has also developed further, and the data basis covers now a wide range of countries and their major commodities in the period 1982-1987 [USDA, 1990]. PSEs are presented in percent of the value of production, per ton in local currency and in US dollars. Moreover, the policy transfers to producers are decomposed into the major agricultural policies of the countries which cause the transfers.

By now, there is a vast empirical evidence on PSEs in DCs [OECD, a, 1988, 1989, 1990, 1991; b] and also on PSEs in DCs compared with LDCs [USDA, 1987; 1988a; 1988b; 1990; OECD, a, 1991] for the last decade. This evidence allows for the 1980s a cross-country comparison of agricultural income support and of income support for individual agri-

cultural products. It further allows a cross-commodity comparison within individual countries and an analysis of agricultural protection over time.

The advantages of the PSE concept have been addressed very clearly by those who are engaged in the PSE estimation: "First, despite the data problems, the PSE methodology can be implemented for a wide range of countries, commodities and policies ... Second, by aggregating a wide range of government policies into a single indicator, PSEs improve our ability to make the extent of government subsidies more transparent to policymakers and the public. PSEs illustrate the relative importance of total government assistance in different countries and commodity markets. PSEs help to show which forms of government assistance are most important in individual countries or in specific commodity markets. When examined over time, PSEs indicate changing government involvement in agricultural sectors" [Chattin, 1989, pp. 354-355].

Although it is generally appreciated that PSEs go beyond all other measures of protection in their policy coverage, there is an ongoing discussion on the pros and cons of the concept. Criticisms of the PSE refer to remaining insufficiencies of the concept, to some simplifying assumptions and the conceptual limitations. The first argument is that there are still insufficiencies left if a comprehensive analysis of all income-relevant policies is aimed at. Several agricultural policies are still excluded from the computation of PSEs like implicit transfers in the social security system¹ or the impacts of most instruments of general economic policy. Hence, PSEs are still limited due to an incomplete coverage of policies, and the missing policies are designed rather differently across countries. However, it has to be borne in mind that these insufficiencies in policy coverage are much more important in most applications of the other concepts of protection measurement.

The second argument refers to the assumptions of the concept. In its implemented form, some strong assumptions were introduced which restrain the capabilities of the concept to model correctly the income effects of agricultural policies. Cases in point are that the price elasticity of supply is assumed to be zero, that cross-country effects in supply

¹ Empirical studies suggest that hidden income transfers towards agriculture within the social security system may be significant in individual countries. This is shown (e.g., for Germany) in Scheele [1990].

and demand are ignored and that the small-country case is posited. Thus, the computation of PSEs along the lines of the OECD or the USDA cannot substitute for a detailed and careful modelling of income effects of agricultural policy within a more realistic framework.¹

The third argument refers to limitations of the concept as such. It is argued by several authors that it depends on the objectives of analysis whether PSEs are a suitable indicator of policy interventions. It has been proposed, e.g., to use PSEs as a guideline for trade liberalization under the auspices of the General Agreement on Tariffs and Trade (GATT). The measurement of PSEs is income-oriented and not oriented at the trade effects of agricultural policies. Therefore, one can show that there are other indicators which are superior to PSEs in serving this end. Very different agricultural policies may be equivalent PSE-wise but may have crucially different trade effects [de Gorter, Harvey, 1990]. It is a major argument of DCs relying upon quotas that they provide income support to their farmers without affecting trade compared with a free-trade scenario. On the basis of this reasoning, trade distortion equivalents (TDEs) have been introduced into the discussion as a superior measure.² A TDE is defined as

$$[21] \quad TDE = 100 \cdot (q^T - q_w^T) / q_w^T.$$

q^T is the traded quantity under policy-induced distortions, and q_w^T is the hypothetical traded quantity under free-trade conditions.

In a further refinement of the same idea, de Gorter and Harvey [ibid.] suggest the measurement of nominal and effective rates of distortion. They stress that it is crucial to distinguish between protection, support and distortion and to concentrate on distortions within the agri-

¹ A detailed analysis on the pros and cons of PSEs is given in Peters [1988]. Differences between PSEs, NRPs and effective rates of protection (ERPs) are elaborated in Schwartz and Parker [1988]. Hertel [1989a; 1989b] elaborates limitations of the PSE concept showing that income changes and changes in trade distortions may differ from PSE changes within a realistic modelling framework. For a comprehensive overview of the concept and its potential use, see Cahill and Legg [1990].

² On implementation issues of the various concepts within the GATT negotiations, see Tangermann et al. [1987], McClatchy and Cahill [1989] and Sarris [1989].

cultural trade liberalization debate. The measurement of these rates of distortion is closely linked with the recommendation to introduce producer entitlement guarantees (PEGs) into agricultural policy [Blandford et al., 1989]. According to the proponents, PEGs are supposed to be an acceptable compromise for a distortion-free or nearly distortion-free agricultural policy under the GATT negotiations. They would allow individual countries to support farm income while reducing or eliminating international trade distortions. Price support would be allowed for a PEG quantity and would range below the quantity supplied under multilateral free trade. All other support measures would be eliminated, so that domestic prices would be equal to the world price and, hence, the world price would guide the domestic production decisions.

Our discussion has focused on producer-oriented policies up to now. A counterpart measure to the PSE is the consumer subsidy equivalent (CSE). CSEs are computed by the OECD and the USDA in addition to PSEs [OECD, b, Annex II]. The CSE is defined as the implicit tax on consumption resulting from given policy measures. The measures included are market price support and any subsidies to consumption. Analogous to Equations [17]-[19] for PSEs, CSEs are expressed in three different analytical versions. First, the absolute value of the consumer subsidy equivalent (ACSE) is defined as

$$[22] \quad ACSE = -q_i^D \cdot (p_i^D - p_w) + G.$$

q_i^D indicates the quantity demanded, and p_i^D and p_w are the domestic consumer price and the world price, respectively. G stands for budget payments to consumers.

Additionally, the OECD calculates a **consumer subsidy equivalent per consumed unit (acse)**

$$[23] \quad acse = ACSE/q_i^D$$

as well as in percent of the actual consumer expenditures including the policy-induced income transfers

$$[24] \quad CSE = (ACSE \cdot 100)/(q_i^D \cdot p_i^D).$$

In general, a positive value of the CSE indicates that consumers are subsidized due to policy measures, and a negative value means that they are taxed. The calculation of CSEs provides important additional information for an inter-country comparison of agricultural and food policies since many countries utilize a two-tier price policy for consumers and producers. Separate measures are in force for consumers leading to an ambiguous connection between PSEs and CSEs across countries.

As PSEs were utilized recently in order to calculate NACs, the same approach was introduced by the OECD [a, 1991] for CSEs. A consumer nominal assistance coefficient (CNAC) measures the price wedge for consumers. It relates the difference between the border price and the CSE per unit to the border price:

$$[25] \text{ CNAC} = (p_w - \text{acse})/p_w$$

According to Equation [25], a taxation of consumers and, thus, a negative CSE per unit drives the CNAC above unity. Analogously, a subsidization of consumers implies a positive CSE per unit, thus leading to a CNAC below unity.

3. Effective Protection

The NRP and the PSE do not yet provide a sufficient indication of the policy-induced income protection in a sector when inputs are used in the production process. The effective protection is then the superior concept. Policy may not only affect output prices but may influence input prices, too. A typical example in agriculture is livestock production, where input costs are often raised by a market price support for feed grains. Whereas the NRP neglects this issue, the ERP takes policy impacts on input costs into account.

The ERP is defined as the difference between the value added (VA) of a sector in the situations with and without protection as a percentage of the value added under free-trade conditions (VA_w):

$$[26] \text{ ERP} = 100 \cdot (VA_i - VA_w)/VA_w$$

As in the case of nominal protection, it is also common to work with an effective protection coefficient (EPC):

$$[27] \quad \text{EPC} = \text{VA}_i / \text{VA}_w$$

The ERP is a widespread instrument of policy analysis mostly used in detailed country studies that has its origin in studies of Balassa and Corden [Balassa et al., 1971; Corden, 1971].¹ When ERPs are available for all sectors of an economy, it can be derived whether the agricultural sector is discriminated against or supported compared with other sectors. In case that disaggregated ERPs are available for subsectors of agriculture, those parts of agriculture can be identified that are favored or taxed as compared to others. As far as NRPs as well as ERPs are available for agriculture, one can conclude whether total protection is overestimated or underestimated when concentrating the analysis on output protection.

It is a straightforward exercise to show under which conditions NRPs and ERPs are equal or unequal. Suppose that one output 0 is produced with one input I. Quantities are again assumed to be constant, i.e., unaffected by the move from free trade to protection. This assumption is in line with the common definitions of PSEs, but given quantities refer here to inputs, too. Let us express now the ERP in relative rather than percentage terms ($t_E = \text{ERP}/100$). It follows then that

$$[27'] \quad t_E = (\text{VA}_i - \text{VA}_w) / \text{VA}_w.$$

We posit that a tariff exists on the output (t_0) and on the input (t_1). Let the output as well as the input be tradable, so that prices under world market conditions can be figured out easily. Those world prices are p_w for the output and r_w for the input. The linkage between

¹ On the theoretical foundation of the concept of effective protection, see Balassa et al. [1971, Appendix A] and on its applicability, see *ibid.* [pp. 21 ff.]. Besides these classical studies of Balassa and Corden, there are very comprehensive studies available on effective protection, e.g., Hiemenz, von Rabenau [1973], Michaely [1977, Chapter 4] and ten Kate [1987]. See also the survey of Donges [1975].

the prices under the influence of policy and those in the hypothetical situation without policy is then

$$[28] \quad p_i = (1+t_0) \cdot p_w$$

on the output side and

$$[29] \quad r_i = (1+t_I) \cdot r_w$$

on the input side. Denominating the output quantity with q and the input quantity with x yields

$$[30'] \quad VA_i = p_i \cdot q - r_i \cdot x$$

for the value added in the existing situation with policy or

$$[30] \quad VA_i = (1+t_0) \cdot p_w \cdot q - (1+t_I) \cdot r_w \cdot x.$$

The value added in the hypothetical situation without policies, i.e., under world market conditions, is

$$[31] \quad VA_w = p_w \cdot q - r_w \cdot x.$$

Introducing Equations [30] and [31] into Equation [27'] gives the following expression for the ERP:

$$[32] \quad t_E = \frac{[(1+t_0) \cdot p_w \cdot q - (1+t_I) \cdot r_w \cdot x] - (p_w \cdot q - r_w \cdot x)}{p_w \cdot q - r_w \cdot x}$$

Let us now introduce a new parameter a . This parameter a stands for the share of input costs in the production value under free-trade conditions:

$$[33] \quad a = (r_w \cdot x) / (p_w \cdot q)$$

Dividing the right-hand side of Equation [30] by $(p_w \cdot q)$ leads, after some reformulations, to

$$[32'] \quad t_E = (t_0 - t_I \cdot a)/(1-a).$$

Various interesting conclusions can be drawn from Equation [32']:

- (1) If the output sector does not use inputs, it follows that $a = 0$ and $t_E = t_0$. The effective protection in the output sector is equal to the nominal protection.
- (2) If a uniform tariff is applied to the input and the output ($t_0 = t_I$), the effective protection is again identical with the nominal protection. This can easily be shown with a numerical example. Let $t_0 = t_I = 0.2$ and $a = 0.5$, it follows then that $t_E = (0.2 - 0.2 \cdot 0.5)/(1 - 0.5) = 0.2$.
- (3) If the tariff on the final product is higher than the respective tariff on the raw product ($t_0 > t_I$), the effective protection of the final product is higher than its nominal protection: $t_E > t_0$ (or ERP > NRP).
- (4) If the tariff on the final product, however, is smaller than the respective tariff on the raw product ($t_0 < t_I$), the effective protection of the final product is lower than its nominal protection: $t_E < t_0$ (or ERP < NRP).
- (5) If $t_0 < t_I \cdot a$, the effective protection of the final product is negative. t_E may be negative even if t_0 is positive.
- (6) It is possible to interpret the ERP as a goal variable.¹ Suppose, e.g., that a and t_I are constant and known. It is possible then to compute that tariff on the final product which would lead to an ERP of zero. This is to compute the compensating tariff on the final product (t_0^*) which treats the sector equally as under free-trade conditions in value-added terms. In order to realize $t_E = 0$, it must hold true that

$$0 \stackrel{!}{=} (t_0 - t_I \cdot a)/(1-a)$$

or

$$0 \stackrel{!}{=} t_0 - t_I \cdot a$$

¹ Such an interpretation dominates in Gans [1985].

or

$$t_0^* = t_I \cdot a.$$

t_0^* is the compensating tariff on the final product. Analogously, NRP^* ($= t_0^* \cdot 100$) is the compensating NRP.

The theory on ERPs has been developed further in various directions.¹ When more than one input is utilized in production, the algebra must be modified without changing the bottomline of the argument. Suppose that n inputs I_i with $i = 1, \dots, n$ enter into the production process. The effective protection of the output good can then be measured as

$$[34] \quad t_E = (t_0 - \sum_{i=1}^n a_i t_{Ii}) / (1 - \sum_{i=1}^n a_i).$$

a_i is the share of input costs for input i in the production value. From the individual input tariffs, a weighted tariff on all n inputs can be calculated as

$$[35] \quad \bar{t}_I = (\sum_{i=1}^n a_i t_{Ii}) / (\sum_{i=1}^n a_i).$$

Solving Equation [35] for $\sum_{i=1}^n a_i t_{Ii}$ and introducing this into Equation [34] yields

$$[34'] \quad t_E = (t_0 - \bar{t}_I \cdot \sum_{i=1}^n a_i) / (1 - \sum_{i=1}^n a_i).$$

It can be seen from Equation [34'] that the effective protection is identical with the nominal protection of the output good if the tariff on the output is equal to the weighted tariff on the inputs ($t_0 = \bar{t}_I$). Analogously, t_E is higher (lower) than t_0 if $t_0 > \bar{t}_I$ ($t_0 < \bar{t}_I$).

¹ Extensions include, e.g., the application of ERPs on the case of input substitution [Ethier, 1972].

When the concept of effective protection is applied to LDCs and a cross-country comparison of effective protection is aimed at, it is again important to take exchange rate misalignments into account. All equations above refer to **gross effective protection**. It is possible, however, to introduce the following exchange rate adjustments as it was done in the case of nominal protection. The **net effective protection coefficient** (net EPC) is defined as

$$[36] \text{ net EPC} = \text{gross EPC} \cdot (e/e^*)$$

and the **net effective rate of protection** (net ERP) as

$$[37] \text{ net ERP} = (\text{net EPC} - 1) \cdot 100.$$

e and e^* are again the actual and the equilibrium exchange rate, respectively.

It is undoubted that the ERP is superior to the NRP and to the PSE on theoretical grounds. It has been applied on agricultural protection in various country studies¹ but less so in comparative analyses across countries. That the concept is primarily used in country studies rather than cross-country studies is due to the fact that very detailed information on input-output coefficients is needed for a solid analysis of effective protection in agriculture. This information is often not available for LDCs on a recent basis and, in particular, it is not available in the form of time series. Hence, effective protection is an important tool of policy analysis within a country study where an input-output matrix is available for a certain point of time. It can then fruitfully be used to evaluate the structure of protection within a country and to draw conclusions for a welfare-increasing change of that structure. The use of ERPs for cross-country comparisons of agricultural protection will, however, remain limited due to data constraints. Measurement concepts,

¹ The first detailed country studies aiming at a comprehensive analysis of incentives for agriculture in LDCs were based on the concept of effective protection. Studies by Gotsch and Brown [1980] on Pakistan, Reza [1980] on Argentina, Cuddihy [1980] on Egypt, Bertrand [1980] on Thailand, and Bovet and Unnevehr [1981] on Togo are cases in point.

which are easier to quantify, have to be utilized for that purpose, especially NRPs or PSEs.¹ Moreover, there is ample evidence for the agricultural sector in LDCs that nominal protection indicates approximately the same pattern of protection as does effective protection.²

4. Domestic Resource Costs

The concept of DRCs is closely linked to a central element of trade theory, i.e., the theorem of comparative advantage. More precisely, it is the objective of the DRCs approach to measure the comparative advantage or disadvantage a country or region has in the production of a certain commodity.

Theory suggests that a country has a comparative advantage in the production and the export of a commodity, if the macroeconomic opportunity costs of producing an additional unit of the commodity are lower than the country's export price. In an algebraic formulation, this implies that

$$[38] \quad f^* \cdot e + d \leq p^* \cdot e$$

with

f^* = costs of foreign inputs per unit of output,

e = exchange rate (price of one unit of foreign exchange in domestic currency),

d = opportunity costs of domestic inputs per unit of output in domestic currency,

p^* = international price of the commodity in foreign currency.

Equation [38] can be reformulated to

¹ A recent study by Conway and Bale [1988] indicates that EPCs may be approximated quite easily by regression techniques using information on NRPs for outputs and inputs and on macroeconomic data.

² This finding was confirmed recently in the country study by Dorosh and Valdés [1990] on Pakistan.

$$d < (p^* \cdot e - f^* \cdot e)$$

or

$$[39] \text{ drc} = d / (p^* - f^*) < e.$$

drc stands for the domestic resource costs per unit of earned or saved foreign exchange. Equation [39] is the formulation of DRCs originating from Bruno [1972]. The bottomline of Equation [39] is the following: a country has a comparative advantage in the production of an exportable, if the macroeconomic opportunity costs of earning an additional unit of foreign exchange are lower than the exchange rate.

Some assumptions must be fulfilled so that DRCs actually express comparative advantage:

- (1) The homogeneity assumption is fulfilled; there are no quality differentials.
- (2) Shadow exchange rates rather than official exchange rates are utilized.
- (3) The markets are undistorted by governmental interventions.

Bruno used Equation [39] in order to study the differences in comparative advantage across sectors for Israel. In this sense, Bruno's DRC approach is similar to the concept of effective protection which has been used primarily for intersectoral comparisons within an economy.¹

An interesting reformulation of the concept was utilized in agricultural economics. This analysis focused there on international comparisons of comparative advantage [Pearson, Meyer, 1974; Murphy, 1989].² One can easily rearrange Equation [39] to

$$[40] \frac{d / (p^* - f^*)}{e} < 1$$

or

¹ For the differences between DRCs and effective protection, see Bruno [1972] and Krueger [1972].

² Monke and Pearson [1989] discuss DRCs as an integral part of policy analysis for agricultural development.

$$[40'] \quad (\text{drc}/e) \leq 1.$$

The ratio (drc/e) is then used for investigating the relative efficiency of individual countries in producing and exporting an exportable. If this ratio is smaller for country A than for country B, it is argued that country A has a larger comparative advantage than country B to export the commodity. Other reformulations of Equation [40] are

$$[40''] \quad (d \cdot q) / ((p-f) \cdot q) \leq 1$$

or

$$[40'''] \quad (\text{DRC}/\text{DVA}) \leq 1.$$

q is the produced quantity of the commodity, p is the price of the commodity in domestic currency, and f indicates the costs of foreign inputs per output unit in domestic currency. DRC stands for total domestic resource costs of producing output q , and DVA is the domestic value added in the respective sector. The approach of one of Equations [40]-[40'''] can be used to show which country has the strongest comparative advantage in the export of a commodity and which countries would possibly survive in case of trade liberalization.

Equations [40] and [40'''] were applied by Pearson and Meyer [1974] to African coffee exporters and by Murphy [1989] to milk production in the European Community (EC). Both studies exhibited clear differences between countries. In the first study, all four countries - Ethiopia, Ivory Coast, Tanzania, and Uganda - had coefficients below unity indicating a comparative advantage for coffee production. The second study, however, revealed coefficients below and above unity saying that some EC countries have a comparative advantage and others a comparative disadvantage in milk production.

Although the concept of DRCs is well-founded in trade theory, it cannot be used directly for the problem at hand. First, time series and cross-country data on the macroeconomic opportunity costs are not available. Second, the concept aims at the measurement of comparative advantage in an intervention-free world, whereas this study is targeted at the impacts of policy on production incentives.

5. True Protection

The measures of protection discussed up to now have one common feature: they are usually computed in order to picture the degree of intervention or the impacts of intervention in one sector. Often, they additionally aim at providing guidelines for policy changes within this sector. Consequently, NRPs, PSEs and ERPs have been used extensively to show agricultural price intervention effects.

Thus, agricultural economics research has nearly exclusively dealt with the impact of direct agricultural policy on agricultural incentives.¹ When the incentives or disincentives for agriculture which face agriculture as a consequence of the total set of government policies are to be worked out, this approach remains unsatisfactory. This is especially true for LDCs where agriculture is an important sector of the economy and where the influence of general economic policies on agriculture has been stressed for many years. Various recent studies emphasize that trade and exchange rate policies in LDCs affect agriculture heavily, in several cases more than direct agricultural policies. One important reason for this phenomenon is that many LDCs protect their manufacturing sectors against foreign competition within a strategy of import substitution. This raises factor costs for agriculture, since wages increase as well as prices of imported inputs like fertilizer. Moreover, the value of the domestic currency improves, and this will implicitly tax agricultural exports. Agricultural exports, however, make up a large proportion of total value added in many LDCs, and this implicit taxation may place a heavy burden on the overall economy. In general, it holds true that the described policy discriminates against agriculture and against exportables within agriculture, whereas the manufacturing sector is favored.

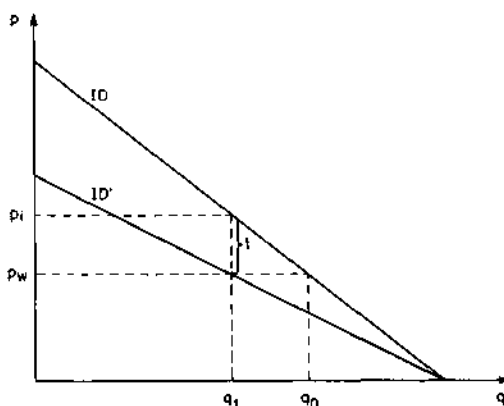
As these arguments on relative incentives capture the basic idea of true protection,² we will show them in more detail within a few graphs.³

¹ This argument is, of course, not valid for studies which dealt with exchange rate misalignments and where net nominal protection, net effective protection or PSEs on the basis of equilibrium exchange rates were computed.

² The concept rests upon the seminal work of Dornbusch [1974] and Sjaastad [1980]. See also the survey article of Greenaway and Milner [1987] and the extension of the concept in Greenaway and Milner [1988a].

³ The following presentation draws heavily upon Herrmann [1990a].

Figure 1 - Primary Effects of Import Protection in the Nonagricultural Sector



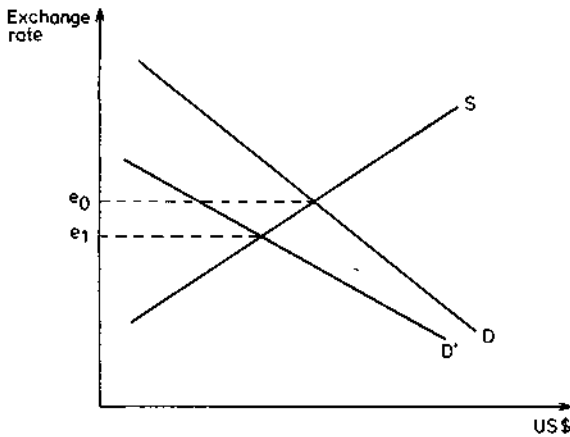
Suppose that any LDC taxes manufacturing imports in order to protect the domestic industry. The country follows a strategy of import substitution. Figure 1 shows how the tariff affects the market of the protected manufactured product.

The import demand function of the importing country is ID , and the country imports are q_0 at the given world price in the benchmark situation without protection. The introduction of the import tariff shifts the import demand curve to the left, from ID to ID' . This leads to a decrease of imports, from q_0 to q_1 . The domestic price of the manufactured good rises to p_1 , and it lies now by the import tariff t above the world price. Hence, the incentive increases to produce the imported good domestically.

Lower imports of the manufactured good imply a decreasing demand for foreign exchange. The country's expenditure for the imports of the manufactured good decline from $(p_w \cdot q_0)$ to $(p_w \cdot q_1)$. When import protection covers all manufacturing imports or a large share thereof, this effect will matter in quantitative terms, and the declining demand for foreign exchange will affect the exchange rate. Figure 2 shows the impact on the market for foreign exchange.

The basic equilibrium on the free market for foreign exchange is given at the exchange rate e_0 where the supply function for foreign exchange (S) intersects the demand function for foreign exchange (D). Decreasing imports in the manufacturing sector lower the demand for foreign exchange from D to D' , and the exchange rate falls to e_1 . We

Figure 2 - Impacts of Nonagricultural Import Protection on the Exchange Rate



define the exchange rate as the price of one foreign currency unit in domestic currency units, and, therefore, a falling exchange rate implies an appreciation of the domestic currency. This currency appreciation induces important consequential effects on agriculture, i.e., the agricultural import as well as the agricultural export sector. Figure 3 illustrates first how the appreciation of the domestic currency affects the agricultural import sector which is often represented in LDCs by food crops.

On the left-hand side of Figure 3, the domestic market is shown with the domestic supply function (\bar{S}) and the domestic demand function (D). This yields the surplus or import demand function ID in the right-hand diagram. In the basic situation, q_0^D is consumed, q_0^S is produced, and q_0^{ID} is imported at the price p_0^D . p_0^D indicates the equilibrium market price denominated in the domestic currency, and it arises from the international price denominated in US dollars ($p_w^{\$}$), multiplied by the base-period nominal exchange rate (e_0). Suppose now that the policy-induced appreciation of the domestic currency follows. The price of the agricultural importable in domestic currency falls to p_1^D , since the exchange rate lowers to e_1 . Thus, it becomes more attractive to import foods. Imports rise to q_1^{ID} , consumption increases also to q_1^D , and production lowers to q_1^S . Obviously, the importing countries are getting more dependent upon agricultural imports due to the import substitution strategy in the manufacturing sector.

Figure 3 - Effects of Nonagricultural Import Protection on the Agricultural Import Sector (Food Crops)

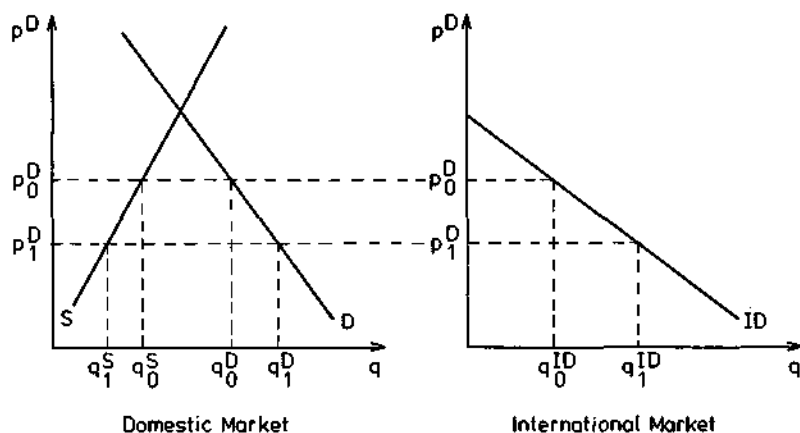


Figure 4 captures impacts of the currency appreciation on agricultural exports. The export supply curve of the country is ES and it exports q_0^{ES} at the market equilibrium price p_0^D . The appreciation of the domestic currency reduces the price which a coffee producer, e.g., receives in domestic currency: from p_0^D to p_1^D . If producers plan in the domestic currency, export supply lowers to q_1^{ES} . It follows that export earnings fall, too, from $(p_0^D \cdot q_0^{ES})$ to $(p_1^D \cdot q_1^{ES})$. An implicit taxation of the agricultural export sector occurs.

The impacts shown above can be summarized as a rise of the price ratio between manufactured and agricultural products, i.e., the relative price between urban and rural goods. Thus, rural-urban migration is favored, and consequential effects on markets for nontradables like services, construction and housing are induced. The major impacts on the market for nontradables are presented in Figure 5. In the basic equilibrium, demand for nontradables (D_0) is equal to the supply of nontradables (S_0) at the price p_0 . The quantity of nontradables supplied and demanded is q_0 . Rural-urban migration due to the changed rural-urban price ratio increases demand for nontradables to D_1 . We can think of increased demand for housing, construction and services in the urban areas. Nontradable sectors have to compete with the manufacturing sector which is booming due to import protection. Hence, factor prices in the nontradable sector are raised, and the supply curve for nontradables shifts to the left: from S_0 to S_1 . This increases prices for nontradables from p_0 to p_1 . It can be concluded that import-substitution policy in the

Figure 4 - Impacts of Nonagricultural Import Protection on the Agricultural Export Sector

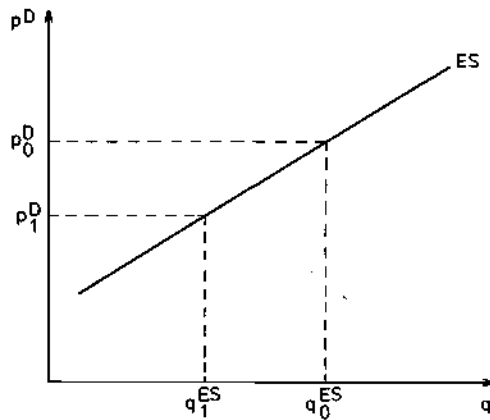
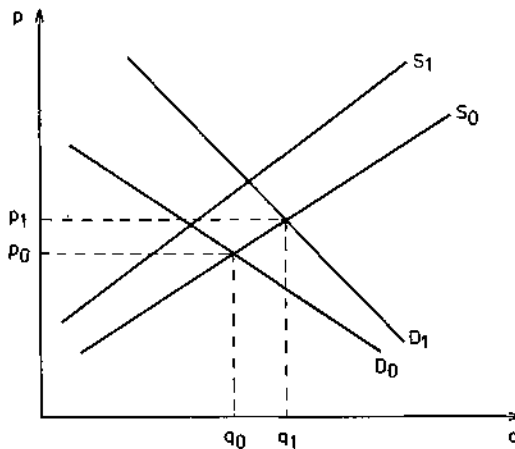


Figure 5 - Impacts of Nonagricultural Import Protection on the Nontradable Sector



manufacturing sector will cause prices to rise not only in the protected but also in the unprotected nontradable sector.

Some important findings can be derived from the simple graphical analysis shown above:

- (1) If the nonagricultural sector in a LDC is insulated from the world market and domestic production is protected by tariffs, the production of agricultural tradables is implicitly taxed.
- (2) Food imports are stimulated as a consequence of an import substitution strategy in the manufacturing sector. Domestic production of food crops is hindered by the industrialization policy and the macro-

economic framework. Import substitution in the nonagricultural sector thus leads to an increasing import dependence in agriculture.

- (3) Agricultural exports suffer from an import substitution policy in the nonagricultural sector. The price of agricultural exportables drops in domestic currency. In relative terms, it falls compared with prices of the protected manufacturing products and of nontradables.

The concept of true protection is suitable to analyze the intersectoral linkages presented above. It captures implications of trade policy measures in one sector on relative prices between sectors of the economy. With this approach, true protection is clearly different from nominal or effective protection. Whereas NRPs or ERPs are applied to individual markets or sectors, often within partial equilibrium approaches, the concept of true protection is by definition a concept of general equilibrium analysis.¹

In the theoretical foundation of the true protection concept [Dornbusch, 1974; Sjaastad, 1980], an importable, an exportable and a nontradable are produced and consumed. True protection is related to the question how policy changes the price of exportables relative to those of importables and nontradables. Or, put differently: true protection measures how the burden of import protection is shifted on to exportables and nontradables.² Dornbusch has shown that an import tariff raises the price ratios between the importable and the nontradable and also between the nontradable and the exportable.³ Hence, import tariffs imply that nontradables are taxed compared with importables. Additionally, it is discriminated against exportables relative to both importables and nontradables. It depends on the substitutive relationship between

¹ This is not to say that NRPs and ERPs cannot be used in general equilibrium analyses. They certainly can, but they were mostly used within partial equilibrium analyses, and the definition of NRPs and ERPs are related to one sector. On the differences between true and effective protection, see Greenaway and Milner [1987].

² It is also possible to study the effects of trade liberalization or financial market liberalization within general equilibrium models of the true protection type. For such analyses, see Sell [1988; 1990].

³ The analysis is based on the assumption that the cross price elasticities of surplus demand for nontradables with regard to the prices of the tradables are positive, whereas the corresponding cross price elasticities between the tradables are zero. See Dornbusch [1974, pp. 179 and 181].

the products in supply and demand how strong these impacts actually are.

Standard measures of true protection are the true tariff rate (t^*) and the true subsidy (s^*). The definitions rely upon the assumption that import tariffs and export subsidies exist as trade-regulating devices. The true tariff rate measures the change of the price ratio between the import sector (M) and the nontradable or home goods sector (H):

$$[41] \quad t^* = \Delta (p_M/p_H) = (1+t)/(1+d) - 1 = (t-d)/(1+d)$$

t stands for the tariff on the aggregate import good, and d indicates the price increase for the nontradable good. Thus, t^* describes how strongly the import sector is actually protected through an import tariff relative to the nontradable sector. The true subsidy is defined as a change of the price ratio between the exportable (X) and the nontradable sector:

$$[42] \quad s^* = \Delta (p_X/p_H) = (s-d)/(1+d)$$

s is the nominal subsidy rate, and the true subsidy shows how strongly the export sector is actually taxed compared with the nontradable sector.

Empirical studies utilizing the concept of true protection often work with Sjaastads incidence parameter ω [Sjaastad, 1980].¹ This parameter expresses the percentage change of the price ratio between nontradables and exportables due to a one percent change of the price ratio between importables and exportables:

$$[43] \quad \omega = \frac{\Delta(p_H/p_X)}{p_H/p_X} / \frac{\Delta(p_M/p_X)}{(p_M/p_X)}$$

¹ Empirical studies with the concept of true protection are available for Cameroon [Milner, 1990], Colombia [García, 1981], Ivory Coast [Greenaway, 1989], Ghana [Miethbauer, 1990], Mauritius [Greenaway, Milner, 1986], Nigeria [Oyejide, 1986; Zachäus, 1990], Pakistan [Dorosh, Valdés, 1990], the Philippines [Bautista, 1987], Zimbabwe [Mlambo, 1989; Wiebelt, 1992], Zaire [Tshibaka, 1986], and in a comparative analysis for Peru and Malaysia [Herrmann et al., 1990].

ω ranges between 0 and 1. The magnitude of ω provides information to which extent the burden of import protection is transmitted to the export sector. This is all the more the case, the more ω approaches unity. $\omega = 1$ implies that the prices of importables and home goods rise by the same rate, whereas prices in the exportable sector remain unchanged. There is a tendency of ω to approach unity when importables and nontradables are close substitutes and when nontradables and exportables are not substitutes or the substitutional relationship is very weak. Alternatively, ω will converge towards zero when nontradables and exportables are close substitutes, whereas importables and nontradables are not. Then, p_H is not closely following the changes in p_M .

The following interpretation of empirical estimates of the incidence parameter ω is possible:

- In case of $\omega = 0$, the burden of import protection is imposed equally on the nontradable and the export sector.
- If $\omega = 1$, the export sector alone is burdened with the consequences of import protection.
- If ω ranges between 0 and 1 and if it is significantly higher than zero, import protection places a heavier burden on the export sector than on the nontradable sector.

It must be added that the incidence parameter ω has to be combined with additional information on protection levels when true tariff rates and true subsidy rates shall be derived. Suppose that the true subsidy rate for total agricultural exports is searched for. From Equation [42], the true subsidy rate is the result of

- direct subsidies for agricultural exports (s) and
- indirect taxes resulting from the appreciating effect (d) of both export subsidies and import taxes on manufactures.

The latter effect is given by

$$[44] \quad d = \omega \cdot t + (1-\omega)s$$

where t and s are the weighted average implicit import taxes on manufactures and export subsidies on agricultural exportables, respectively.

By now, the concept of true protection has been successfully applied in empirical studies to show how import substitution strategies in favor of the manufacturing sector, overvalued exchange rates or booms

in other sectors tax agriculture and, in particular, agricultural exports. The empirical evidence reveals that the estimates of ω are relatively high. They are in nearly all cases above 0.5 and approach unity for some countries and commodities.¹ This implies that the implicit taxation of agricultural exports via macroeconomic policies is strong. Starting from individual inter-country comparisons, the evidence suggests that an inter-country comparison of incidence parameters is insufficient when differential incentives for production in various countries are to be elaborated. It seems that the NRPs in the agricultural sector and in the manufacturing sector vary widely across countries, whereas this is not the case for the incidence parameter ω [Herrmann et al., 1990].

6. Nominal Protection of the Price Ratio between Agriculture and Non-agriculture

This concept has been developed as a major element of 18 country studies within the World Bank's project on "The Political Economy of Agricultural Pricing Policy" [Krueger et al., 1984; 1988; Krueger, 1989; Schiff, 1989].² The computation of net NRPs is combined with a general equilibrium approach. Policy impacts on agricultural incentives in a country are measured by the NRP of the price ratio between agriculture and nonagriculture. Consequential policy impacts like those on production, trade and economic welfare are based upon this measurement of protection.

¹ For a critical discussion of the magnitude of ω and some other features of the concept, see Singh [1988], Smeets [1989] and Greenaway and Milner [1988b; 1990].

² Published country studies include Avillez et al. [1988] on Portugal, Jansen [1988] on Zambia, Dethier [1989] on Egypt, García and Llamas [1989] on Colombia, Greene and Roe [1989] on the Dominican Republic, Jenkins and Lai [1989] on Malaysia, Moon and Kang [1989] on South Korea, Siamwalla and Setboonsarng [1989] on Thailand, Tuluy and Salinger [1989] on Morocco, Intal and Power [1990] on the Philippines, Stryker [1990] on Ghana, Valdés et al. [1990] on Chile, Sturzenegger and Otrera [1990] on Argentina, and Hamid and Nabi [1990] on Pakistan. Forthcoming are the studies on Brazil (Carvalho, Brandao), Ivory Coast (Atsain et al.), Sri Lanka (Bhalla), and Turkey (Olgun, Kasnakoglu). Preliminary results of the Turkey study are included in Olgun [1989].

A distinctive feature of the approach is that the measure of total agricultural protection (NRP_T) can be decomposed into one component that indicates protection due to direct agricultural policies (NRP_D) and another component that captures protection due to indirect agricultural policies (NRP_I):

$$[45] \quad NRP_T = NRP_D + NRP_I$$

The measure of total agricultural protection, NRP_T , can be defined more precisely as

$$[46] \quad NRP_T = \left(\frac{p_i / p_{NA}}{p_i^* / p_{NA}^*} - 1 \right) \cdot 100.$$

Agricultural protection due to direct agricultural policies, NRP_D , is defined as

$$[47] \quad NRP_D = \left(\frac{p_i / p_{NA} - p_i' / p_{NA}}{p_i^* / p_{NA}^*} \right) \cdot 100.$$

Agricultural protection due to indirect agricultural policies, NRP_I , is

$$[48] \quad NRP_I = \left(\frac{p_i' / p_{NA}}{p_i^* / p_{NA}^*} - 1 \right) \cdot 100.$$

NRP is in each case defined for an agricultural/nonagricultural price ratio. p_i is the domestic producer price of a tradable agricultural product i , and p_i' is the border price of this product evaluated at the official nominal exchange rate ($p_i' = p_i^B \cdot e_o$). p_i^* marks the border price of the product evaluated at the equilibrium exchange rate ($p_i^* = p_i^B \cdot e^*$). p_{NA} is the nonagricultural sector price index in domestic currency defined as

$$[49] \quad p_{NA} = \alpha p_{NAT} + (1-\alpha)p_{NAH}$$

with a tradable share α and a nontradable share $(1-\alpha)$ and the respective prices P_{NAT} and P_{NAH} . P_{NA}^* is the nonagricultural price index where the price index of the tradable part is evaluated at the equilibrium exchange rate and in the absence of trade policy measures affecting nonagricultural tradables (indicated by a tariff t_{NA}). Let the equilibrium price of the tradable component be defined as P_{NAT}^* . Then, P_{NA}^* can be written as

$$[50] \quad P_{NA}^* = \alpha \cdot P_{NAT}^* + (1-\alpha)P_{NAH}$$

P_{NAT}^* itself is equal to the world market price of nonagricultural tradables, denominated in foreign currency, multiplied by the equilibrium exchange rate:

$$[51] \quad P_{NAT}^* = P'_{NAT} \cdot e^*$$

P'_{NAT} influences, together with the official exchange rate and the existing trade policy, the actual price index for nonagricultural tradables as follows:

$$[52] \quad P_{NAT} = P'_{NAT} \cdot e_0 \cdot (1+t_A)$$

Introducing Equations [51] and [52] into Equation [50] yields the following reformulation of the equilibrium price index for the nonagricultural sector:

$$[50'] \quad P_{NA}^* = \alpha \cdot \frac{P_{NAT} \cdot e^*}{(1+t_{NA}) \cdot e_0} + (1-\alpha) \cdot P_{NAH}$$

Four aspects make the approach of the World Bank's project especially attractive:

- (1) The total magnitude of agricultural protection originating from direct and indirect agricultural policies can be analyzed with the approach. Direct agricultural policies cover those policies that are directed towards agriculture, like market price policies, export taxes or input subsidies within the sector. Indirect agricultural policies are those

instruments of general economic policy which have consequential effects on agriculture, like trade or exchange rate policy.

- (2) The contributions of direct and indirect agricultural policies on total agricultural protection can be determined precisely on the basis of the algebra shown above.
- (3) The analysis of price protection is the basis for detailed studies of the impacts on production, consumption, trade, the budget, and economic welfare.
- (4) The World Bank's approach goes beyond the true protection analysis with regard to the policies covered. General macroeconomic policies, e.g., fiscal policies, can be captured in addition to trade, exchange rate and price policies.

Given the broad country and commodity coverage of the World Bank's project, innovative new results were produced on the magnitude, structure and causes of agricultural protection in LDCs.

Although being attractive conceptually, the approach is much more suitable for detailed country analyses than for combined cross-country and time series analyses of agricultural protection.¹ Data requirements are usually too demanding for realizing detailed country studies for a sufficiently long time period on a broad country basis.

7. Other Measures of Agricultural Protection or Protection Effects

The preceding analysis provided an overview of some commonly used measures of agricultural protection or of agricultural protection effects. Other measures have been emphasized in the literature and were used in quantitative studies. They will be reviewed here only briefly.

Another measure used by Balassa et al. [1971, pp. 331 ff.] considers the fact that production for domestic markets in LDCs may be treated differently by policy than production for exports. This measure is called the **bias against exports (BAE)** and is defined as follows:

¹ An interesting extension of the World Bank's concept is provided by Schmitz [1989] who distinguishes three components of the total NRP: the internal direct effect, the internal indirect effect and the external effect. The first two effects are those considered in Equation [45]. The external effect arises from agricultural policies in DCs.

$$[53] \text{ BAE} = 100 \cdot (\text{VAD} - \text{VAX})/\text{VAX}$$

It captures the percentage excess of value added obtainable from producing for domestic markets (VAD) over that obtainable in exporting (VAX). Value added is in both cases defined for the existing situation with protection. As far as BAE is positive, there is a policy-induced BAE and an incentive to produce for the domestic market. If BAE is negative, the reverse holds true.

There is an additional measurement concept which did not receive general acceptance but was used in an important empirical study of agricultural protection by Peterson [1979], whose results will be discussed later. Peterson addressed the issue whether the pattern of agricultural protection differs crucially between DCs and LDCs. Within a cross-section approach, he measured for each country a relative price (p^R) between an aggregate output price for the agricultural sector (p) and a weighted fertilizer price (p^F) as a proxy for agricultural input prices:

$$[54] \quad p^R = p/p^F$$

In Equation [54], the agricultural price level p is computed as follows:

$$[55] \quad p = \sum_i \frac{p_i^D}{p_i^W / p_{WH}^W} \cdot w_i$$

where p_i^D is the domestic price of the commodity i , p_i^W the world market export price in US dollars of the commodity i , p_{WH}^W the world market export price for wheat in US dollars, and w_i the share of the commodity i in total output of each country in wheat equivalent units. p can be interpreted as the overall wheat equivalent price for a country. Based on Equations [54] and [55], Peterson compared the relative incentives for agricultural production across countries.

Individual measures of protection have gained importance in the discussion around the liberalization of international agricultural trade. This holds especially true for the support measurement unit (SMU) introduced by the EC Commission [Riethmuller et al., 1990]. It was

proposed as an instrument at which agricultural reform should be orientated. The concept of the SMU is similar to that of the PSE; it is supposed to be an aggregate measurement of support which would cover the protective impact of various agricultural policy instruments.¹ The SMU would be computed as the price difference per unit of output. Although the concept has never been defined precisely by the EC, there are differences to the PSE concept which are stressed by the EC Commission. In particular, the SMU shall be based on the world price in a fixed period rather than on the actual price as a reference price. The reason for this is that fluctuations in markets and exchange rates shall be kept outside of the measure. The EC argues that those fluctuations have nothing to do with protection and, hence, should not be treated as an element of protection in the measurement concept.

Finally, when impacts of agricultural protection are derived within modelling approaches, many important economic variables are covered which have not been discussed up to now. Depending on the objective of the analysis, policy impacts on output, on trade, on government revenue or expenditures, on the welfare of economic groups within an economy, and on aggregate welfare are analyzed.²

III. Review of Empirical Studies on Agricultural Protection

There is a famous traditional hypothesis saying that price policy in LDCs discriminates against agriculture. Most agricultural economists, e.g., Schultz³, profess to this view and stress the negative economic consequences of the discrimination. They argue that policy-induced distortions cause insufficient investments in agriculture of LDCs, a low adap-

¹ A more precise interpretation of the concept is given in Christen [1990, pp. 113 ff.].

² For a detailed analysis of agricultural policy or welfare economics, see Boadway and Bruce [1984], Gardner [1987], Houck [1986], Just et al. [1982], and Tsakok [1990, pp. 131 ff.].

³ See Schultz [1978, pp. 5 ff.]. There are similar arguments in Brown [1978] and Hayami and Ruttan [1985, pp. 383 ff.]. A comprehensive qualitative analysis of the urban bias, or anti-rural bias, in LDCs' policies is given in Lipton [1977]. A very detailed analysis of incentives for agriculture and price distortions in world agriculture is provided in World Bank [1986].

tion of technical change and an increasing dependence on imported food. Wrong price signals on output and input markets and economic welfare losses due to this policy are emphasized as well as their unintended side effects on rural-urban migration and on urban poverty.

Up to the early 1980s,¹ the traditional hypothesis was investigated empirically only for some countries. Since then, however, quite a few cross-country studies on agricultural price incentives or distortions in LDCs have appeared. In the following, we will give a brief summary of the recent empirical literature on agricultural protection in LDCs. The current knowledge on the issue will be elaborated first. Then, it will be worked out where deficiencies of the available studies exist and what our own quantitative analysis, which follows in the next chapter, adds to the available literature.

1. The Empirical Evidence

The results of recent empirical analyses on agricultural protection and food policy in LDCs give rise to the following stylized facts:

- (1) The degree of agricultural support is much higher in DCs than in LDCs.
- (2) Within the agricultural sector in LDCs, it is discriminated against export crops as opposed to food crops.
- (3) In many cases, direct agricultural policies in LDCs are less important than indirect agricultural policies for agricultural incentives.
- (4) Food consumption in LDCs tends to be heavily subsidized by food policy.
- (5) There is no clear-cut evidence whether direct agricultural policies in LDCs discriminate against food crops.
- (6) Direct agricultural policies in LDCs tend to insulate domestic producer prices from world prices and often stabilize prices.

¹ See Bale and Lutz [1981], where the traditional hypothesis is confirmed for Argentina, Egypt, Thailand, and Pakistan for the year 1976. The same result occurred for Kenya which is additionally covered in Lutz and Scandizzo [1980]. The conventional hypothesis of a taxation of agriculture is elaborated in further country studies, too, e.g., in Rea [1980] for Argentina. A somewhat more mixed result is presented for Pakistan in Gotsch and Brown [1980].

a. Agricultural Support in LDCs as Opposed to DCs

By now, there is a wide empirical evidence available showing that DCs protect their agricultural sectors. Table A1 gives an overview of the pattern of protection in this country group. Recent PSE estimates for the OECD countries are summarized there by country and by product [OECD, a, 1990]. Percentage PSEs for total agriculture were positive in all periods between 1979 and 1989. The percentage PSE according to Equation [19] amounted to 37 percent in the period 1979-1986 and to 44 percent in 1990, on average, for the OECD countries. Additionally, the average PSE across OECD countries for individual products were in all cases positive. Within this general pattern, there are remarkable structural differences, however. The inter-country comparison shows that the agricultural protection of Switzerland and Norway ranked highest in all years. Besides this, it can be summarized that percentage PSEs for total agriculture were in each period in Japan higher than in the EC, in the EC higher than in the USA and in the USA higher than in Australia and New Zealand. The latter two countries have the lowest level of agricultural protection among the OECD countries. Scandinavian countries, in particular Norway and Finland, rank very high in the scale of agricultural protection. Percentage PSEs are not far from those of Japan, i.e., clearly above average. When average PSEs in the OECD are compared across agricultural products, it is striking that percentage PSEs fluctuate strongly from year to year. This is primarily due to variations in the world price, in particular in crop production. Among the crops, rice and sugar were the most heavily protected products in all years. In livestock production, net percentage PSEs are in all years highest for either milk production or sheepmeat, followed by beef and veal. When PSEs for crops are compared with those for livestock products, no consistent pattern is visible over the years. The results reveal that PSEs for crops vary stronger over time, mostly due to fluctuating world market prices. Consequently, PSEs for crops were higher than those for livestock production in the period 1986-1989, but slightly lower before.

In any case, Table A1 shows clearly how strongly agriculture is supported in the most important DCs. Additionally, there are some

cross-country studies available dealing with the comparison of agricultural incentives in DCs versus LDCs.

A direct comparison of real agricultural prices across countries was provided for 1968-1970 in a study by Peterson [1979]. Based on real producer prices as defined in Equation [54], Peterson computed the protection levels shown in Table 1. The major finding is that real prices received by farmers in DCs were clearly higher than those in LDCs. Although there are a few exceptions like South Korea or Pakistan, this major result is very pronounced. The highest level of protection, in Japan, was more than seven times higher than the lowest level of protection, in Niger. And: "Prices received in the top ten countries averaged 3.7 times larger than prices in the lowest ten" [ibid., p. 14].

A further important element of the Peterson study is that he used the real prices received by farmers for estimating an international agricultural supply function. A main result of this analysis is that the estimated price elasticities of agricultural supply ranged between 1.25 and 1.66. Thus, they were way beyond traditional estimates of the price elasticity of agricultural supply.¹ Peterson argues first that the cross-sectional analysis rather yields the long-run supply elasticity, whereas traditional time series approaches capture the short-run elasticity, and second that the high magnitude of the supply elasticity indicates that a discriminatory price policy in LDCs places a much higher burden on the overall economy than previously expected.

Although the price data and the conclusions of the Peterson study were criticized,² especially in their relevance for Africa, other recent studies seem to support the major findings of Peterson. Various empirical studies reveal that the degree of agricultural protection rises with economic development [Balisacan, Roumasset, 1987; de Haen, Schäfer, 1988; Skully, 1990]³ or with other variables that are correlated with economic

¹ Kislev [1981, p. 280] adds the argument that Peterson's relative prices can be viewed as effective exchange rates and that his supply equation "can be interpreted more generally as a response function to effective exchange rate distortions".

² See McIntire [1983] and the response of Peterson [1983].

³ It is also shown in commodity-related studies for wheat and rice that protection increases with economic development [Herrmann, 1989; Thiele, 1990; Schenck, 1991]. Some empirical evidence is also given

Table 1 - Real Prices Received by Farmers, 1968-1970 (a)

Japan	52.5	Chile	25.4
Hungary	51.9	Colombia	25.4
Switzerland	45.5	Morocco	25.2
Finland	44.5	Greece	23.1
USA	44.0	Tunisia	23.0
South Korea	43.8	Portugal	22.0
Norway	43.3	Kenya	20.8
France	41.2	Ghana	20.7
Sweden	40.4	Panama	19.9
Belgium	37.6	Jordan	19.7
West Germany	38.0	Senegal	19.1
UK	36.7	Guatemala	18.2
Poland	36.3	Iraq	18.0
Denmark	35.9	Cameroon	16.1
Ireland	35.9	Ivory Coast	15.9
Austria	35.5	Peru	15.8
Yugoslavia	32.4	Uruguay	15.5
Pakistan	32.2	Philippines	15.0
Spain	31.2	Burkina Faso	14.3
Turkey	29.8	Argentina	13.4
Netherlands	29.4	Benin	13.0
Italy	29.2	Burma	12.2
Israel	28.5	Guyana	10.8
Sri Lanka	27.9	Kampuchea	10.2
Canada	27.8	Paraguay	8.4
Cyprus	27.8	Niger	7.1
Mexico	25.8		

(a) Real prices are kilograms of fertilizer that could be purchased with 100 kg of wheat equivalents (see Equation [54]).

Source: Peterson [1979, p. 14].

development [Honma, Hayami, 1986]. There is ample evidence, too, that the price elasticity of agricultural supply is positive and relatively high in the medium and long run [Cavallo, 1989; Mundlak et al., 1989].¹ This

and explained in political economy terms by Anderson and Tyers [1989].

¹ Price elasticities of agricultural supply derived within a comparative static framework are usually smaller. See, e.g., Binswanger et al. [1987] or Bond [1983]. Surveys of these traditional estimates of supply elasticities are given in Askari and Cummings [1976], Ghatak and Ingersent [1984, Chapter 7] and Rao [1989]. A discussion of the importance of price versus nonprice factors in determining agricultural supply response can be found in Krishna [1982] and Beynon [1989] for Sub-Saharan Africa.

implies that the distortion of price incentives for agriculture as opposed to nonagriculture places a heavy burden on the overall economy [Valdés, 1986]. By utilizing a sectoral growth model, Cavallo [1989] and Mundlak et al. [1989] show in the context of Argentina that a freer trade regime combined with monetary and fiscal discipline would have produced substantially better economic performance. The price ratio would have changed strongly in favor of agriculture, and agricultural output would have increased significantly.

It has to be borne in mind, however, that the stronger policy-induced support of agriculture in DCs than in LDCs does not imply that agricultural prices relative to nonagricultural prices are also higher in DCs. Quite the opposite is true. Prasada Rao et al. [1990, p. 221] elaborate in a cross-country study for 1975 and 1980 that "agricultural prices relative to nonagricultural prices are lower in high-income developed economies relative to low-income developing economies". This finding is based on a comparison between agricultural output-based and gross-domestic-product-based purchasing power parities. It can be explained by the fact that agricultural prices tend to deteriorate more with economic development. This is a consequence of relatively high rates of technical change in agriculture, relatively small changes in food demand due to a low income elasticity and rather low price elasticities of supply and demand thus favoring relative strong price changes.

b. The Structure of Agricultural Support in LDCs: Export Crops versus Food Crops

A further empirical result which is rather safe in the light of empirical analyses is that many LDCs discriminate against their export crops as opposed to their food crops. The most important recent findings on this issue come from the World Bank's project on "The Political Economy of Agricultural Pricing Policy" [Krueger et al., 1988; Schiff, 1989]. As was argued in Section B.II.6, the measurement approach of this project incorporates the incentives and disincentives from direct as well as indirect agricultural policies and disaggregates total protection of agriculture accordingly.

Table 2 summarizes major results on direct, indirect and total NRPs for representative exportables and importables within agriculture for 18 LDCs. The protection rates refer to 1975-1984. Table 2 allows the following major conclusions regarding the differential protection of export and food crops:

- (1) Columns (4) and (8) of Table 2 illustrate that the total NRP, as defined in Equation [46], is on average -38 percent for export crops. Compared with the average value of -6 percent for food crops, this suggests that agricultural policies in LDCs discriminate against export crops as compared to food crops.
- (2) The results for the individual countries are such that the NRPs for the representative export crops are lower than for the representative import products. The differential is in 8 countries higher than 20 percentage points. There are only two exceptions, namely Pakistan and Zambia, where the representative importables were taxed even more than the representative export crops.

c. The Relative Importance of Direct and Indirect Agricultural Policies for Agriculture in LDCs

Traditionally, the policy discussion around agricultural incentives in LDCs has emphasized the effects of such policies as agricultural price and credit policies, fertilizer subsidies or food price policies. This means that direct agricultural policies were in the foreground of the political discussion. Although the importance of macroeconomic policies for agricultural incentives has been stressed for a rather long time [Lipton, 1977], rigorous quantitative analyses of those indirect agricultural policies were unavailable until the recent past.

Again, the World Bank's project on "The Political Economy of Agricultural Pricing Policy" provides important empirical findings on the relative importance of direct and indirect agricultural policies for total protection. Table 2 allows this disaggregation in Columns (2)-(4) for representative export crops of LDCs and in Columns (6)-(8) for representative import crops. Some challenging results can be summarized:

- (1) Of the 18 LDCs considered, 17 tax their agricultural sectors via indirect agricultural policies. Indirect effects include the effects of

Table 2 - Direct, Indirect and Total NRPs for Exportables and Importables within Agriculture, 1975-1984
(percent) (a)

	Exportables				Importables			
	product	protection rates			product	protection rates		
		direct	indirect	total		direct	indirect	total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Argentina	Wheat	-19	-27	-46	-(c)	-(c)	-27	-(c)
Brazil	Soybeans	-14	-23	-37	Wheat	14	-23	-9
Chile	Grapes	1	7	8	Wheat	10	7	17
Colombia	Coffee	-6	-30	-36	Wheat	7	-30	-23
Dominican Republic	Coffee	-23	-19	-42	Rice	23	-19	4
Egypt	Cotton	-29	-16	-45	Wheat	-20	-16	-36
Ghana	Cocoa	30	-78	-48	Rice	99	-78	21
Ivory Coast	Cocoa	-26	-30	-56	Rice	12	-30	-18
Malaysia	Rubber	-22	-7	-29	Rice	53	-7	46
Morocco	-(b)	-(b)	-10	-(b)	Wheat	-4	-10	-14
Pakistan	Cotton	-9	-42	-51	Wheat	-17	-42	-59
Philippines	Copra	-18	-28	-46	Maize	22	-28	-6
Portugal	Tomatoes	17	-9	8	Wheat	21	-9	12
South Korea	-(b)	-(b)	-15	-(b)	Rice	89	-15	74
Sri Lanka	Rubber	-30	-33	-63	Rice	15	-33	-18
Thailand	Rice	-22	-17	-39	-(c)	-(c)	-17	-(c)
Turkey	Tobacco	-13	-38	-51	Wheat	13	-38	-25
Zambia	Tobacco	4	-50	-46	Maize	-11	-50	-61
Average		-11	-27	-38		21	-27	-6

(a) Direct, indirect and total NRPs are computed according to Equations [45]-[48] in Section B.II.6. -
 (b) South Korea and Morocco's main agricultural products are all imported. - (c) Argentina and Thailand's main agricultural products are all exported.

trade and macroeconomic policies on the real exchange rate and on the extent of protection granted to nonagricultural products. The only exception is Chile, where indirect agricultural policies slightly favor agricultural protection. The average indirect NRP with -27 percent is rather remarkable.

- (2) For the agricultural exportables, disincentives via indirect agricultural policies strengthen the disincentives due to direct agricultural policies which exist in all but three cases. On average, a stronger taxation of agriculture stems from indirect rather than direct agricultural policies. The average direct NRP is -11 percent and, combined with the average indirect NRP of -27 percent, adds up to a total NRP of -38 percent.
- (3) For the agricultural importables, the picture is somewhat different. In 12 out of 16 countries, the direct NRP is positive. On average, the NRP is 21 percent. Concentrating on direct agricultural policies alone would yield the result that agricultural importables, i.e., food crops, experience policy-induced subsidies. When the impacts of indirect agricultural policies are also taken into account, however, this subsidization is overcompensated, and an average total nominal protection of -6 percent can be observed. Total NRPs are negative in 10 out of 16 countries.

We can summarize that indirect agricultural policies are in most countries more important than direct agricultural policies for overall incentives in agriculture.¹ They tend to increase taxation of agricultural exportables in LDCs and tend to reverse subsidization due to direct agricultural policy for importables into a net taxation.

d. The Widespread Existence of Food Subsidization in LDCs

A stylized fact in the agricultural protection literature is that LDCs tend to subsidize food consumption [Byerlee, 1987]. This stylized fact is confirmed by cross-country analyses in which consumer prices of food are compared with "world prices". One of these studies is of Byerlee and

¹ The importance of economy-wide measures is also visible in a study on government intervention in agriculture of the six largest Latin American economies by Roberts and Trapido [1991].

Sain [1986], and some of its results are presented in Table 3. For 1980-1982, the authors argue that bread prices in wheat-importing countries should have amounted to about US\$0.75/kg, an estimate confirmed by consumer prices in Singapore and Panama where wheat was traded freely. The computed NRP suggest that a widespread policy of subsidizing bread consumption existed. The magnitude of subsidization was fairly important. Byerlee and Sain demonstrated that the average price was 22 percent below the world price, or 27 percent if exchange rate overvaluation is considered.

e. Does Agricultural Policy in LDCs Tax or Subsidize Food Production?

It has been shown that many LDCs favor food crops rather than export crops in their agricultural policies. Empirical evidence has proven, too, that important export crops are taxed in many LDCs compared with free-trade price levels. It is much less clear, however, whether agricultural policy subsidizes or taxes the production of food crops compared with world prices.

It is a stylized fact in the traditional literature on agricultural policies in LDCs that food production is taxed due to economic and agricultural policies [Brown, 1978; Lutz, Scandizzo, 1980; Schultz, 1978; Lutz, Saadat, 1988]. The urban population has been believed to be favored at the direct expense of the rural population. Again, Byerlee and Sain [1986] contributed to this issue by a cross-country analysis of wheat producer prices in 1980-1982. Based on the results contained in Column (1) of Table 4, Byerlee and Sain came up with the challenging result that producer prices for wheat in LDCs approached long-run trend prices in the world wheat market during 1980-1982 and showed no consistent evidence of price disincentives to wheat producers.¹ Unexpectedly, this basic result remains valid when exchange rate overvaluation is taken into account. Column (3) in Table 4 shows this with ad-

¹ The cross-country study of Mergos [1987] indicates a similar result for wheat, rice and maize in 1972 and 1978, but is one of the studies that relates directly farmgate and border prices without correcting for transport costs and exchange rate distortions.

Table 3 - NPCs for Bread Consumption in LDCs, 1980-1982 (a)

	NPC	Adjusted NPC
Colombia	2.01	1.68
Nigeria	1.46	0.80
Burma	1.41	2.40
Cameroon	1.38	1.21
Kenya	1.06	1.02
Chile	1.04	0.82
Nepal	0.97	1.20
Tanzania	0.95	0.66
Uruguay	0.87	0.63
Ecuador	0.86	0.69
Paraguay	0.78	0.61
Lesotho	0.77	0.61
Bangladesh	0.77	0.74
Peru	0.70	0.78
Bolivia	0.62	0.45
Pakistan	0.61	0.53
Sudan	0.60	0.22
India	0.54	0.76
Brazil	0.52	0.62
Mexico	0.41	0.34
Turkey	0.39	0.48
Jordan	0.38	0.22
Morocco	0.33	0.37
Afghanistan	0.31	na
Tunisia	0.30	0.38
Egypt	0.12	0.05

(a) NPCs are related here to consumer prices. Countries are ranked according to the unadjusted NPC. Adjusted NPCs take exchange rate misalignments into account. - na = not available.

Source: Byerlee, Sain [1986, Appendix].

justed NRPs. The findings of the Byerlee/Sain study are rather remarkable, since the authors' approach goes beyond several earlier quantitative studies in three respects:

- (1) NPCs are calculated at one point of the marketing chain. Transport costs are taken into account.
- (2) NPCs are not only computed with official exchange rates but also with corrected exchange rates that are supposed to incorporate exchange rate overvaluation in many LDCs.
- (3) NPCs are based on "normal" world prices. This is done in order to avoid a comparison of domestic prices with fluctuating world prices.

Table 4 - Estimated and Adjusted NPCs (a) for Wheat Producers in 31 Countries, 1980-1982: On the Sensitivity of the Byerlee/Sain Results

	NPC ₁	NPC ₂	aNPC ₁	aNPC ₂
	(1)	(2)	(3)	(4)
Nigeria	2.60	2.40	1.43	1.32
Sudan	2.37	2.19	0.90	0.83
Burma	2.05	1.89	3.49	3.22
Colombia	1.67	1.54	1.40	1.29
Jordan	1.66	1.53	0.98	0.90
Algeria	1.50	1.38	1.52	1.40
Brazil	1.35	1.25	1.67	1.54
Morocco	1.35	1.25	1.55	1.43
Ethiopia	1.32	1.22	1.05	0.97
Ecuador	1.24	1.14	0.99	0.91
Bolivia	1.21	1.12	0.88	0.81
Cameroon	1.19	1.10	1.05	0.97
Paraguay	1.08	1.00	0.85	0.78
Chile	1.07	0.99	0.85	0.78
China	1.06	0.98	1.25	1.15
Lesotho	1.02	0.94	0.81	0.75
Bangladesh	1.00	0.92	0.96	0.89
Syria	1.00	0.92	0.91	0.84
Argentina(b)	1.00	1.00	0.60	0.60
Kenya	0.89	0.82	0.86	0.79
Tunisia	0.84	0.77	1.06	0.98
Uruguay	0.80	0.74	0.59	0.54
Nepal	0.79	0.73	0.98	0.90
Mexico	0.76	0.70	0.66	0.61
Tanzania	0.73	0.67	0.50	0.46
Pakistan	0.71	0.66	0.62	0.57
Afghanistan	0.68	0.63	na	na
India	0.66	0.61	0.92	0.85
Turkey(b)	0.65	0.65	0.79	0.79
Peru	0.51	0.47	0.58	0.54
Egypt	0.41	0.38	0.19	0.18
Producers taxed (NPC < 0.85) (percent)	35	39	37	50
No significant taxation or subsidization (0.85 < NPC < 1.15) (percent)	26	32	40	27
Producers subsidized (NPC > 1.15) (percent)	39	29	23	23
All countries (percent)	100	100	100	100
Average NPC (percent)	1.13	1.05	1.03	0.95
Median (percent)	1.02	0.94	0.92	0.84

(a) On the definitions of NPC₁, NPC₂, aNPC₁, and aNPC₂, see Section B.II.1. -

(b) Net exporters; the calculation of Byerlee and Sain were not changed for these two countries as a different method for computing international prices was used there. - na = not available.

Source: Byerlee, Sain [1986, Table A1]; own computations.

The basic economic result of Byerlee and Sain has been challenged in the literature due to two reasons [Herrmann et al., 1991; Taylor, 1989]. First, the major result seems to be sensitive to the modelling approach. Second, the findings seem to be very period- and product-specific, and a comprehensive and well-founded protection analysis for food crops should extend the period as well as the product coverage. Concerning the first point, it can be put forward that the modelling of the normal world price affects the economic result. Byerlee and Sain compute their NPC, which we call NPC₁, as follows:

$$[56] \text{ NPC}_1 = p_1/p_w^*$$

Like in Equation [12] of the methodological survey, p_1 indicates the domestic producer price of wheat and p_w^* the normal world wheat price. The latter price variable is measured by a linear time trend regression of world prices over the period 1960-1982, and both prices are evaluated at the consumption point. The rationale for using a normal rather than the actual world price is that p_w^* is an indicator of expected world prices, whereas actual world prices include a stochastic component u :

$$[57] p_w = p_w^* + u$$

Hence, the approach of Byerlee and Sain can be interpreted as one which deals with price uncertainty, whereas the traditional approach does not. The issue to be raised here is: Does the method which is used to eliminate the stochastic component affect the economic results? In order to answer this question, a reduced-form econometric model of the world wheat market was developed. The estimated world wheat price from this econometric model (p_w^{**}) was introduced as a normal price into the calculation of the NPCs. The resulting NPC, which we call NPC₂, differs from the Byerlee/Sain approach by the way the normal world price is calculated:

$$[58] \text{ NPC}_2 = p_D/p_w^{**}$$

The econometric model is based on a stylized representation of import demand and export supply in the world wheat market.¹ The export supply function is

$$[59] X_t = a + b p_{wt} + c Y_{Xt} + d PR_{Xt} + e PR_{Xt-1} + f POP_{Xt}$$

and the import demand function

$$[60] M_t = g + h p_{wt} + i p_{Rt} + j Y_{Mt} + k PR_{Mt} + l PR_{Mt-1} + m POP_{Mt}$$

X is exports and M is imports of wheat. P_w stands for the world wheat price, p_R for the world rice price, PR for production of wheat, and POP for population. Y is an income variable. The subscript X indicates exporting and the subscript M importing countries. t and t-1 are the two periods considered. Actual and lagged production are taken into account, since a time lag between production and exports is realistic for many exporting countries. The hypotheses on the signs of the coefficients are: $b > 0$, $c < 0$, $d > 0$, $e > 0$, $f < 0$, $h < 0$, $i > 0$, $j > 0$, $k < 0$, $l < 0$, $m > 0$. In an equilibrium situation, exports are equal to imports:

$$[61] X_t = M_t$$

Introducing Equations [59] and [58] into Equation [61] yields the reduced form of the world wheat model:

$$[62] p_{wt} = (g-a)/(b-h) + i/(b-h) \cdot p_{Rt} + j/(b-h) \cdot Y_{Mt} \\ - c/(b-h) \cdot Y_{Xt} + k/(b-h) \cdot PR_{Mt} + l/(b-h) \cdot PR_{Mt-1} \\ - d/(b-h) \cdot PR_{Xt} - e/(b-h) \cdot PR_{Xt-1} + m/(b-h) \cdot POP_{Mt} \\ - f/(b-h) \cdot POP_{Xt}$$

Equation [62] was the starting point of the econometric model. In order to save degrees of freedom and to avoid multicollinearity problems, however, the production of the exporting and importing countries was ag-

¹ Detailed and much more disaggregated econometric models of the world wheat economy are available in the studies of Schiff [1985] and Harwood and Bailey [1990].

gregated. This seems acceptable, since it was not the goal of this analysis to identify the underlying supply and demand Equations [59] and [60]. It was also experimented with current and lagged income variables, and the income variables were constructed as weighted variables for the major countries.¹

The following regression model performed best in the specification search:

$$\begin{aligned}
 [63] \quad \ln p_{wt} = & 5.9305 & + & 0.3544* \ln p_{RT} & + & 0.0848 \ln Y_{Mt-1} \\
 & 1.32 & & 2.76 & & 1.20 \\
 & & & (0.38) & & (0.22) \\
 & + 0.8681** \ln Y_{Xt} & - & 0.8433* \ln PR_t & - & 0.9077** \ln PR_{t-1} \\
 & 5.07 & & -2.63 & & -3.07 \\
 & (1.17) & & (-0.42) & & (-0.45) \\
 & -0.2089 \ln POP_{Mt-1} & + & 0.7687* \ln POP_{Xt-1} \\
 & -0.72 & & 2.80 \\
 & (-0.14) & & (0.23) \\
 & (\bar{R}^2 = 0.96; DW = 1.63; F = 83.31)
 \end{aligned}$$

¹ The price of American Red Hardwinter 2, cif Rotterdam, in US\$/mt was used as p_{wt} . p_{RT} was measured as the price of American long corn rice, cif Northsea ports in US\$/mt. Both series are from the Statistischen Bundesamt [various issues]. Y_M is the weighted gross domestic product (GDP) of five major wheat-importing countries - China, India, Japan, UK, and Brazil - in million US dollars. The GDP is purchasing-power-parity-corrected and in current prices. As there were no GDP data available in current prices for China, the real GDP was taken from Summers and Heston [1988] and corrected by the Chinese national income deflator shown in IMF [1987]. The countries' shares in wheat imports were used as weights. Y_X is the weighted GDP of five major wheat-exporting countries - France, Canada, USA, Argentina, and Australia - in million US dollars. It is again purchasing-power-parity-corrected and in current prices. The countries' shares in wheat exports were used as weights. The data for the calculation of Y_M and Y_X are from Summers and Heston [1988], and the trade shares are calculated from FAO [e]. PR , the world production of wheat, is measured with data from FAO [c]. POP_M and POP_X are trade-weighted population variables calculated with population data from IMF [1987].

The values below the coefficients are t-values and the values in parentheses are beta coefficients. * indicates the 1 percent level of statistical significance and ** the 5 percent level. \bar{R}^2 is the corrected coefficient of determination, F the F-value and DW the Durbin/Watson coefficient. Given the common test statistics, the overall performance of the econometric model is quite good. 96 percent of the variation in the logarithm of world prices can be explained with the model and major hypotheses are confirmed. The world wheat price rises with an increasing world rice price, with a growing income in exporting countries, with a reduced world wheat production in the same year and in the previous year, and with a rising population in the exporting countries. The sign of the income variable Y_{ML-1} indicates also that the world wheat price is raised by a growing purchasing-power-parity-corrected GDP in major wheat-importing countries with a one-year time lag. The coefficient of the production variable can be interpreted as price flexibility. An increase of world wheat production by 1 percent reduces the world wheat price by 0.84 percent in the same period and by another 0.91 percent in the next period.

Moreover, a comparison of simulation errors indicates that the actual world wheat price can be much better explained with this model than with a linear trend model as used by Byerlee and Sain. The root mean square error over the estimation period 1960-1982 is 23.9 US\$/mt with the trend model and 6.9 US\$/mt with the econometric model. Theil's inequality coefficient (TU) shows with 1.20 that the time trend model performs worse than a naive simulation on the basis of previous years' values, whereas the econometric wheat model clearly outperforms the naive simulation (TU = 0.34). The antilog of $\ln p_w$ according to Equation [63] was now calculated for 1980-1982 and introduced into the denominator of NPC_2 . This allows to compare the NPCs of Byerlee and Sain with those on the basis of an econometric world wheat model.

Table 4 shows NPC_1 and NPC_2 for the 31 LDCs in Columns (1) and (2). The results are summarized in the lower part of Table 4 in Columns (1) and (2) for 1980-1982. It follows that, due to the better explanation of movements in world wheat prices, the normal price according to the structural model is closer to the actual world price than the linear trend price. P_w^{**} is 197.4 US\$/mt as opposed to p_w^* with 182.11 US\$/mt. This

means that NPC_2 is by 7.7 percent lower than NPC_1 for all countries. Table 4 shows that this makes a significant difference for the frequency distribution of the NPCs. Whereas more LDCs subsidized than taxed wheat production according to Byerlee and Sain, the reverse is true when world price uncertainty is eliminated with a different method. The median NPC is now 0.94 compared with 1.02, and it indicates that the typical LDC taxes wheat producers.

The result becomes even more pronounced when exchange rate misalignments are taken into account. The coefficients $aNPC_1$ and $aNPC_2$ in Columns (3) and (4) of Table 4 capture this point by an adjustment of NPC_1 and NPC_2 , respectively. The comparison of $aNPC_1$ and $aNPC_2$ shows that the median falls from 0.92 to 0.84. This means that the frequency distribution exhibits a clear shift towards countries which tax producers when price uncertainty is excluded with a structural economic model - rather than with a trend model. According to our modelling approach, the typical LDC clearly did tax wheat producers when exchange rate overvaluation is taken into account.

We can conclude on the sensitivity of the results of Byerlee and Sain: the way how normal world prices are modelled matters to the measured protection level. Put differently: the computed degree of agricultural protection depends upon the modelling of price uncertainty when normal rather than actual world prices are used.

Besides the importance of the modelling approach, another criticism of the Byerlee/Sain findings is that they are too period- and product-specific. A broader analysis of food price protection was provided by Taylor [1989] who extended the analysis from 1980-1982 to 1980-1986 and the product coverage by maize and rice. Additionally, the Taylor study is based on national border prices rather than a uniform unit value of imports, on actual rather than normal border prices and an exchange rate correction via black market exchange rates. Table 5 presents her major findings.

Taylor's results show that farmgate prices for wheat, maize and rice were clearly below border price equivalents when exchange rate distortions are taken into account. This pattern is valid for all subperiods distinguished in Table 5. Maize prices, were on average, above and rice

Table 5 - Cross-Country Results on Incentives for Food Production in LDCs, 1980-1986 (a)

	1980-1982	1982-1983	1984-1985
Wheat (31 countries)			
NPC			
Average	1.10	1.07	1.20
Standard deviation	0.32	0.43	0.52
Adjusted NPC			
Average	0.83	0.67	0.74
Standard deviation	0.30	0.29	0.37
Maize (36 countries)			
NPC			
Average	1.37	2.83(b)	1.30(c)
Standard deviation	1.72	7.93(b)	0.52(c)
Adjusted NPC			
Average	0.89	1.01(b)	0.93(c)
Standard deviation	0.51	0.82(b)	0.56(c)
Rice (23 countries)			
NPC			
Average	0.74	0.84	0.85(d)
Standard deviation	0.34	0.49	0.41(d)
Adjusted NPC			
Average	0.61	0.61	0.60
Standard deviation	0.33	0.34	0.16(d)
(a) On the definitions and measurement of the NPC and the adjusted NPC, see Taylor [1989, Chapter 3]. - (b) 1982-1984. - (c) 1985-1986. - (d) 1983-1985.			

Source: Taylor [1989, Tables 4.1 and 4.4].

prices below border price equivalents when unadjusted NPCs are measured. The average NPC for wheat ranged between 1.07 and 1.20. Given possible data errors, Taylor evaluated this as being neither higher nor lower than border price equivalents.

Given the still limited period covered and the differential results in the empirical literature, we must conclude that the evidence on price incentives for food crops in LDCs is still inconclusive. In particular, this holds true on a broad cross-country basis using more comprehensive time series data.

f. On the Stabilizing Influence of Agricultural Policy in LDCs

The presented empirical evidence has substantiated the view that economic and agricultural policies in LDCs tend to discriminate against agriculture. This refers to the influence of policies on the level of agricultural prices. There is, however, some evidence available indicating that agricultural policy might have stabilized real producer prices and, thus, might have created some risk benefits for farmers. Table 6 presents some empirical results from the World Bank's project on "The Political Economy of Agricultural Pricing Policy" on this issue. It is revealed that, on average, producer price fluctuations were smaller than border price fluctuations. This result is valid for representative agricultural exportables as well as agricultural importables. It suggests that

Table 6 - Ratio of Standard Deviations of Deflated Producer and Border Prices, 1960-1984 (a)

	Exports		Imports	
	crop	ratio	crop	ratio
Argentina	Wheat	0.37	None	
Brazil	Soybeans	0.80	Wheat	0.41
Chile	Grapes	0.94	Wheat	0.73
Colombia	Coffee	0.87	Wheat	0.93
Dominican Republic	Coffee	0.84	Rice	0.66
Egypt	Cotton	0.42	Wheat	0.30
Iory Coast	Cocoa	0.42	Rice	1.20
Malaysia	Rubber	1.02	Rice	0.47
Morocco	None		Wheat	0.63
Pakistan	Cotton	0.62	Wheat	0.17
Philippines	Copra	0.94	Corn	0.27
Portugal	Tomatoes	1.13	Wheat	1.00
South Korea	None		Rice	1.58
Sri Lanka	Rubber	0.44	Rice	0.65
Thailand	Rice	0.26	None	
Turkey	Tobacco	1.16	Wheat	0.56
Zambia	Tobacco	0.83	Corn	0.75
Average		0.73		0.69

(a) The border price was measured at the official exchange rate. The deflator was the price index of the nonagricultural sector.

Source: Krueger et al. [1988, Table 3].

a price-stabilizing impact of most policies existed in the period 1960-1984.

Table 6 also indicates, however, that there is a large dispersion in the stabilization success of domestic agricultural policies. This as well as the dominating stabilizing impact is confirmed in recent studies by Knudsen and Nash [1990] and Guillaumont [1991]. Knudsen and Nash provide empirical results for 15 crops across 37 LDCs, mostly for the period 1967-1981, and find out that producer prices and producer earnings were in most cases more stable than under world market conditions. This pattern, however, is much more distinct for grains than for beverages and fibers. The percentage of cases with stabilizing effects were clearly higher for the typical food crops than for the typical export crops. Guillaumont presents additional evidence on the degree of stabilization of real producer prices for export crops in the period 1979-1988. He concludes that there was a slight stabilization impact, by 7 percent, on average, although destabilizing existed in several cases.

g. On the Isolating and Stabilizing Influence of Limited Substitution in Agricultural Markets

All studies on protection discussed so far used world market prices - however measured - as the relevant reference prices against which to judge domestic price policy. However, few countries look at the prevailing world prices when setting their domestic prices for agricultural goods. Instead, farm and consumer prices are administered and restrictions are placed on international trade to defend the domestic policies [Timmer, 1986]. As a result of trade restrictions, the relevant free-trade reference prices are unknown. Substitutions in both production and consumption in the face of foreign competition will bring a new equilibrium in farm output, consumption and trade, which is not easily predictable on the basis of historical evidence before trade was openly permitted.

Moreover, a large country's new agricultural policy may have a significant effect on prices in world markets which have to be recognized when estimating the protective effects of the former policy. A different

result is also obtained, if imported and domestically produced agricultural commodities cannot be regarded as close substitutes because of consumer preferences. If the cross price elasticity of domestically produced agricultural products with respect to changes in the price of imported products is relatively low, trade liberalization and the accompanying changes in the domestic price of imports will induce quantity adjustments in the market for the domestic product which are not sufficiently large to induce an equal percentage change in the domestic price. This also implies that the protective effect [Hiemenz, von Rabenau, 1973, p. 83] and, consequently, the welfare effects are overestimated if import parity prices are used to evaluate agricultural policy.

There is enough empirical evidence to reject the assumption of homogeneous agricultural markets found in standard welfare analyses of agricultural markets. In fact, two-way trade in any sector, which is ruled out by the "law of one price", can be found in agricultural trade statistics at the most disaggregated commodity level [e.g., FAO, e; IRR, 1988]. Furthermore, empirical evidence from Asia [e.g., ADB, 1988] shows that there exists a wide spectrum of domestic prices indicating limited substitution possibilities between different varieties, even for such a narrowly defined market as that for rice. Finally, the law of one price was rejected quite uniformly for various agricultural markets in a recent study by Ardeni [1989].

In the following, we will first show how limited substitution can be introduced into a model of an agricultural market and then discuss how this influences the protection, welfare and stabilizing outcome of government-imposed interventions. We shall discuss these issues more specifically with reference to rice in Malaysia. Limited substitution implies that domestic consumers demand a composite commodity, C , which is a function of imported quantities, M , and domestically produced quantities, D :

$$\{64\} C = C(M, D)$$

Since total expenditure on the composite commodity must equal expenditure on its imported and domestic components, we have the following budget constraint:

$$[65] \quad p \cdot C = p_M \cdot M + p_D \cdot D$$

where p , p_M and p_D stand for the composite commodity price, the import price and the price for the domestic import substitute, respectively.

Assuming that consumers minimize the cost of purchasing a given amount of the composite good, the demand for imported and domestic rice will be functions of both the domestic price and the import price. The supply, S , of domestic rice will be a function of its own price:

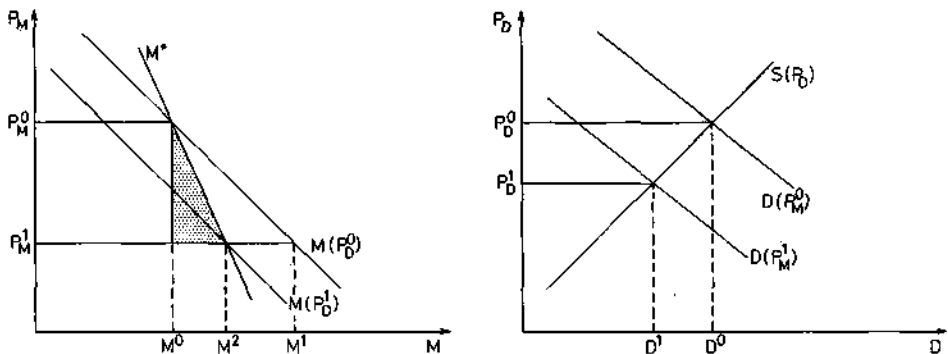
$$[66] \quad M = M(p_M, p_D)$$

$$D = D(p_D, p_M)$$

$$S = S(p_D)$$

Now consider two varieties of rice that are substitutes in demand. The supply of imported rice is perfectly elastic under the small-country assumption, while the supply of domestic rice is upward sloping. As a result of government-imposed distortions, the domestic prices of both varieties are above the border price, and the welfare gains of free trade are to be calculated. The situation is depicted in Figure 6. The demand curves for imported and domestic rice are each conditional on the other's price, i.e., $M(p_D)$ and $D(p_M)$. The demands are also conditional on income, but this income is assumed to be constant with respect to the policy change considered.

Figure 6 - Welfare Effects of Liberalization



Now let the price for M decrease from p_M^0 to p_M^1 as a result of liberalization. Initially, consumers attempt to increase M from M^0 to M^1 , but because of substitution in demand the lower price for M causes a decrease in consumers' demand for D. This shift in demand for D from $D(p_M^0)$ to $D(p_M^1)$ causes a change in p_D from p_D^0 to p_D^1 which, in turn, leads to a shift in demand for M from $M(p_D^0)$ to $M(p_D^1)$. The new equilibrium finally occurs at price p_M^1 and quantity M^2 .

Thus, the demand relationship M^* , which takes account of adjustments in the market for domestic rice, is obtained and this relationship is less elastic than the movement along $M(p_D^0)$.

The total welfare gain generated by liberalization is the shaded triangle under M^* . As shown by Just et al. [1982, pp. 188-192], that triangle measures consumer gains in the import market net of the loss of government revenues as well as the gains to consumers and losses to producers in the market for the domestic substitute.

What, then, determines the price adjustment in the domestic market? Assuming a constant-elasticity-of-substitution (CES) function for Equation [62], de Melo and Robinson [1985] derive an expression which relates percentage changes in the domestic price (\dot{p}_D) to percentage changes in the domestic price for imports (\dot{p}_M):

$$[67] \quad \dot{p}_D = \frac{(\sigma - \delta) \cdot \theta}{\epsilon + \delta + (\sigma - \delta) \cdot \theta} \cdot \dot{p}_M$$

where σ is the elasticity of substitution between imports and domestically produced substitutes, δ the price elasticity of demand for the composite commodity, θ the import share, and ϵ the price elasticity of domestic supply.

As can be seen from Equation [67], the price adjustment in the market for domestic rice depends crucially on the elasticity of substitution. Thus, the higher the elasticity of substitution, the larger the price adjustment of domestic supply.

Furthermore, it can be seen from Equation [67] that for any elasticity of substitution the responsiveness of the domestic price depends on the import share. Thus, even if imported and domestic rice are close substitutes in demand, the response of the domestic price to a change in the import price will be small if the import share is low.

Finally, the derived nature of demand for domestic rice is shown by the presence of the supply elasticity in Equation [67]. Thus, the higher the elasticity of supply, the smaller the adjustment in the domestic price necessary to bring equilibrium back to the market. The same can be said of the role of the price elasticity of demand for the composite good.

These theoretical considerations are reflected in Table 7 which summarizes the results from a sensitivity analysis on Malaysian rice policy. The methodology involved the systematic elimination of distortions from existing price levels to obtain a picture on prices, supply and demand under a nonintervention scenario. In order to do this, the theoretical model above was calibrated for prices and quantities on the rice market for the period 1982-1986 given in Tamin and Meyanathan [1988] and solved for the no-intervention prices and quantities. The supply, demand and substitution elasticities, as reported in Tamin and Meyanathan [ibid.] and Ahluwalia and Lysy [1983], were used as a central estimate. However, because elasticity estimates differ widely from researcher to researcher and because we wished to demonstrate the sensitivity of the results to changes in elasticities, the supply, demand and substitution elasticities actually used are the central estimate ± 0.5 times the point elasticities given by the sources. Thus, the results are providing orders of magnitude rather than exact measures. The detailed results for 1982-1986 are presented in Herrmann et al. [1991]. Table 7 shows averages over 1982-1986. The effects of rice market interventions are evaluated in terms of nominal protection afforded, net social efficiency loss, the welfare trade-off between producers and consumers, and changes in government revenue and expenditures.

If imported and domestically produced rice are perfect substitutes, the welfare trade-off depends on the price elasticities of supply and demand and the difference between the intervention prices and the border price. Between 1982 and 1986, the domestic consumer and producer prices in Malaysia have always been above the border price with nominal protection being slightly higher for producers than for consumers. With perfect substitutability apparent protection equals actual protection, because arbitrage quickly equates goods prices internationally under free trade. Assuming low supply and demand elasticities, producer gains from intervention are estimated to average M\$508.5 million and government expenditures are M\$145.5 million. However, consumers suffered

an average loss of M\$383.2 million due to government intervention. Thus, the average net social welfare loss (i.e., the deadweight efficiency loss) amounted to M\$20.2 million. Comparing these results with those of the high elasticity case shows that the losses depend linearly on the assumed supply and demand elasticities.

If imported and domestically produced rice is not perfectly substitutable in consumption, the no-intervention outcomes change drastically. As a result of product differentiation in demand, the fall in domestic prices will be smaller than in the case of perfect substitutability and will never equal border prices. As can be seen from Table 7, domestic consumer and producer prices in the free-trade situation are always above the border price with consumer prices being a consumption-share-weighted average of the border and producer prices. Actual protection coefficients relating the initial domestic prices to the free-trade domestic prices are less than the apparent protection coefficients relating domestic prices to border prices. As a result, the welfare effects are much lower than in the case of perfect substitutability.

This is best illustrated by comparing the previous results with those calculated under the assumption of weak substitutability and high supply and demand elasticities. In this case, producers realize an average welfare gain of only M\$123.8 million, which is only one-fourth of producers' surplus estimated under the assumption of perfect substitutability. This result is intuitively clear, because domestic producers would benefit from some kind of "natural protection" with weak substitutability, even in a free-trade situation. Furthermore, consumers suffer an average loss of M\$168.6 million which is below 50 percent of the previous case. These consumer losses are mainly attributable to the implicit tax on imports. As a result, government expenditure for producer subsidies are less, on average, than revenues from implicit taxes on imports leaving net government revenues of M\$37.3 million as compared to net expenditures of M\$145.5 million with perfect substitutability. Thus, the average deadweight losses amount to only M\$7.5 million.

Our results indicate that limited substitution possibilities can play an important role in determining the final welfare effects of government intervention in the Malaysian rice market. Assuming stronger substitutability ($\sigma = 4.5$) changes only the quantitative results leaving the

qualitative conclusions from the comparison of the two extreme cases unaffected. In any case, limited substitution drives a wedge between domestic prices and border prices, the extent of which depends on the degree of substitutability on the consumer side, the share of imports in total domestic supply and the supply and demand conditions in the domestic market.

Some other observations which can be made are summarized in Table 8. There, the mean and the coefficient of variation (CV) of selected variables over 1982-1986 in the free-trade situation and for various elasticity assumptions are confronted with those in the distorted situation. The results can be summarized as follows:

- (1) In terms of magnitude, the supply mean is raised (though not substantially) with intervention, while demand is reduced compared to intervention. Imports, on the other hand, were in fact reduced over the period.
- (2) The changes in quantities increase with increasing substitutability and increasing supply and demand elasticities. The same holds true for producer and consumer prices. Thus, limited substitutability diminishes the need to support producer prices in order to increase producer income.
- (3) Limited substitution in connection with high supply and demand elasticities has a stabilizing effect on both producer and consumer prices. This result also suggests that there is less need for intervention if substitution possibilities are limited.

Although the above welfare calculations are not based on an econometric estimation of the substitution elasticity for rice in Malaysia, they provide nevertheless useful insights into the impact of agricultural pricing policies. Perhaps the most important result that emerges from our findings is the importance of the import share in determining domestic price changes. Standard trade theory would predict that, even for a large market such as the rice market in Asian countries, price liberalization would exert strong pressure on domestic prices. On the contrary, the Armington specification implies that a large market with a low import share has substantial price autonomy. From the government point of view, another interesting result is the fact that expenditures to support the guaranteed minimum price (GMP) would need to be much lower than is predicted under traditional assumptions.

Table 8 - Means and CVs with and without Intervention in Malaysia, 1982-1986 (a)

	With inter- vention		Without intervention					
			perfect sub- stitutability		strong sub- stitutability		weak sub- stitutability	
	mean	CV (per- cent)	mean	CV (per- cent)	mean	CV (per- cent)	mean	CV (per- cent)
Low supply and demand elasticities								
Production	1135	5.97	1088	6.51	1098	6.40	1109	6.28
Consumption	1504	7.23	1566	6.96	1557	7.10	1546	7.20
Imports	370	22.62	478	19.24	459	20.45	437	21.59
Border price			662	15.65	662	15.65	662	15.65
Consumer price	913	0.28	662	15.65	700	12.74	746	9.73
Producer price	1123	1.78	662	15.65	753	11.18	865	7.53
High supply and demand elasticities								
Production	1135	5.97	996	8.14	1057	7.08	1100	6.45
Consumption	1504	7.23	1689	7.49	1628	7.68	1585	7.58
Imports	370	22.62	693	20.05	571	22.48	485	23.36
Border price			662	15.65	662	15.65	662	15.65
Consumer price	913	0.28	662	15.65	746	9.73	804	6.27
Producer price	1123	1.78	662	15.65	865	7.53	1007	3.84
(a) Production, consumption and imports in 1000t. Prices in M\$/t. CV is the coefficient of variation. It is equal to the standard deviation of the respective variable divided by the mean of the variable, times 100. Mean is the arithmetic mean.								

Source: Herrmann et al. [1991].

The question remains whether the assumption of product differentiation at the micro level is reasonable. There may be disagreement on the correct specification of the substitution elasticity, but one certainly does not observe the degree of substitutability found in standard trade theory.

2. Deficiencies in the Empirical Literature and the Additional Benefit of the Following Quantitative Analysis

The survey has shown that our knowledge on the international pattern of agricultural protection has significantly developed further during the 1980s. In particular, many more country studies have become available in which the extent, the structure and the causes of agricultural protection have been measured and analyzed in detail. Important findings of country studies include that macroeconomic and trade policies are often more important than direct agricultural policies for agricultural incentives in LDCs. The results of country studies indicate in most cases that overall incentives work against agriculture and that policy discriminates against agriculture. Despite these important findings, the quantitative literature on agricultural incentives in LDCs is in some important aspects insufficient:

- (1) The information on agricultural protection at the commodity level is much more limited than at the country level. Country studies refer to those commodities that are relevant from the individual countries' points of view. Comprehensive cross-country comparisons of price protection for important export and food crops are much more rare. The study of Byerlee and Sain [1986] is limited to the period 1980-1982 and the wheat sector, and the results of Taylor [1989] refer to 1980-1986 and wheat, maize and rice. Similar cross-country results for important export crops are not available at all.
- (2) Within the given literature on agricultural protection, the discussion has focused on the level of agricultural protection. There exists no analysis of the longer run time series pattern of agricultural protection, i.e., of trends and instabilities in agricultural protection.
- (3) Most country studies on agricultural protection still focus on protection vis-à-vis foreign competitors neglecting policy-induced distortions in the domestic terms of trade between individual agricultural commodities and nonagriculture. This holds also true for protection analyses on Peru and Zimbabwe. For Malaysia, Jenkins and Lai [1989] investigate the relative protection afforded to producers of rubber, palm oil and rice, but neglect another promising cash crop, i.e., cocoa. Moreover, the analysis does not

include the periods of structural adjustment (1985-1986) and recovery (1987-1988).

- (4) Existing analyses of indirect agricultural protection do not differentiate between indirect protection which is attributable to trade policies on nonagricultural tradables and indirect protection resulting from macroeconomic policies. Such a differentiation, however, is necessary when it comes to policy recommendations. The recommendations for policy reform may be quite different depending on the source of agricultural discrimination.

The empirical analysis in the following parts will deal with these significant shortcomings of the quantitative literature on agricultural protection. To begin with, a rather comprehensive data basis on commodity-specific protection levels will be presented for wheat, rice and coffee. Comprehensiveness will be attempted in terms of the countries covered and the period of analysis: 1969-1985. In computing the protection levels, transport costs will explicitly be considered as well as exchange rate distortions. The magnitude, the development and the instability of protection levels will be measured, and the components of the instability of protection rates will be elaborated for the three major food and export crops of LDCs. This information will then be used to draw conclusions on various policy-relevant issues like the relative importance of direct and indirect agricultural policies for agricultural incentives, its developments over time, relative incentives for coffee compared with wheat and rice, or the policy impacts on price stability.

Next, we analyze the effects of trade restrictions and macroeconomic policies on the agricultural sector in Malaysia, Peru and Zimbabwe. In a first step, true protection resulting from agricultural pricing policies and nonagricultural pricing policies are measured and contrasted with nominal protection. This analysis covers the most important export crops in the three countries. Following is an in-depth analysis of indirect protection in Malaysia. Here, the focus is on different sources of indirect protection. Finally, the results on indirect protection are compared with those on other countries and the question whether food crops are subsidized and cash crops are taxed is discussed on a broad commodity basis.

C. Magnitude and Structure of Protection

I. Introduction

The literature survey in the previous chapter revealed that a number of country studies on protective measures in the agricultural sector are available, whereas comprehensive cross-country analyses for specific goods are still lacking. In this part of the present study, it is the objective to provide a contribution to fill this gap by establishing a broad data set on an individual commodity basis. We examine the extent of protection, the change in protection over time and its variation across a wide range of countries for three important agricultural commodities, namely wheat, rice and coffee.

The chapter is organized as follows: Section C.II introduces the measurement concept applied in our analysis and describes the data base used in the calculations. After this, the quantitative results for all three crops will be presented and interpreted. In the cases of wheat (see Section C.III.1) and rice (see Section C.III.2), the samples comprise DCs as well as LDCs. This enables us to investigate in how far the conclusion drawn in Section B.III that DCs generally protect their agricultural sectors as opposed to LDCs is also valid for specific agricultural commodities. Furthermore, we make a distinction between net importers and net exporters, because one would expect government authorities to behave differently in either case, emphasizing self-sufficiency goals in the first and tax revenues or the maintenance of world market shares in the second situation. With respect to coffee (see Section C.III.3), however, the sample does only consist of LDCs for which coffee is a major cash crop. In Section C.IV, the instability of protection and its possible causes, domestic or border price fluctuations, are examined. The main goal of this analysis is to elaborate whether producer prices are successfully stabilized in the presence of volatile world market prices. Finally, Section C.V contains a comparison of the results obtained for the individual commodities. We address the question there whether government authorities treat food crops (in this case wheat and rice) more favorably than export crops (in this case coffee), as is often suggested in the literature [e.g., Krueger et al., 1988] but which has not yet

been demonstrated for specific commodities by broad cross-country analyses.

II. Data and Procedures

In the following, the NPC serves as a measure of agricultural price policies with two alternatives to be considered.

First, the gross NPC is calculated as the ratio between domestic prices and border prices, the latter being regarded as the opportunity costs facing domestic producers (see Section B.II.1). Data for producer prices of various agricultural commodities are available from FAO statistics on prices that farmers received [FAO, d]. They were converted into US dollars at the prevailing official exchange rate. For the calculation of border prices, we distinguish between net-exporting and net-importing countries. The appropriate price for the former is measured fob at the local port. In the latter case, cif prices are used. The respective data are obtained as unit values from FAO [e]. For two wheat importers (South Africa, Poland) the reported data were fob for both imports and exports. In these cases the import values were converted into cif using a standard conversion factor of 112 percent [ibid.]. With respect to rice and coffee, produced and traded quantities are not directly comparable. Since rice production is reported in paddy units and rice trade in milled rice units, the former was transformed into milled rice units by applying the standard conversion factor 0.65 (1 paddy unit $\hat{=}$ 0.65 rice units). Border prices for coffee refer to green or roasted coffee and coffee substitutes containing coffee, whereas prices received by farmers relate to green coffee. As coffee is mainly exported in the form of green coffee,¹ border prices as reported by the FAO are determined to a high degree by green coffee exports. Therefore, the bias between the two reference quantities is rather small and can be neglected.

¹ The term "green coffee" is a synonym for "raw coffee" and is commonly used by coffee traders for beans which are only prepared for storage and transport. In 1980/81, about 90 percent of all coffee exports were unprocessed. In earlier years, this share was even larger [International Coffee Organization, various issues].

Since producer prices and border prices should be brought to a single marketing point in order to be comparable (see Section B.II.1), we, first, carried out an adjustment for internal transportation costs between the farm gate and the local port to obtain export and import parity prices, respectively.¹ The transport margins are taken for some countries from Taylor [1989]. For all other countries of our sample, information about major production regions for the respective commodities is taken from the World Atlas Agricultural Committee [1973], and internal transportation costs are computed along the lines suggested by Taylor [1989].

Second, a factor correcting for exchange rate distortions was included to account for indirect effects resulting from general economic policies like commercial, exchange rate, monetary, and financial policies. Currency overvaluations are widespread in LDCs, because governments have often failed to adjust exchange rates when expansionary monetary policies have produced higher inflation at home than abroad. Such a policy implicitly results in import subsidization of food or taxation of agricultural export commodities, i.e., agriculture is discriminated against. Hence, using the official exchange rate to convert domestic producer prices into US dollars may lead to severe overestimations of the protection level. More realistic NPCs adjusted for exchange rate distortions (net NPCs) were calculated by multiplying the unadjusted protection coefficient by the ratio of the published black market rate [Cowitt, 1986; Pick, 1978] to the official exchange rate [IMF, 1990], both expressed in US dollars per home currency.² We posit that the black market exchange rate is an acceptable estimate of the unobservable free-market price for foreign exchange, although black market rates certainly include a risk premium given the illegality of transactions on those markets.

In order to assess the variability of NPCs and to quantify in how far this variability was due to instabilities in domestic and world market prices, respectively, we finally conducted a variance decomposition of

¹ Taylor [1989, p. 32] provides a detailed description of the calculation of internal transportation costs.

² This method of considering exchange rate distortions is discussed in Section B.II.1.

the protection coefficient for each single country.¹ In a second step, we also decomposed the variance of the domestic prices in US dollars into price and exchange rate components to answer the question whether government authorities achieved the goal of stabilizing agricultural producer prices in home currency.

The variance decomposition procedure can formally be derived as follows: since the NPC is defined as the domestic price ($P_i^{\$}$) divided by the border price (P_w), $\log NPC$ equals the difference between $\log P_i^{\$}$ and $\log P_w$. For the variance of this difference holds the following equation [e.g., Mood et al., 1974, p. 179]:

$$[68] \quad \text{Var}(\log NPC) = \text{Var}(\log P_i^{\$} - \log P_w) = \text{Var}(\log P_i^{\$}) \\ + \text{Var}(\log P_w) - 2 \cdot \text{Cov}(\log P_i^{\$}, \log P_w)$$

According to Equation [68], instabilities in the protection levels either reflect movements in domestic dollar prices or in world market prices. Moreover, the joint effect of both components as measured by the covariance term does affect the variance of the protection coefficient. A positive covariance indicates that both prices move in the same direction and - since we analyze a quotient - offset each other, thereby lowering the variability of the NPC compared to a situation in which domestic and world market prices would vary independently.

Alternatively, the equation may also be formulated for variations of the variables around loglinear trends. In order to decide which of both versions is appropriate in a special application, one has to test initially whether the trend function of the variables in use is significant. In almost all cases, at least two out of three time series showed significant trend functions. We then calculated standard deviations from a loglinear trend. In particular, this holds true for prices and exchange rates. There were only a few exceptions in which standard deviations from the mean had to be calculated.

¹ This method was previously used, e.g., for isolating the contributions of price and quantity effects to revenue instabilities in the agricultural sector [Murray, 1978/79; Herrmann, Schmitz, 1984].

From Equation [68], the percentage contributions of instabilities in domestic and world market prices to variations in NPCs can easily be derived as

$$[69] \quad CP_i^{\$} = 100 \cdot \text{Var}(\log P_i^{\$}) / \text{Var}(\log \text{NPC}),$$

$$[70] \quad CP_w = 100 \cdot \text{Var}(\log P_w) / \text{Var}(\log \text{NPC})$$

and

$$[71] \quad CP_i^{\$} P_w = 100 \cdot 2 \cdot \text{Cov}(\log P_i^{\$}, \log P_w) / \text{Var}(\log \text{NPC}).$$

$CP_i^{\$}$ denotes the contribution of domestic price movements to protection instabilities, CP_w the respective contribution of world price fluctuations and $CP_i^{\$} P_w$ the joint effect of both prices.

The variance decomposition of the domestic price follows the same principle. Since the dollar price ($P_i^{\$}$) equals the price in home currency (P_i) multiplied by the exchange rate in US dollars per domestic currency unit (E), it follows that

$$[72] \quad \text{Var}(\log P_i^{\$}) = \text{Var}(\log P_i + \log E) = \\ \text{Var}(\log P_i) + \text{Var}(\log E) + 2 \cdot \text{Cov}(\log P_i, \log E).$$

Hence, exchange rate fluctuations or price changes in home currency may be the reason for dollar price variations. The covariance term, which now refers to a product, has to be interpreted differently from Equation [68]: a positive (negative) sign indicates that price and exchange rate movements intensify (neutralize) each other in their effect on dollar prices. The respective percentage shares in the variance of $\log P_i^{\$}$ are

$$[73] \quad CP_i = 100 \cdot \text{Var}(\log P_i) / \text{Var}(\log P_i^{\$}),$$

$$[74] \quad CE = 100 \cdot \text{Var}(\log E) / \text{Var}(\log P_i^{\$})$$

and

$$[75] \quad CP_i E = 100 \cdot 2 \cdot \text{Cov}(\log P_i, \log E) / \text{Var}(\log P_i^{\$})$$

where CP_i is the contribution of price changes in home currency to dollar price instabilities, CE the contribution of the exchange rate component and CP_iE the joint effect of both exchange rates and home prices.

The instability analysis enables us to assess in how far producer prices for wheat, rice and coffee are successfully stabilized by comparing the variations of world market prices and domestic prices in home currency. A successful stabilization requires that

$$[76] \text{Var}(\log P_i) < \text{Var}(\log P_w).$$

The greater the difference between $\text{Var}(\log P_w)$ and $\text{Var}(\log P_i)$, the more producer prices in home currency are stabilized.

III. Estimates of the Nominal Rates of Agricultural Protection

1. Survey of Protection Levels for Wheat

Wheat is the major traded food grain in the world. The world wheat market is dominated by four exporters: Australia, Canada, France, and the USA. Argentina is the only other country which has a considerable, regular wheat export trade. On the other hand, China and the former USSR have been the world's largest producers and importers of wheat, apart from the old established importers Japan and the UK. Furthermore, LDCs have become importers on a steadily increasing scale, particularly in Asian market economies, North Africa and the Middle East [Josling, 1980, p. 15; Harwood, Bailey, 1990, p. 11].¹ Wheat has become the most important agricultural product concerning world food security. The ability of the world to feed its growing population rests heavily on the production and the international trade flows of wheat. Hence, conditions in the wheat market are the most significant single determinant of world food security [Josling, 1980, p. 15]. Having this importance of wheat as foodgrain in mind, one would expect that domestic policies at least in

¹ Byerlee [1987, pp. 307-328], investigated the political economy of increasing wheat imports by LDCs.

import-dependent countries tend to favor wheat producers rather than to discriminate against them in order to improve self-sufficiency.

The structure of protection in the world wheat sector is now analyzed by means of NPCs which are calculated for the period 1969-1985. The sample of wheat-producing countries is divided into net importers and net exporters, since it can be expected that price policies are different depending upon the self-sufficiency ratio in each country (see Section C.1). With these countries, 57 percent of the world wheat production is captured, on average, during the period considered. The sample covers 20 net importers (including 6 typical poorer LDCs, 10 richer LDCs and 4 DCs) and 12 net exporters (including 5 richer LDCs and 7 DCs). The classification of countries resulted from the dominating trade status in the years under consideration. The NPCs for individual years, however, were calculated according to the trade situation in the respective year. A detailed list of NPCs for all countries is presented in Tables A2 and A3.

Table 9 gives an overall impression of the distribution of alternative NPCs for wheat producers across countries and over time. In Column (1), traditionally measured coefficients are shown. Over the whole period and across the total sample of wheat-producing countries, gross NPCs are clearly above unity, thus indicating that wheat producers do not face direct price discrimination in the long run. Hence, the wheat sector is protected by direct agricultural price policies worldwide, which may be explained by the particular role of this product as a staple food.

In individual years, however, protection coefficients diverge from the average values depending upon the movement of border prices and the degree of price transmission in each country. Particularly, this became obvious during the world food crisis in 1974/75, when world market prices for cereals more than doubled because of a worldwide supply shortage and a boom in world demand. In these two years, NPCs differed significantly from those in other years and were below unity in most country groups except in importing DCs. This suggests a widespread strategy of insulating domestic markets from world market conditions.

Moreover, the difference between the average coefficients for the total period as opposed to the two years of the food crisis are a rough indicator of how world prices are transmitted into domestic markets. The

Table 9 - Gross and Net NPCs for Wheat Producers, 1969-1985

	Measures of protection(a)	
	gross NPC	net NPC(b)
	(1)	(2)
All countries		
1969-1985	1.23	0.98
1974-1975	0.86	0.72
LDCs		
1969-1985	1.14	0.82
1974-1975	0.79	0.61
DCs		
1969-1985	1.41	1.39
1974-1975	1.00	0.99
Net importers		
1969-1985	1.27	0.93
1974-1975	0.89	0.71
Poorer LDCs(c)		
1969-1985	1.17	0.78
1974-1975	0.86	0.62
Richer LDCs(d)		
1969-1985	1.27	0.86
1974-1975	0.86	0.68
DCs(e)		
1969-1985	1.44	1.43
1974-1975	1.02	1.00
Net exporters		
1969-1985	1.17	1.09
1974-1975	0.80	0.74
Richer LDCs(f)		
1969-1985	0.91	0.79
1974-1975	0.59	0.50
DCs(g)		
1969-1985	1.40	1.40
1974-1975	0.99	0.98
<p>(a) Aggregated by the unweighted geometric mean. - (b) Adjusted for exchange rate distortions. - (c) Egypt, Kenya, Morocco, Nigeria, Tanzania, India, Pakistan (GDP per capita 1980 < US\$1,200). - (d) Brazil, Chile, Mexico, Algeria, Tunisia, South Korea, Syria, Yugoslavia, Poland. - (e) West Germany, Italy, UK, Japan. - (f) Argentina, Uruguay, South Africa, Turkey, Hungary. - (g) Australia, Canada, USA, France, Greece, Spain, Sweden.</p>		

Source: Own computations with data from World Bank [1982] and Tables A2 and A3.

greater the reduction of NPCs due to extremely high world market prices, the lower the price transmission is, and the higher the degree of

insulating domestic markets is. Regarding the various country groups, there is a remarkable distinction. While the difference between both periods is only 0.35 percentage points in LDCs, DCs show a much greater deviation from the average in 1974/75, notably a difference of 0.41 percentage points. Hence, in LDCs the degree of insulating domestic wheat production is greater than in DCs. This implies that not only the level of wheat subsidization is higher in DCs than in LDCs but also the degree of protecting domestic producer prices from world price variability.

Net-importing and net-exporting countries differ in the level of support. On average, net importers show higher protection coefficients than net exporters. This indicates that self-sufficiency might be a major objective of wheat pricing policies in net-importing countries. While high income exporting countries also clearly protect wheat producers, exporting LDCs even tend to discriminate against them. This suggests that wheat exports in these countries are often taxed in order to raise governmental revenues. Another important finding which can be derived from Column (1) is the fact that protection levels rise with economic development in importing as well as in exporting countries. While gross NPCs in DCs are clearly above the average levels of the two samples, importing and exporting LDCs exhibit lower values. That is, LDCs do not favor wheat production as much as DCs do.

One country stands out from the whole sample with an average unadjusted NPC of 3.40: Japan. This extremely high protection coefficient rests on the fact that agricultural imports into Japan are more restricted quantitatively and by means of import tariffs than in any other OECD country. With relatively poor endowments of arable land, Japan heavily relies on imports of foodstuffs. The self-sufficiency rate for wheat was only 10-12 percent in the early 1980s. Therefore, domestic farmers are highly protected from import competition in order to stimulate domestic food production [OECD, b, p. 18; Vincent, 1989, p. 173].¹

In Column (2) of Table 9, NPCs adjusted for exchange rate distortions are shown. These net NPCs were calculated by multiplying unadjusted coefficients by the ratio of the black market exchange rate to the

¹ For a detailed analysis of the background of agricultural protection in Japan, see Hayami [1988] and Australian Bureau of Agricultural and Resource Economics [1988].

official exchange rate in US dollars per home currency. Assuming that black market exchange rates represent the true demand price for foreign currency on free capital markets [Taylor, 1989, p. 39], the indirect impact of macroeconomic conditions on agriculture can be captured with this exchange rate adjustment.

Table A8 presents average exchange rate factors which measure exchange rate distortions. Most countries show factors lower than 1, implying that black market exchange rates are lower than official rates, thus indicating widespread policies of exchange rate overvaluation. In 16 out of 32 countries, factors range below 0.9 and in 8 countries, factors are even lower than 0.75. The 11 DCs of the sample present no distinct exchange rate distortions. Hence, overvalued exchange rates are typical for LDCs. Table 9 shows that the overall protection level decreases in importing as well as in exporting countries due to exchange rate distortions. In comparing country groups, one can recognize that the degree of exchange rate distortion varies considerably. While in all DCs the differences between gross and net NPCs are negligible, the protection level decreases from above to below unity in importing LDCs. Among the net exporters, LDCs show a significant reduction of the protection coefficient, too. It becomes clear that the wheat sector is heavily discriminated against in low-income countries when exchange rate overvaluation is taken into account. Hence, indirect macroeconomic policies affect agriculture seriously and often reduce production incentives for farmers. This is one reason why self-sufficiency particularly in African countries could not be improved substantially, although it is a major goal of producer price policy as it is indicated by the results of Column (1).¹

Summing up, the main results of Table 9 are the following. On the one hand, producer prices for wheat are by and large favorable not only in DCs but also in LDCs. The only exception is constituted by the net-exporting LDCs that tend to discriminate against wheat production directly. On the other hand, macroeconomic policies like overvalued ex-

¹ For a detailed description of the influence of macroeconomic policies on agriculture in general and of currency overvaluation on the performance of African agriculture in particular, see Valdés [1986, pp. 161-183] and Lofchie [1987, pp. 95-97]. An analysis of the political economy of rapidly increasing wheat imports into LDCs is provided by Byerlee [1987, pp. 307-328].

change rates have a major indirect impact on agriculture in LDCs causing unfavorable production conditions for wheat producers. Hence, these policies are responsible for a poor performance of the wheat sector in many low-income countries and for the high import dependence those countries are facing.

The results of our study confirm the findings of Byerlee and Sain [1986] and Taylor [1989] for a much longer period. The two earlier studies also analyzed gross and net nominal protection for wheat in LDCs (see Section B.III.1.e). Contrary to the traditional hypothesis that producers in LDCs are discriminated against by low farm prices for food crops, they also found out that wheat producers in LDCs, on average, did not face direct price discrimination in the early 1980s. Indirect taxation caused by exchange rate distortions, however, appeared to be widespread in LDCs and to offset direct protection often. One limitation at least of the Taylor study is the fact that general statements about the treatment of agriculture should not be based on short-run measurements of protection,¹ since extreme world market prices in single years produce protection coefficients which differ significantly from those in "normal" years. Our analysis presents evidence that direct price protection and indirect discrimination of wheat production in LDCs did not only occur in the 1980s but in most of the earlier years from 1969 on, too.

Moreover, the demonstrated importance of indirect as opposed to direct agricultural policies for the overall performance of agriculture in LDCs is in line with the findings of the World Bank's project on "The Political Economy of Agricultural Pricing Policy" (see Section B.III.1.c). Finally, our study provides the additional benefit that the pattern of agricultural protection in the world wheat sector can be analyzed, since typical LDCs as well as typical DCs are taken into account, and protection levels can be compared directly across countries and country groups as well as over time because of the uniform measurement of protection.

¹ Byerlee and Sain compared producer prices with a so called normal world market price which represented a long-run trend price calculated by a linear time trend regression of world prices over the period 1960-1982 [Byerlee, Sain, 1986] (see Section B.III.1.e).

2. Survey of Protection Levels for Rice

Rice is a very important commodity for human nutrition in the developing world, especially in Asia and West Africa. In some Asian countries (Bangladesh, Burma, Kampuchea, Laos, Thailand), the rice calory supply accounts for more than two third of the total calory supply [IRRI, 1988, p. 112]. Asia contributes about 90 percent to the world rice production, the most important producers being China (including Taiwan), India, Indonesia, and Bangladesh. Most of the rice is grown for domestic consumption, while only a small fraction of about 5 percent is sold in the world market, predominantly by China, Thailand, Pakistan, and the USA.¹ The direction of trade has changed during the period under consideration [USDA, 1986]: Asian countries like India, Indonesia and South Korea, which heavily relied on rice imports during the 1970s, became more or less self-sufficient in the early 1980s, whereas the African share in world rice imports increased significantly.

Against this background, price incentives in the rice sector are examined by means of gross and net NPCs. Protection coefficients for each individual country are presented in Tables A4 and A5. Table 10 provides a condensed survey of the level of protection across different country groups covering the time period 1969-1985. The whole sample consists of 29 rice producers including 5 DCs and 24 LDCs.² The average traditional NPC that reflects only direct price policies was slightly above unity for the total country sample, thus indicating a moderate overall price support in the world rice market. As one would expect, DCs were, on average, more protectionist than LDCs.

Significant deviations from the general pattern of protection occurred in two subperiods. First, between 1970 and 1972 depressed world market prices corresponded with above average NPCs. Second, NPCs were comparatively low during the commodity price boom in 1974 and 1975. Both peculiarities indicate that fluctuations in world prices are not entirely transmitted to the domestic market (see Section C. III. 1).

¹ Childs [1990] points out that the low trade flows are, among other things, a result of very restrictive policies like import bans in Japan and South Korea.

² Some socialist countries, which are important rice suppliers (China, Laos, Kampuchea, South Korea, Vietnam), are excluded from the sample due to a lack of data.

Table 10 - Gross and Net NPCs for Rice Producers, 1969-1985

	Measures of protection(a)	
	gross NPC	net NPC(b)
	(1)	(2)
All countries		
1969-1985	1.09	0.85
1970-1972	1.30	1.00
1974-1975	0.75	0.61
LDCs		
1969-1985	1.01	0.74
1970-1972	1.19	0.87
1974-1975	0.67	0.53
DCs		
1969-1985	1.60	1.59
1970-1972	2.01	1.99
1974-1975	1.46	1.45
Net importers		
1969-1985	1.12	0.87
Poorer LDCs(c)	0.99	0.73
Richer LDCs(d)	1.66	1.50
Asia	1.20	0.98
Africa	1.00	0.73
Net exporters		
1969-1985	1.04	0.83
LDCs(e)	0.73	0.48
DCs(f) (except Japan)	1.26	1.25
Japan	4.14	4.13

(a) Aggregated by the unweighted geometric mean. - (b) Adjusted for exchange rate distortions. - (c) Cameroon, Kenya, Ivory Coast, Madagascar, Nigeria, Senegal, Tanzania, Bangladesh, India, Indonesia, Philippines, Sri Lanka (GDP per capita 1980 < US\$1,200). - (d) South Korea, Malaysia, Mexico, Turkey. - (e) Egypt, Burma, Nepal, Pakistan, Thailand, Argentina, Colombia. - (f) USA, Australia, Italy, Spain.

Source: Own computations with data from World Bank [1982] and Tables A4 and A5.

With respect to the degree of price transmission, an interesting asymmetry between DCs and LDCs becomes evident: while the former showed larger deviations from the average in the period 1970-1972 than during the world food crisis, the opposite was true for the latter. That is, the DCs tended to insulate their domestic markets more effectively against declining world prices as compared to the LDCs, but let the rice farmers more likely gain from international price increases.

The disaggregation of the sample according to the trade status reveals that net rice importers as well as net rice exporters were slightly protected, on average. The different composition of each group, however, does not allow a direct comparison of the respective NPCs. All 17 net importers are LDCs, whereas the 12 net exporters are divided into 5 DCs and 7 LDCs (see footnotes in Table 10).

Among the net importers, protection levels vary strongly with different stages of economic development. On the one hand, newly industrialized economies like Malaysia and South Korea pay heavy subsidies for their rice farmers.¹ This behavior supports the view that self-sufficiency goals force governments to protect the domestic food production. On the other hand, an average protection coefficient around unity for the poorer rice importers does not confirm the self-sufficiency hypothesis. Within this group, in turn, there are countries like Nigeria, Senegal and Ivory Coast, the governments of which followed protective price policies in most years, and others like Tanzania, Zambia, Kenya, and Indonesia, where policy discriminated systematically against rice farmers (see Table A4). The latter might be explained by the fact that cheap food prices guaranteed by public marketing boards are common in many LDCs [see Timmer, 1988] and that the boards would run severe losses if they additionally granted high producer prices. As another possible reason for the observed discriminatory policies, one can mention that rice is of lower importance for human nutrition in these countries (except Indonesia),² whereas it is a food staple in West Africa.

The results for the net exporters reveal how differently agricultural producers are treated by policymakers in DCs and LDCs. On average, the rice farmers of the LDCs faced a substantial discrimination. In Egypt and in the Asian exporting countries (Burma, Nepal, Pakistan, Thailand), the protection coefficient was below unity throughout the period under consideration (see Table A4), i.e., rice exports served as a source of taxation to raise public revenues. It is remarkable that more

¹ The subsidization of rice farmers is well documented for South Korea by Anderson [1989] and for Malaysia by Jenkins and Lai [1989].

² In Indonesia, the government grants high fertilizer subsidies to rice farmers [Timmer, 1989]. This may explain that the country became self-sufficient in the early 1980s, although producer prices were below their world market equivalents.

favorable price incentives were given by the Latin American countries included in the sample, namely Argentina and Colombia. Among the industrial rice exporters, one has to look separately at Japan because of its extreme policy of insulating domestic markets from international competition that is not limited to the rice sector (see Section C.III.1). An average gross NPC of 4.14 illustrates impressively the price distortions in the Japanese rice market. The remaining DCs, however, showed rather modest rice price protection as compared, for example, to the newly industrialized Asian economies.

The additional consideration of exchange rate overvaluations resulting from trade and macroeconomic policies changes the measured structure of incentives fundamentally. When direct as well as indirect effects are included, the world rice economy can be characterized by a dominance of discriminatory agricultural policies. Since overvalued currencies are a widespread phenomenon in LDCs but very rarely in the developed world, protection levels for the former are significantly overestimated by the traditional NPC.¹ Only for the richer net rice importers, the adjusted protection coefficients remain above unity. For the low-income net importers, however, exchange rate distortions were considerable and led to a net taxation of the rice producers. Furthermore, the exporters in LDCs were taxed by both direct and indirect policies, which is reflected in a very low average net NPC of 0.48. In several countries, e.g., Nigeria and Sri Lanka, policy inconsistencies became evident: rice farmers were subsidized by direct agricultural policies, but adverse macroeconomic conditions counteracted these incentives. From this observation, one can conclude that agricultural planning should take into account the effects of general economic policies in order to be effective.

Summing up, the world rice sector can be characterized as being slightly protected from a cross-country point of view when only direct agricultural policies are considered. Different country groups show significant deviations from this pattern: while governments in richer net-importing LDCs and - to a lower extent - in DCs grant generous subsidies to their rice farmers, it is discriminated against rice exports in LDCs. The additional consideration of indirect effects caused by general

¹ Average exchange rate distortion factors for all countries included in our study are given in Table A8.

economic policies leads to an overall taxation of the rice sector. Particularly in poorer LDCs, overvalued exchange rates contribute substantially to negative production incentives.

There are only limited possibilities to compare these results to other studies dealing with price protection in the rice sector. The only cross-country study that applies the same methodology as we do is provided by Taylor [1989] (see Section B.III.1.e). Taylor does, however, only consider LDCs, and the investigation is limited to the period 1980-1986. Her general conclusions are similar to ours referring to LDCs: net rice importers (excluding aid recipients) are protected by direct agricultural policies and disprotected when exchange rate overvaluations are taken into account, while net rice exporters are discriminated against by both direct and indirect effects [ibid., pp. 55 ff.]. The present investigation shows that this outcome is also valid for the 1970s and that agricultural price policies in DCs as opposed to LDCs subsidize rice exporters.

3. Survey of Protection Levels for Coffee

Coffee is produced in many LDCs which have a natural production monopoly because of their climatic conditions, whereas coffee processing and consumption is mainly located in DCs. Production levels vary strongly from year to year according to weather conditions. A number of countries in Latin America, Africa and Asia rely heavily on coffee exports in terms of foreign exchange. It is often argued that coffee comes next to oil in political and economic importance. The outstanding contributor to world coffee supply is Brazil. Hence, weather conditions in Brazil are an important determinant of world prices. Cold weather reported from there in July will cause a price rise, even when world stocks are sufficiently on hand. The second largest coffee producer is Colombia. Its influence in the market has steadily grown since 1970. Coffee is very important to Colombia, because it is responsible for 50 percent of export income in many years and sometimes a great deal more [Marshall, 1983, p. 8].

Having the importance of coffee export earnings for many countries in mind, it is interesting to investigate in more detail domestic policies which affect coffee production. Analogously to rice and wheat, the structure of protection in the world coffee sector is analyzed for the

period 1969-1985. The sample includes 22 coffee-producing nations, notably 8 African, 11 Latin American and 3 Asian countries. During the period considered, these countries were responsible for 84 percent of the world coffee production, on average, for 1969-1985. Table 11 surveys the situation for several country groups and over time. In Column (1), gross NPCs are shown. The overall result in the first line reveals a serious direct price discrimination against coffee producers. The geometric mean of protection levels indicates that domestic coffee prices only amount to 63 percent of world prices. This result confirms the stylized fact that cash crop exports are often controlled by marketing boards in LDCs and are heavily taxed possibly in order to raise governmental revenues. Another reason might be the fact that it is easier for politicians to implement taxes on export crops than on food crops because only the supply side is affected and not urban consumers with their greater political influence [Mellor, Ahmed, 1988]. Finally, many countries try to support domestic processing of coffee by implementing higher export taxes on green coffee than on roasted or soluble coffee. It is remarkable that protection levels do not differ between poorer and richer LDCs. Independent of a country's stage of development, coffee producers face relatively low producer prices. With respect to regions, however, a significant difference can be stated. While African countries show clearly lower protection coefficients, indicating a much stronger price discrimination compared with the other regions, farmers in Asia get higher prices than elsewhere. This finding must be explained by the long history of the marketing board system in Africa which was originated during the colonial era. Already the colonial governments viewed the export sector as a source of tax revenue and foreign exchange. After becoming independent, marketing boards dealing with export crops were the principal source of hard currency for financing Africa's new industries in most countries. Since much of the industrial sector in Africa is governed by an import substitution strategy, it depends heavily on foreign exchange to finance the import of the necessary inputs. "The operative idea was that the difference between the prices that marketing boards paid their farmer clientele and the prices they received on world markets would be used as venture capital for the new industrial sector" [Lofchie, 1987, p. 99]. Nowadays, agricultural marketing boards in Africa, which meanwhile exist for almost every crop

Table 11 - Gross and Net NPCs for Coffee Producers, 1969-1985

	Measures of protection(a)	
	gross NPC	net NPC(b)
All countries		
1969-1985	0.63	0.47
1977	0.40	0.30
Poorer LDCs(c)		
1969-1985	0.62	0.45
1977	0.40	0.29
Richer LDCs(d)		
1969-1985	0.64	0.54
1977	0.40	0.36
Africa		
1969-1985	0.57	0.36
1977	0.27	0.16
Latin America		
1969-1985	0.64	0.52
1977	0.46	0.40
Asia		
1969-1985	0.80	0.69
1977	0.69	0.58

(a) Aggregated by the unweighted geometric mean. - (b) Adjusted for exchange rate distortions. - (c) Cameroon, Ivory Coast, Kenya, Madagascar, Rwanda, Tanzania, Uganda, Zaire, Colombia, Dominican Republic, El Salvador, Guatemala, Honduras, Peru, Indonesia, Philippines, Sri Lanka (GDP per capita 1980 < US\$1,200). - (d) Brazil, Costa Rica, Ecuador, Mexico, Venezuela.

Source: Own computations with data from World Bank [1982] and Tables A6 and A7.

of economic significance, seem in most cases to be characterized by waste, inefficiency, mismanagement, and corruption, and, hence, must be regarded as the major reason for the continent's agricultural decline [Lofchie, 1987].¹ One important exception - not only among the African countries - is Kenya. Contrary to all other nations, coffee growers receive prices which nearly reach the world price level in most years (see Table A6). Over the whole period, a gross NPC of 0.99 was measured. This relatively favorable treatment of coffee production in Kenya is due to the fact that the state, the exporters, the whole

¹ For additional background information about the agricultural performance in Africa, see also Bates [1981].

industry preparing and handling the coffee, and in particular the growers, benefit from the central auctions organized by the Kenya Coffee Board in Nairobi. Here, buyers from all over the world compete to buy the coffee assuring themselves of the best possible price on the day. Moreover, contrary to most other countries, it is the explicit policy of the Kenyan Marketing Board to maximize returns to growers. Hence, coffee growers in Kenya are in a position to get a higher proportion of the international value of coffee than in other countries [Marshall, 1983, pp. 87-88; UNCTAD, 1983, p. 10]. As in the case of wheat and rice, protection coefficients diverge significantly from the average values in individual years because of strong world price variability. In the world coffee sector, 1977 was a year of extremely high world prices due to large supply shortages in Brazil in the year before. Only a few hours of frost in one night had affected some 75 percent of trees to some degree [Marshall, 1983, p. 42]. As a result, protection levels in all countries heavily declined in this year. Moreover, the difference between the values in this year and in the whole period reveals that the degree of price transmission of world prices into domestic markets is lower in poorer than in richer LDCs and greater in Asian and American nations than in Africa. That is, most African coffee growers do not only face absolutely low domestic price levels but also do not participate in high world prices.

In Column (2) of Table 11, average NPCs adjusted for exchange rate distortions (net NPCs) are presented. The adjustment procedure is the same as for rice and wheat. Table A8 indicates that exchange rate overvaluation is widespread in coffee-producing countries, because values of below unity are given in most countries meaning that official exchange rates are higher than black market rates. In 15 out of 22 countries, the average exchange rate factor is lower than 0.9, and in 9 countries it is even lower than 0.75.

The comparison with Column (1) of Table 11 reveals that net protection is clearly lower than gross protection in most coffee-producing countries. That is due to the fact that currency overvaluation directly affects agricultural exports, since producer prices of export crops are determined by the conversion factor between foreign and domestic currency. Consequently, the greater the overvaluation, the fewer units of local currency per unit sold are realized by agricultural producers.

Hence, world coffee production is taxed twofold: on the one hand by direct price policies and on the other hand by indirect macroeconomic policies. Regarding the difference between gross and net NPCs, the degree of currency overvaluation is higher in poorer LDCs than in richer ones and in African countries again stronger than in other regions. As a result, many of Africa's export-oriented agricultural marketing boards experience severe cash constraints, since their income in local currency is also a function of the exchange rate. It has been the general tendency of marketing parastatals, however, to pass the systematic penalty on to the farmers by making either partial or late payments for their crops. Moreover, African governments, which are normally rather interested in the political loyalty of parastatal personnel than of poor farmers, often provide supplemental budgetary appropriations for parastatal operating deficits. Hence, the final result is that only the producers really suffer from currency overvaluation, since their prices remain low [Lofchie, 1987, pp. 95-96].

Summing up, the main message of Table 11 is the worldwide unfavorable treatment of coffee production, particularly in African countries. Contrary to wheat and rice, the strong taxation occurs already due to direct agricultural policies. Although earnings from coffee exports are very important for many countries, coffee production has not been protected during the period considered but is heavily taxed in order to finance governmental expenditures. As in the cases of rice and wheat, indirect macroeconomic policies like currency overvaluation have a strong negative impact on the overall protection level and on the poor performance of the agricultural sector in many LDCs.

IV. Instability of Protection Levels

In the following, we analyze how NPCs for rice, wheat and coffee producers as well as their components, notably producer and border prices, vary over time. We investigate by means of variance decomposition what the contribution of components to the variation of protection coefficients is (see Section C.1). Moreover, we try to find out whether the instability of producer prices in US dollars is due to variations of domestic

prices or to fluctuations of exchange rates. In this way, we want to discover the main causes of protection instability.

This analysis shall give a deeper insight into the structure and the development of protection levels in world agriculture. It is a stylized fact that many countries insulate domestic markets from world market conditions in order to stabilize producer prices. In such countries, domestic price stabilization are typically obtained by a buffer stock system and government monopoly of the country's foreign trade together with the enforcement of price targets for producers and consumers. Moreover, the stability of food prices is a politically sensitive issue in most LDCs. Hence, one would expect that in DCs as well as in LDCs domestic price variability is relatively lower than world market price instability [Bautista, 1990].

1. Measurement of Causes of Protection Instability in the World Wheat Sector

The instability of protection coefficients for wheat producers as well as of prices and exchange rates is measured by the percentage standard deviation from a loglinear trend line. Table 12 presents in Columns (1)-(3) a summary of results of instability measures for the NPC and its components, the domestic producer price and the world price, for various country groups. In Columns (4) and (5), the mean percentage contributions of the trend-corrected variances of producer and border prices to the trend-corrected variances of NPCs, i.e., the aggregated results of the variance decomposition, are shown. The country-specific results are given in Tables A9 and A10. Table 13 surveys the instability of producer prices in US dollars and of its components, producer prices in domestic currency and exchange rates. Furthermore, it shows the average contributions of the components to the variation of producer prices in US dollars for different country groups. Table 13 gives additional information about the causes of protection instability. Hence, both tables have to be analyzed simultaneously. Standard deviations of producer prices in US dollars differ slightly between both tables, because transportation costs were not considered in Table 13.

Table 12 - Instability of Gross and Net NPCs for Wheat Producers and Their Components, 1969-1985

	Mean(a) of					
	standard deviation from loglinear trend (percent)			contribution of components to Var(NPC) (percent)(b)		
	NPC	$P_i^{\$}$	P_w	$CP_i^{\$}$	CP_w	$CP_i^{\$}P_w$
	(1)	(2)	(3)	(4)	(5)	(6)
Gross NPC						
All countries(c)	23.2	16.9	27.8	81.4	176.6	158.0
DCs	20.5	17.7	28.3	118.7	249.5	268.2
LDCs	24.8	16.4	27.4	58.6	132.1	90.7
Net importers	23.7	15.8	26.8	69.1	153.7	122.8
DCs(d)	17.0	19.4	25.1	153.2	267.1	320.3
LDCs(e)	25.6	14.8	27.2	45.1	121.2	66.3
Net exporters	24.6	19.8	29.4	101.5	214.2	215.7
DCs(f)	22.5	16.8	30.2	98.9	239.4	238.3
LDCs(g)	22.1	21.9	28.1	105.9	170.2	176.0
Excluded countries(c)	35.1	26.4	28.1	55.7	70.9	26.6
Net NPC						
All countries(c)	23.2	20.3	28.0	102.5	192.8	195.3
DCs	20.7	17.7	28.3	117.0	246.7	263.7
LDCs	24.7	21.9	27.9	93.6	159.9	153.5
Net importers	23.5	20.4	27.2	90.5	159.8	150.3
DCs	17.4	19.4	25.1	137.0	235.4	272.4
LDCs	25.3	20.7	27.8	77.2	138.2	115.4
Net exporters	22.5	20.0	29.4	122.0	246.9	269.9
DCs	22.5	16.7	30.2	105.5	253.1	258.6
LDCs	22.6	25.9	28.1	150.6	236.1	286.7
Excluded countries	52.6	49.1	28.1	78.4	55.6	34.0

(a) Arithmetic mean. - (b) The method of decomposing variances is defined in Section C.II. Var stands for the trend-corrected variance, $P_i^{\$}$ and P_w are domestic and border prices in US\$, respectively. - (c) Argentina, Brazil and Chile were excluded as outliers because of extreme inflation rates. - (d) Italy, Japan, UK, West Germany. - (e) Egypt, Algeria, Kenya, Morocco, Nigeria, Tanzania, Tunisia, India, South Korea, Pakistan, Syria, Yugoslavia, Poland, Chile, Mexico. - (f) Australia, France, Greece, Spain, Sweden, Canada, USA. - (g) South Africa, Uruguay, Hungary, Turkey.

Source: Own computations with data from Tables A9 and A10.

Table 13 - Instability of Producer Prices (a) for Wheat in US\$ and Their Components, 1969-1985

	Mean(b) of					
	standard deviation from loglinear trend (percent)			contribution of components to $\text{Var}(P_i^{\$})$ (percent)(c)		
	$P_i^{\$}$	P_i	E	CP_i	CE	$CP_i E$
	(1)	(2)	(3)	(4)	(5)	(6)
All countries(d)	19.4	15.7	19.2	99.3	138.7	-138.0
DCs	22.0	12.4	16.1	32.9	74.8	-7.7
LDCs	17.9	17.5	21.0	136.2	174.2	-210.4
Net importers	17.6	15.6	18.5	127.0	152.3	-179.3
DCs(e)	21.5	11.7	15.4	32.6	54.4	13.0
LDCs(f)	16.4	16.7	19.4	154.0	180.2	-234.2
Net exporters	22.8	15.8	20.6	49.5	114.2	-63.7
DCs(g)	22.4	12.9	16.6	33.0	88.4	-21.4
LDCs(h)	23.2	20.3	26.4	74.1	153.1	-127.2
Excluded countries(d)	31.7	107.5	103.6	1132.0	1106.5	-2158.5

(a) Producer prices without transportation costs. - (b) Arithmetic mean. - (c) The method of decomposing variances is defined in Section C.II. Var stands for the trend-corrected variance, $P_i^{\$}$ and P_i are producer prices for wheat in US\$ and local currency, respectively. E indicates the exchange rate between US\$ and the local currency. - (d) Argentina, Brazil and Chile were excluded as outliers because of extreme inflation rates. The USA were not considered, as $P_i^{\$}$ and P_i are the same. - (e) Italy, Japan, UK, West Germany. - (f) Egypt, Algeria, Kenya, Morocco, Nigeria, Tanzania, Tunisia, India, South Korea, Pakistan, Syria, Yugoslavia, Poland, Mexico. - (g) Australia, France, Greece, Spain, Sweden, Canada. - (h) South Africa, Uruguay, Hungary, Turkey.

Source: Own computations with data from Table A15.

Regarding the gross NPC in Table 12, the hypothesis is confirmed that the variability of border prices around the loglinear trend (27.8 percent) is stronger than that of producer prices in US dollars (16.9 percent). This indicates that producer prices in US dollars are stabilized

in most countries. With 176.6 percent compared with 81.4 percent, the contribution of world price variations to the instability of gross NPCs is much greater than that of producer price variations (see Columns (4) and (5)). The positive covariance term in Column (6) indicates that world market prices being above the trend often go along with producer prices which are above their trend values, too, and vice versa. Hence, both effects neutralize each other, thus reducing the instability of gross NPCs. Therefore, the mean variation of protection coefficients is smaller than that of border prices. Table 13 shows that producer prices in US dollars vary mainly as a result of exchange rate fluctuations (see Columns (4) and (5)). For all countries, the absolute instability of producer prices in US dollars is slightly higher than that of producer prices in domestic currency. It can be concluded that domestic prices for wheat producers are indeed stabilized, on average, because variations of border prices (27.8 percent) are much stronger than fluctuations of producer prices in domestic currency (15.7 percent). The negative covariance term in Column (6) of Table 13 indicates that the fluctuations of producer prices in domestic currency and exchange rates are negatively correlated. Hence, both effects again neutralize each other resulting in lower variations of producer prices in US dollars than of the components.

In LDCs, protection levels for wheat vary stronger than in DCs (24.8 percent as against 20.5 percent), although the instability of producer prices and border prices is rather similar (see Table 12). This implies that the instability of protection coefficients is not only determined by the absolute variations of the components but also by the correlation between both price series. In DCs the covariance term is much higher than in LDCs (268.2 percent as against 90.7 percent). This suggests that both price series move more synchronously in DCs than in LDCs. From this, one might conclude that producer price policies in DCs are more closely linked to border price fluctuations than in LDCs. By comparing Tables 12 and 13, however, we obtain the additional result that prices in domestic currency (12.4 percent) vary much less than producer prices in US dollars (22.0 percent) and border prices (28.3 percent) in DCs. Hence, wheat farmers in high-income countries actually enjoy highly stabilized prices. As there is only little covariance between producer prices in domestic currency and exchange rates in DCs (-7.7

percent), the instability of producer prices in US dollars is rather strong. The opposite is true in LDCs. While producer prices in domestic currency and exchange rates fluctuate more heavily in these countries, both effects tend to neutralize each other. This is indicated by a high negative covariance term, thus reducing the instability of producer prices in US dollars. It can be concluded that the variation of producer prices in LDCs, denominated in foreign currency, does not only result from domestic price policies but is determined to a higher degree by fluctuating exchange rates. That explains why producer prices in US dollars and border prices develop less synchronously in LDCs compared with DCs. The overall conclusion can be drawn that policies to stabilizing producer prices are more effective in DCs than in LDCs.

With regard to the comparison between net-importing and net-exporting countries, the overall protection instability presented in Table 12 is rather similar (23.7 percent and 24.6 percent). Border price variations obviously contribute more to the variations of NPCs than producer price variations (see Columns (4) and (5)). But again, there are some remarkable differences between DCs and LDCs. As in the whole sample, in net-importing countries, the fluctuations of the gross NPC are lower in DCs (17.0 percent) than in LDCs (25.6 percent). Net-importing DCs even show the lowest protection instability. This is due to the fact that producer prices in US dollars and border prices are closely correlated as indicated by the high positive covariance value. Moreover, Table 13 shows that industrialized net importers experience the lowest instability of producer prices in domestic currency (11.7 percent). In these countries, price stabilizing policies seem to be very effective. Furthermore, the fluctuations of producer prices in domestic currency and exchange rates are positively correlated (see Column (6)). Hence, both series reinforce each other concerning their effects on producer prices in US dollars. Although somewhat weakened, similar statements hold true for industrialized net exporters. Although the protection instability is nearly the same in DCs and LDCs (22.5 percent and 22.1 percent), Table 13 shows that domestic prices are more stable in net-exporting DCs than in net-exporting LDCs (12.9 percent against 20.3 percent). That is, DCs strongly protect wheat producers from price fluctuations independent of their trade status in order to stabilize the agricultural income.

The main distinction between importers and exporters among the LDCs arises from different producer price variations in US dollars, whereas the protection instability is nearly the same. While fluctuations of producer prices in US dollars are rather small in net-importing countries (14.8 percent), they are the highest in net-exporting nations (21.9 percent). This can be explained by the results in Table 13. Net-importing LDCs not only show smaller fluctuations of producer prices in domestic currency compared with those of net-exporting LDCs but also present a lower exchange rate variability. Moreover, the covariance values between producer prices in domestic currency and exchange rates are highly negative in importing LDCs (see Column (6)). Both effects strongly neutralize each other resulting in a low instability of producer prices in US dollars. The comparison with the fluctuations of border prices (27.2 percent) reveals that domestic prices are also strongly stabilized in these countries.

As mentioned above, producer prices in domestic currency and exchange rates fluctuate rather heavily in net-exporting LDCs. The negative covariance term again indicates that both series are negatively correlated. Therefore, the instability of producer prices in US dollars (23.2 percent) is much smaller than the variations of exchange rates (26.4 percent) but still higher than variations of producer prices in domestic currency (20.3 percent). It follows that in net-exporting LDCs domestic producer prices are also stabilized against heavily fluctuating border prices but to a lower degree than in net-importing LDCs. Hence, we can conclude that domestic policies of stabilizing prices are most effective in DCs and more effective in net-importing than in net-exporting LDCs. Protection instabilities mainly result from border price variations, while instabilities of producer prices in US dollars are strongly affected by exchange rate fluctuations.

Three countries, notably Argentina, Brazil and Chile, were excluded from the sample because of extremely high inflation rates in many years which increase the instability of price series (see Table A15) and produce a bias in the aggregated values of domestic price and exchange rate series. The mean results for these three countries which are presented in the last line of Table 13 show that instabilities differ significantly from the values in other countries.

Table A9 gives some additional information on the movement of protection levels for wheat producers over time. The indices +, - indicate whether the series follow a significant positive or negative loglinear trend. It is interesting that NPCs move in only 15 out of 32 countries significantly upwards or downwards. In 6 countries, protection levels rise over time, while 9 countries show declining coefficients. In the group of the DCs, an upward-moving coefficient occurs only for Japan, while protection levels in Italy, Canada, France, and the USA decline significantly during the period considered. In LDCs, the structure is ambiguous. From the results shown in Table A9, the conclusion can be drawn that protection levels for wheat producers do not follow a homogenous pattern across LDCs, whereas DCs tend to reduce direct wheat price protection.

Regarding the net NPC in Table 12, the conclusion can be drawn that protection coefficients, which were adjusted for exchange rate distortions, vary rather similarly to unadjusted NPCs. While currency overvaluation does not affect border prices at least in the small-country case, it has a strong impact on producer prices in US dollars or exchange rates, respectively. As exchange rate factors vary strongly over time, the instability of producer prices in US dollars and of exchange rates is higher than in the case of official exchange rates. Therefore, percentage standard deviations of producer prices in US dollars are higher in case of net NPCs than of gross NPCs. Prices in domestic currency, however, remain unchanged.

Furthermore, Columns (4) and (5) of Table 12 show that the contribution of producer price fluctuations to the instability of net NPCs across all countries has increased compared to the results of gross NPCs. A comparison of DCs and LDCs, however, reveals that the differences between the alternative measures of protection only arise from changes in LDCs. That is due to the fact that exchange rate overvaluation is widespread in low-income countries alone (see Section C.III). Moreover, the impact of the adjustment procedure is stronger for net-importing LDCs than for net exporters, since the instability of producer prices in US dollars has increased more in these countries. This suggests that exchange rate overvaluation is more frequent and stronger in net-importing countries compared with net exporters. That might be due to the fact that the group of developing net importers includes even

poorer countries than the sample of developing net exporters, since exchange rate overvaluation is particularly typical for low-income countries.

Furthermore, Columns (4) and (5) of Table 12 show that the contribution of border price fluctuations to instabilities of net NPCs are still higher than the contribution of producer price variations. The positive covariance terms in Column (6) indicate that both price series often move together and therefore more or less neutralize each other.

Table A10 presents the country-specific results. Compared with Table A9, some changes can be recognized within the group of LDCs. While in the case of gross NPCs 10 LDCs showed significantly upward- or downward-moving protection coefficients, now the number amounts to 13 countries. 6 nations, Algeria, Nigeria, Poland, Tanzania, Hungary, and Uruguay, join this group, whereas the trends in protection coefficients become insignificant for 3 nations, Egypt, Syria and Argentina. 9 LDCs show significantly declining net protection coefficients, 4 LDCs show increasing ones. When all countries are taken into account, net protection levels moved downwards in 13 out of 32 countries, while only 5 nations showed upward-moving coefficients. Hence, the broad country sample shows that the degree of net protection for wheat tends to decline rather than to increase over time.

Summing up, it can be stated that protection coefficients for wheat producers vary over time mainly as a result of border price fluctuations. Hence, policies of stabilizing producer prices are widespread. This finding gets even more distinct when the variation of producer prices in US dollars is decomposed, because in most cases the instability of producer prices in domestic currency is indeed much lower than the price instability in US dollars. Moreover, the efficiency of stabilization policies increases with a rising stage of development and is higher in net-importing than in net-exporting countries. Exchange rate overvaluation, which almost exclusively occurs in LDCs, causes increasing variations of producer prices in US dollars, while producer prices in domestic currency remain unchanged. Nevertheless, net protection in LDCs varies more heavily over time than gross protection. The contribution of the instability of border prices to fluctuating NPCs, however, is still stronger than the variations of producer prices.

Our results confirm basically the findings of Krueger et al. [1988] (see Section B.III.1). For a smaller sample of countries and for their main commodities, they also found out that domestic producer prices for agricultural products in many LDCs have been more stable than their border prices based on calculated standard deviations. Moreover, they also discovered that the domestic price variability is significantly larger for exported than for imported products. That might be explained by the theory of collective action. With respect to imported food crops like wheat, there is a pressure for price stability not only from producers (as in the case of exports) but also from politically more influential urban consumers because of the impact of food price variability on real wages (*ibid.*). As a result, politicians in LDCs rather provide stabilization policies for staple crops than for export crops.

2. Measurement of Causes of Protection Instability in the World Rice Sector

As in the case of wheat, variations of protection coefficients, prices and exchange rates were quantified for each single rice-producing nation of our sample. The results of the variance decomposition of NPCs into producer and border price components are documented in detail in Tables A11 and A12. The instabilities of dollar prices and its possible causes, i.e., variations of domestic prices in home currency and exchange rate fluctuations, are shown in Table A16. Tables 14 and 15 provide a summary of the aggregated results for different country groups.

Table 14 shows in Columns (2) and (3) that producer prices for rice fluctuated to a lesser extent (21.8 percent standard deviation) than its world market equivalents (31.1 percent), on average, thus indicating a trend towards granting rice farmers stable prices in US dollars. As a consequence, volatile border prices contributed more to instabilities of the gross NPC than varying producer prices (see Columns (4) and (5)).¹ The positive covariance between producer and border prices (see

¹ This result is confirmed by various studies examining the determinants of nominal rice price protection [David, 1990; Timmer, 1990; Thiele, 1990]. In all these studies, world price fluctuations were identified as an important source of variations in NPCs, thus indicating that producer prices were insulated from world market price movements.

Table 14 - Instability of Gross and Net NPCs for Rice Producers and Their Components, 1969-1985

	Mean(a) of					
	standard deviation from loglinear trend (percent)			contribution of components to Var(NPC) (percent)(b)		
	NPC	$P_i^{\$}$	P_w	$CP_i^{\$}$	CP_w	$CP_i^{\$}P_w$
	(1)	(2)	(3)	(4)	(5)	(6)
Gross NPC						
All countries(c)	25.2	21.8	31.1	92.0	181.6	173.6
DCs	20.1	21.0	27.2	121.5	197.7	219.2
LDCs	27.2	22.0	31.9	85.2	178.0	163.2
Net importers	28.7	24.1	32.1	89.9	161.3	191.2
Richer LDCs	33.4	27.7	30.1	82.1	86.2	68.3
Poorer LDCs	27.6	23.3	32.5	91.7	178.6	169.3
Net exporters	21.9	18.6	29.7	95.1	183.5	178.6
DCs	20.1	21.0	27.2	121.5	197.7	219.2
LDCs	23.7	16.4	31.7	73.0	222.3	195.3
Excluded countries	35.9	22.8	39.0	41.6	127.8	69.4
Net NPC						
All countries(c)	27.5	25.4	31.1	114.8	157.7	172.5
DCs	20.9	21.1	27.2	117.1	185.1	202.2
LDCs	29.1	26.4	31.9	114.2	151.4	165.6
Net importers	30.4	27.8	32.1	111.7	144.6	156.3
Richer LDCs	33.9	27.3	30.1	77.8	83.3	61.1
Poorer LDCs	29.6	28.0	32.5	119.5	158.8	178.3
Net exporters	23.4	21.7	29.7	119.4	176.6	196.0
DCs	20.9	21.1	27.2	117.1	185.1	202.2
LDCs	29.3	22.1	31.7	121.2	169.7	123.1
Excluded countries	41.5	31.7	39.0	69.5	153.6	123.1
(a) Arithmetic mean. - (b) The method of decomposing variances is defined in Section C.II. Var stands for the trend-corrected variance, $P_i^{\$}$ and P_w are domestic and border prices in US\$, respectively. - (c) Argentina and New Mexico were excluded as outliers because of extreme inflation rates.						

Source: Own computations with data from Tables A11 and A12.

Column (6)) expresses that both prices tended to move parallel during the period considered. Put differently: producer price changes partly offset variations in world market prices and, thus, the variability of protection coefficients was below that of border prices.

Until now, we have only investigated whether producer prices in US dollars were stabilized, on average. For a strategy which intends to stabilize the revenues of farmers, however, the producer price in home currency is the relevant goal variable. Therefore, in a second step, the decomposition of the dollar price into its home price and exchange rate components is necessary. The results of this variance decomposition are reported in Table 15. Table 15 shows that producer prices in domestic currency were indeed stabilized, because their standard deviation (16.9 percent) was lower than that of the dollar price (24 percent) which in turn appeared to be less variable than the border price (see Table 14). Home price and exchange rate variations contributed equally to instabilities of the dollar price. Dollar price instabilities, in turn, were higher than the fluctuations of its components, although the negative covariance term signals that home price and exchange rate fluctuations should tend to offset each other. The covariance term, however, was comparatively low, i. e., producer prices in home currency and exchange rates moved rather independently.

Differences between LDCs and DCs are most striking with regard to the variability of NPCs which was substantially lower in the latter group as a consequence of a strong correlation between producer and border prices. Price stabilization seems to prevail independent of the stage of economic development: in developed as well as developing economies, producer prices in US dollars varied to a lesser extent than border prices and dollar prices, in turn, were less stable than prices in home currency. The rather high variation of the dollar prices as compared to exchange rates and prices in home currency is again due to the fact that the components, although being negatively correlated in most countries, moved more or less independently, particularly in DCs where the average covariance was near zero.

As was already pointed out in Section III.2, the results for net-importing and net-exporting countries are not directly comparable. Nevertheless, it can be stated that both subgroups followed the general pattern, i. e., border price variations lay above those of dollar prices and

Table 15 - Instability of Producer Prices (a) for Rice in US\$ and Their Components, 1969-1985

	Mean(b) of					
	standard deviation from loglinear trend (percent)			contribution of components to $\text{Var}(P_i^{\$})$ (percent)(c)		
	$P_i^{\$}$	P_i	E	CP_i	CE	$CP_i E$
	(1)	(2)	(3)	(4)	(5)	(6)
All countries(d)	24.0	16.9	16.8	63.7	59.5	-23.2
DCs	22.6	13.4	16.3	37.3	60.9	1.8
LDCs	24.2	17.6	16.6	71.3	62.0	-33.3
Net importers	26.7	18.0	17.9	64.4	63.3	-27.7
Richer LDCs	28.4	16.9	23.8	34.6	79.6	-14.2
Poorer LDCs	26.3	18.2	16.5	71.3	59.4	-30.7
Net exporters	20.0	15.3	14.3	68.8	59.6	-28.4
DCs	22.6	13.4	16.3	37.3	60.9	1.8
LDCs	18.3	16.5	13.0	89.7	58.8	-48.5
Excluded countries(e)	28.4	65.5	73.6	528.2	659.0	-1137.1

(a) Producer prices without transportation costs. - (b) Arithmetic mean. - (c) The method of decomposing variances is defined in Section C.II. Var stands for the trend-corrected variance, $P_i^{\$}$ and P_i are producer prices for rice in US\$ and local currency, respectively, E indicates the exchange rate between US\$ and the local currency. - (d) Argentina and Mexico were omitted as outliers because of extreme inflation rates. The USA were not considered, as P_i and $P_i^{\$}$ are identical. - (e) Mexico and Argentina.

Source: Own computations with data from Table A16.

those above variations of prices in home currency. Among the net importers, the richer LDCs showed higher average variability in NPCs, dollar prices and exchange rates than the poorer LDCs. The opposite was true for the producer price in home currency, mainly because of the very low instability of Malaysian and South Korean producer prices (see Table A16).

Within the group of net-exporting countries, NPCs varied to a lesser extent in DCs than in LDCs. The opposite was true for producer prices in US dollars due to two reasons (see Table 15). First, average exchange rate fluctuations were higher in DCs. This may be explained by a tendency in some LDCs like Egypt to fix their currencies to the US dollar, while the currencies of the DCs included in the sample have been floating towards the US dollar since 1973. Second, home price and exchange rate variations in the LDCs were negatively correlated, i.e., offsetting each other, thus reducing the instability of producer prices in US dollars. The producer prices in home currency, in turn, were effectively stabilized in net-exporting DCs as well as in net-exporting LDCs. Although one would expect government authorities to tax exports with frequently changing rates, the developing net exporters showed more stability, on average, than the group of net importers with regard to both dollar prices and prices in domestic currency.

Two highly inflationary economies, namely Argentina and Mexico, were considered separately in the variance decomposition because of extreme fluctuations in domestic prices and exchange rates (see Table 15). Since producer prices in home currency and exchange rates moved strongly parallel in these countries, dollar prices did not show considerable deviations from the average. The high variability of home prices in the inflationary countries may be explained by the fact that future movements of macroeconomic variables like exchange rates and inflation can hardly be forecasted, and government authorities thus adjust producer prices in a very discretionary way.

The additional consideration of exchange rate overvaluations, which were considerable in a number of LDCs (see Table A8), changes parts of the results obtained until now. While border prices and producer prices in domestic currency per definition remained unaffected by distorted exchange rates, the NPCs and the producer prices in US dollars became more volatile. The instability of producer prices, however, was still below that of border prices, i.e., the price stabilization hypothesis is again confirmed. Since overvaluations are generally limited to LDCs, differences in the variability of NPCs between DCs and LDCs become more pronounced when the net NPCs are regarded (see Table 14). Moreover, adjusted dollar prices varied stronger in LDCs than in DCs in

contrast to unadjusted dollar prices which had roughly the same standard deviation in both groups.

From the detailed country specific results reported in Tables A11 and A12, one obtains the additional information that in a number of the countries considered the level of protection did not follow a significant trend over time. Only in 13 (15) out of 29 cases the gross NPC (net NPC) carried a trend. 5 (6) countries showed increasing values and 8 (9) countries decreasing values of the gross NPC (the net NPC) between 1969-1985. That is, no common trend of price protection among the rice producers could be ascertained for that period. Remarkably, all DCs included in the sample, except for Japan, exhibited decreasing protection levels, particularly the USA and Australia.

Altogether, the previous analysis revealed within a broad cross-country comparison that volatile border prices contributed more to protection instabilities than varying producer prices. Producer prices in US dollars, in turn, varied stronger than producer prices in home currency. Hence, it can be concluded that a general tendency towards price stabilization in favor of domestic rice farmers does exist in the world rice economy. This policy is observable independent of the stage of economic development. Only some highly inflationary economies (Mexico, Argentina) showed no successful stabilization. In these countries, producer prices in home currency were more volatile than world market prices.

3. Measurement of Causes of Protection Instability in the World Coffee Sector

After having investigated the instability of protection coefficients for two important food crops, now one typical export crop shall be analyzed: coffee. According to earlier considerations (see Section C.IV.1), it can be expected that domestic coffee prices are less stabilized by policy than prices for food crops. The reason is that urban consumers are hardly affected by coffee price policies and, hence, will not stand up for price stabilization measures in this case. It follows that political pressure for price stability must solely be generated by influential coffee growers who are often not sufficiently influential in the decision-making process.

Again, the instability of protection coefficients, prices and exchange rates is measured by the percentage standard deviation from a loglinear trend function. Moreover, the contribution of the trend-corrected variances of producer and border prices to the trend-corrected variance of NPCs is measured by means of variance decomposition. The summarized results are presented in Table 16. Additionally, we analyze whether variations of producer prices in US dollars are due to fluctuations of prices in domestic currency or to exchange rate instability. Table 17 surveys these results. The country-specific results are given in Tables A13, A14 and A17.

Columns (1)-(3) in Table 16 show again that the instability of the gross NPC for all countries mainly results from border price rather than producer price variations. But there is only a slight difference between the fluctuations of producer prices in US dollars and border prices (31.5 percent as against 33.3 percent). Furthermore, the extremely high covariance terms in Column (6) indicate that variations of producer and border prices are positively correlated in many cases. It follows that both effects neutralize each other, thus reducing the instability of gross NPCs. Therefore, fluctuations of protection coefficients are significantly smaller than the variations of the components. Table 17 shows that prices in domestic currency vary strongly in the total sample and even contribute more to the instability of producer prices in US dollars (67.1 percent) than exchange rate movements (42.5 percent). Hence, coffee producers have to face highly unstable prices, on average, across countries. But it can be recognized, too, that producer prices in domestic currency fluctuate less than in US dollars and even fluctuate less than border prices. This suggests that the instability of world market prices was not as much transmitted into domestic markets as producer price fluctuations in US dollars imply. That is, in the world coffee sector domestic producer prices are also stabilized to some degree. The rather small covariance terms in Column (6) of Table 17 indicate that variations of producer prices in domestic currency and exchange rates are hardly correlated.

Dividing coffee producers into richer and poorer LDCs provides some differences in the case of gross NPCs. In richer LDCs, the instability of protection coefficients is slightly higher than in poorer LDCs, although border price fluctuations are lower. Moreover, the vari-

Table 16 - Instability of Gross and Net NPCs for Coffee Producers and Their Components, 1969-1985

	Mean(a) of					
	standard deviation from loglinear trend (percent)			contribution of components to Var(NPC) (percent)(b)		
	NPC	$P_i^{\$}$	P_w	$CP_i^{\$}$	CP_w	$CP_i^{\$}P_w$
	(1)	(2)	(3)	(4)	(5)	(6)
Gross NPC						
All countries(c)	22.7	31.5	33.3	706.7	716.7	1323.4
Poorer LDCs(d)	22.1	31.3	34.6	675.5	647.7	1223.2
Richer LDCs(e)	24.9	32.1	28.9	815.9	958.3	1674.2
Africa	24.7	24.0	34.1	767.3	828.5	1495.8
Latin America	22.4	34.7	31.2	634.6	656.0	1190.6
Asia	19.6	36.9	38.1	802.0	675.0	1377.0
Excluded countries(c)	48.5	41.7	42.5	110.9	120.8	131.7
Net NPC						
All countries(c)	24.5	36.6	33.5	396.7	317.3	612.5
Poorer LDCs	23.0	36.1	34.8	419.6	343.7	661.4
Richer LDCs	30.0	38.4	28.9	316.5	224.9	441.4
Africa	23.8	29.1	32.8	328.8	309.7	534.1
Latin America	26.0	39.9	31.2	358.9	254.8	513.8
Asia	21.5	41.7	41.7	645.9	519.9	1065.8
Excluded countries(c)	63.2	52.2	42.6	130.7	82.4	113.1
(a) Arithmetic mean. - (b) The method of decomposing variances is defined in Section C.II. Var stands for the trend-corrected variance, $P_i^{\$}$ and P_w are domestic and border prices in US\$, respectively. - (c) Uganda, Zaire, Peru, and Brazil were omitted because of extreme inflation rates. - (d) Cameroon, Colombia, Ivory Coast, Dominican Republic, Guatemala, Kenya, Madagascar, Rwanda, Tanzania, El Salvador, Honduras, Indonesia, Philippines, Sri Lanka. - (e) Costa Rica, Ecuador, Mexico, Venezuela.						

Source: Own computations with data from Tables A13 and A14.

Table 17 - Instability of Producer Prices (a) for Coffee in US\$ and Their Components, 1969-1985

	Mean(b) of					
	standard deviation from loglinear trend (percent)			contribution of components to $\text{Var}(P_i^{\$})$ (percent)(c)		
	$P_i^{\$}$	P_i	E	CP_i	CE	$CP_i E$
	(1)	(2)	(3)	(4)	(5)	(6)
All countries(d)	32.4	26.8	17.0	67.1	42.5	-9.6
Poorer LDCs(e)	32.4	26.2	14.2	64.7	39.0	2.3
Richer LDCs(f)	32.7	28.8	27.1	75.4	76.0	-51.4
Africa	25.6	17.9	16.7	53.0	56.7	-9.7
Latin America	35.5	33.0	21.9	89.2	63.2	-52.4
Asia	36.8	32.7	14.4	77.6	16.9	5.5
Excluded countries(d)	48.4	65.0	72.1	188.9	246.9	-335.8

(a) Producer prices without transportation costs. - (b) Arithmetic mean. - (c) The method of decomposing variances is defined in Section C.II. Var stands for the trend-corrected variance, $P_i^{\$}$ and P_i are producer prices in US\$ and local currency, respectively. E indicates the exchange rate between US\$ and the local currency. - (d) Uganda, Zaire, Peru, and Brazil were omitted because of extreme inflation rates. - (e) Cameroon, Colombia, Ivory Coast, Dominican Republic, Guatemala, Kenya, Madagascar, Rwanda, Tanzania, El Salvador, Honduras, Indonesia, Philippines, Sri Lanka. - (f) Costa Rica, Ecuador, Mexico, Venezuela.

Source: Own computations with data from Table A17.

ance decomposition of producer prices in US dollars shows that prices in domestic currency and exchange rates vary less in poorer LDCs than in richer LDCs (see Table 17). The comparison of producer prices in domestic currency and border prices reveals that producer price stabilization is more frequent in poorer LDCs, whereas richer LDCs show more or less the same fluctuations of both price series.

When the data basis is disaggregated into regions, it can be seen from Table 16 that fluctuations of protection coefficients vary strongly across different regions of the world. The greatest instability of the

gross NPC occurs in African countries, although producer prices in US dollars fluctuate the least there, whereas the lowest variations of protection coefficients occur in Asia, where producer prices in US dollars vary the most. This shows again that the joint effects of both price series must be examined in order to explain the movement of protection levels. In Latin American and Asian countries, the degree of variations of producer and border prices is rather similar. Furthermore, the high covariance values indicate that the course of both series is positively correlated and, hence, fluctuations of the gross NPC are dampened. In Africa, however, border prices vary much stronger than producer prices in US dollars and even very much stronger than producer prices in domestic currency (see Table 17). This suggests that in contrast to other country groups, producer prices for coffee in Africa are clearly stabilized, thus intensifying the instability of the gross NPC. Moreover, Table 17 shows that prices in domestic currency fluctuate much stronger in Asian and American countries than in Africa. Therefore, the conclusion can be drawn from Tables 17 and 11 that coffee producers in Africa face rather stable but low prices, while producers in Latin American and Asian countries more or less face world market conditions. Four countries, notably Uganda, Zaire, Peru, and Brazil, were excluded from the sample, because they had extremely high inflation rates in many years which raise the variances of the price series. It follows that mean values would be biased if these countries remained in the sample. Tables 16 and 17 show that the mean variations of protection levels, prices and exchange rates are significantly stronger in these four countries than in the rest of the sample.

Table A13 shows that 10 out of 22 countries have significantly declining protection coefficients. It is noteworthy that no country showed rising NPCs. This indicates increasingly unfavorable conditions for coffee producers worldwide. Moreover, it can be recognized that the percentage contributions of the components and the covariance terms vary strongly across countries. This suggests that there is no uniform pattern of producer price policies in the world coffee sector.

As in the case of wheat, net NPCs vary stronger than gross NPCs (see Table 16). As border prices remain unaffected by exchange rate

policies, this must be due to the fact that corrected rather than uncorrected exchange rates produce a greater instability of producer prices in US dollars. Columns (4) and (5) show that the contribution of producer price fluctuations in US dollars to the instability of the net NPC is now even greater than the contribution of border price variations. Since exchange rate factors vary over time, too, producer prices in US dollars are not only affected by fluctuations of prices in domestic currency and exchange rates but also by changing degrees of overvaluation in the case of the net NPC. Hence, the instability of producer prices in US dollars increases when exchange rate distortions are taken into account and thus leads to stronger fluctuations of the net NPC. This general result is also valid for the different country groups. Again, the excluded countries show significantly stronger variations of the net NPC and components than the other groups.

Table A14 presents the country-specific results for the net NPC; 11 out of 22 countries show significantly declining protection coefficients and the others follow no significant loglinear trend. Hence, the adjustment for exchange rate distortions does not affect the general statements.

Altogether, the conclusion can be drawn that highly unstable border prices are often transmitted into domestic markets resulting in strong variations of producer prices. As both price series are positively correlated to a high degree, the instability of NPCs is smaller than the variations of the components. Moreover, the variance decomposition of producer prices in US dollars had shown that prices in domestic currency vary rather strongly but compared with border price fluctuations appeared to be stabilized to some degree. Differences between poorer and richer LDCs are rather small, whereas differences between country groups are considerable. Africa showed the lowest instability of prices in domestic currency, while fluctuations in Latin America and Asia are nearly twice as much and are of the same order as border price fluctuations. Hence, Latin American and Asian coffee producers are exposed to world market conditions, while African farmers get more or less stabilized but low prices.

V. Comparison of the Results for Wheat, Rice and Coffee

In this chapter, we have investigated the extent and instability of nominal protection in the world wheat, rice and coffee economy across a number of countries for the period 1969-1985. Major results of the analysis are summarized in Tables 18 and 19. As can be seen from Table 18, wheat producers and, to a lesser extent, rice producers were, from a cross-country point of view, protected by output price policies, while coffee was heavily discriminated against. At first glance, this confirms the hypothesis of a food crop subsidization and cash crop taxation (see Section B.III.1.b). Does this conclusion, however, remain valid when the samples are disaggregated? In the case of coffee, the decomposition into richer and poorer LDCs reveals that producers were taxed independently of the stage of economic development. This result appears to be very stable, as only one out of 22 countries analyzed, namely Kenya, showed average gross NPCs approaching unity (Table A6). With respect to wheat and rice, the samples are much more heterogenous, containing DCs and LDCs as well as net importers and net exporters. As one would expect (see Section B.III.1.a), rice and wheat farmers in DCs generally received prices exceeding world market equivalents. LDCs were, on aver-

Table 18 - Comparison of Gross and Net NPCs in the World Wheat, Rice and Coffee Market

	Measures of protection	
	gross NPC	net NPC
Wheat		
All countries	1.27	0.98
DCs	1.41	0.98
LDCs	1.14	0.82
Rice		
All countries	1.09	0.85
DCs	1.60	1.59
LDCs	1.01	0.74
Coffee		
All countries	0.63	0.47
Richer LDCs	0.62	0.54
Poorer LDCs	0.64	0.45

Source: Tables 9, 10 and 11.

Table 19 - Comparison of the Instability of Gross NPCs and Producer and Border Prices in the World Wheat, Rice and Coffee Market

	Mean of standard deviation from loglinear trend (percent)			
	gross NPC	P_i^S	P_i	P_w
Wheat(a)				
All countries	23.2	19.4	15.7	27.8
DCs	20.5	22.0	12.4	28.3
LDCs	24.8	17.9	17.5	27.4
Rice(a)				
All countries	25.2	24.0	16.9	31.1
DCs	20.1	22.6	13.4	27.2
LDCs	27.2	24.2	17.6	31.9
Coffee(a)				
All countries	22.7	32.4	26.8	33.3
Richer LDCs	24.9	32.7	28.8	28.9
Poorer LDCs	22.1	32.4	26.2	34.6

(a) Some highly inflationary countries are excluded (see notes in Tables 12-15).

Source: Tables 12-17.

age, slightly protected in the wheat sector and treated neutrally in the rice sector. Moreover, the trade status matters in LDCs: net wheat and rice exporters were discriminated against, the latter more heavily than the former, while average NPCs for net rice and wheat importers were above unity (see Sections C.III.1 and C.III.2). Thus, one can put forward the following statement: import-competing wheat and rice farmers in LDCs tend to be protected by direct agricultural policies as opposed to exporters of the two food crops and of coffee, the typical cash crop.¹

The inclusion of indirect effects resulting from general economic policies changes the results fundamentally. The net NPCs indicate that LDCs, which are net importers in the rice and wheat market, move from

¹ The average nominal protection for rice importers in LDCs, however, is rather low (12 percent), reflecting that there are also countries in this group in which rice farmers are taxed. Moreover, the results obtained here should be generalized with caution, because we analyze only two food crops and one export crop.

protection to disprotection, with a few exceptions like South Korea. Exporters, in turn, are taxed by both direct and indirect policies. This outcome, although obtained by application of another methodology, is very much in line with the results reported in Krueger et al. [1988].¹

The most interesting conclusion that can be drawn from the instability analysis is that price stabilization seems to be a very widespread phenomenon. Table 19 shows the average variability of world market prices as measured by the standard deviation from a loglinear trend exceeded the variability of producer prices in domestic currency in all three agricultural markets considered and in DCs as well as in LDCs. However, some qualifications of this general statement have to be made: first, prices granted to coffee producers were substantially less stable than the respective prices for wheat and rice farmers. This observation fits well into the view that government authorities treat food crops more favorably than export crops and provides an extension of the findings in Krueger et al. [ibid.], who did obtain only very weak evidence supporting the hypothesis that price stabilization policies depend on the trade status. Second, in some highly inflationary countries, which are excluded from the figures in Table 19, price stabilization was not successful, i.e., the variation of producer prices exceeded that of border prices. Third, producer prices for wheat and rice were slightly more effectively stabilized in DCs than in LDCs.

Summing up, import-competing producers in LDCs receive higher and more stable prices than exporters. DCs, in turn, grant the highest and most stable prices to farmers.

¹ The effects of trade and macroeconomic policies on agriculture will be discussed more thoroughly in Chapter D.

D. The Impact of Sector-Specific and Economy-Wide Policies on Agriculture: The Cases of Malaysia, Peru and Zimbabwe

I. Introduction

So far the question whether the agricultural sector is actually taxed or subsidized has been analyzed in a partial equilibrium setting, concentrating on the distortionary impact of agricultural policy and exchange rate policy on individual agricultural tradables. However, the size of agriculture in LDCs implies that any policy directed towards this sector inevitably affects other parts of the economy profoundly. Conversely, measures to promote and protect other sectors can severely hamper agricultural development. In this context, the domestic terms of trade between agriculture and the rest of the economy, which result from agricultural and macroeconomic policies,¹ emerge as a key issue. By changing the relative prices of importables, exportables and home goods, trade and exchange rate policies alter the structure of incentives throughout the economy, thereby affecting the sectoral allocation of investment, the level and composition of agricultural output and trade and the migration of labor from farms to urban areas. These issues are particularly important for LDCs, where governments in the 1970s and 1980s have failed to adjust their exchange rates despite acute foreign exchange shortages and have relied instead on increasing import restrictions.

This chapter discusses the extent to which agricultural policies - such as trade duties, subsidies, administered prices etc. - and macroeconomic policies - such as overall trade policy and exchange rate policy - affect the level and structure of incentives of agriculture vis-à-vis other sectors and, within agriculture, the structure of incentives of cash crops relative to food crops in three LDCs: Malaysia, Peru and Zimbabwe.

The importance of agriculture to the three economies and the policy environment is discussed first, in Section D.II. Then, we analyze the

¹ The terms macroeconomic policies and economy-wide policies are used interchangeable in this study. They are defined to encompass all those policies which have a significant influence on resource allocation without being intentionally directed towards agriculture.

extent to which the foreign trade regime has affected the relationship between tradable and home goods prices in the three countries, based on a general equilibrium model of exportables, importables and home goods (see Section D. III). The empirical analysis further distinguishes between different categories of export goods in the determination of the relative price effects vis-à-vis home goods. Following the framework of Krueger et al. [1988] in its approach to analyzing the effects of agricultural price policies (direct effects) and trade and exchange rate policies (indirect effects) on agriculture, Section D. IV examines the level of overall protection in Malaysia. This analysis extends earlier work of Jenkins and Lai [1989] in several areas, as will be shown below. Finally, Section D. V compares the results obtained here with those of other studies which applied the same methodology. The question whether food crops are treated more favorably than export crops, which was already raised in the cross-section analysis of Chapter C, is discussed again, now covering a much broader set of agricultural commodities on an individual country basis.

II. Agriculture in the Three Economies

1. Agricultural and Macroeconomic Performance

a. Recent Economic Trends

The three countries analyzed in our study have shown fundamentally different economic performances during the last two decades. On the one hand, Malaysia's economy appeared to be quite dynamic. Real GDP grew steadily - apart from a short recession in 1985-1986 - at fairly low inflation rates. On the other hand, Peru and Zimbabwe are characterized by a sequence of ups and downs rather than stable economic development.

Malaysia, as an open and resource-rich economy, gained from the price boom for petroleum and other primary commodities in the 1970s,¹

¹ As a result, palm oil production, for example, increased from 400,000 tons in 1970 to more than 2.5 million tons in 1980 [Rahman, 1990b].

which is reflected in high growth of real GDP at an average rate of about 8 percent between 1970 and 1980 (see Table 20). The development in the 1980s can be divided into three subperiods: the economic expansion of 1981-1984, the adjustment period 1985-1986 and the recovery beginning in 1987. At the turn of the decade, the Malaysian economy faced a sharp deterioration in the terms of trade because of a simultaneous reduction in prices for important export goods like petroleum, palm oil, rubber, sawlogs, tin, and cocoa [World Bank, 1988]. The subsequent decline in private investment was compensated by an ambitious heavy industrialization program launched by the government. Although protecting the economy from the global recession of 1981-1982, the costs of this policy were severe budget and current account deficits (see Table 21) which were mainly financed by foreign borrowing, and thus caused the Ringgit (Malaysian dollar, M\$) to appreciate.

To remove the imbalances, the government initiated a process of structural adjustment which started to bear fruits in 1985. Despite a further decline in the terms of trade, the current account improved due to a sharp reduction in imports of investment and intermediate goods which overcompensated the downturn in commodity and manufactured exports. Furthermore, a program of external debt refinancing was instituted. Internal developments, however, were considerably less favorable. Real GDP stagnated for two years, the worst performance since independence in 1957. Main factors that contributed to the recession were significant public expenditure cuts, the adverse terms of trade and the loss of international competitiveness as a result of an overvalued currency and real wage increases exceeding productivity growth [ibid.]. A significant real depreciation of the Malaysian dollar against the currencies of the major trading partners in 1986 and an improvement of the terms of trade were main causes for an export-led economic recovery in 1987. The upswing continued in 1988 and 1989 with growth rates of 8.7 and 8.5 percent, respectively, now being mainly investment-driven [UNIDO, 1991].

Peru's economic performance in the 1970s was determined by the strictly inward-looking development strategy of the military government. After a short period of fairly satisfactory growth, a combination of stagnant exports, a decline in export prices, heavy dependence on food

Table 20 - Macroeconomic Indicators of Malaysia, Peru and Zimbabwe 1971-1989 (a)

	Real GDP	Real GDP per capita	Consumer price index (CPI)
	(1985 prices)		(1985=100)
Malaysia			
1971-1975	7.5	4.4	6.3
1976-1980	8.6	5.5	4.5
1981-1984	6.7	4.1	5.8
1985-1986	0.1	-2.8	0.5
1987-1989	7.5	4.8	1.9
Peru			
1971-1975	5.3	2.8	10.0(b)
1976-1980	2.0	-0.8	48.8(b)
1981-1985	0.0	-2.6	91.6(b)
1986-1987	8.9	6.2	82.0(b)
1988-1989	-10.2	-12.9	2032.5
Zimbabwe			
1971-1975	3.9	1.4	5.1
1976-1980	0.6	-1.7	10.1
1981-1985	3.4	0.7	15.1
1986-1988	2.6	-0.1	11.4

(a) Average annual growth rates. - (b) 1980=100.

Source: IMF [1990].

imports and industrial intermediate goods, and a rapid increase in the burden of foreign debt caused a balance-of-payments crisis in 1975 and a subsequent recession from 1976-1978 [Thiele, 1991b]. By mid-1978, the government embarked on a stabilization program supported by the IMF and the World Bank which led to a slight economic recovery and a rapid improvement of the balance of payments.

President Belaúnde, who was elected in 1980, continued the import liberalization program of his predecessor. On the other hand, public investment was increased, especially for infrastructural projects [Mann, Pastor, 1989]. In 1980 and 1981, the Peruvian GDP grew by 4.7 and 5.5 percent, respectively. Declining terms of trade, the worldwide recession, an overvalued exchange rate and limited access to external funds as a result of the Peruvian debt overhang led to an economic stagnation in 1982. In the following year, the situation was further aggravated by the "El Niño" stream that caused floods in the North and droughts in the

Table 21 - Balance of Payments of Malaysia, Peru and Zimbabwe, 1980-1987 (US\$ mil.)

	Trade balance(a)	Current account(a)	Change in reserves(b)
Malaysia			
1980	2406	-285	-475
1982	-753	-3601	390
1985	3577	-613	-1204
1987	5839	2633	-1419
Peru			
1980	826	-101	-609
1982	-428	-1612	65
1985	1172	135	-124
1987	-521	-1481	855
Zimbabwe			
1980	106	-244	26
1982	-160	-709	24
1985	201	-76	-54
1987	381	48	-113

(a) Minus sign indicates debit. - (b) Minus sign indicates increase.

Source: IMF [1990].

South of Peru [World Bank, 1989]. Consequently, GDP declined by 12.3 percent in 1983. In addition, inflation rose steadily. The government reacted with a reversal of the import liberalization efforts and took measures to stabilize the economy, particularly a currency depreciation and a reduction of public expenditures. It achieved a recovery of the current account via a sharp decrease of imports (see Table 21) but could not overcome inflationary pressures and had to accept low economic growth.

In 1985, the new García government adopted a heterodox policy mix to stabilize the economy [Corsepius, 1989; Foders, 1987].¹ To break inflationary expectations, the exchange rate was devalued and then fixed and prices were frozen. Real wages and - later on - agricultural incomes were raised and public work programs initiated in order to achieve demand-led growth. Additionally, a wide range of imports were banned to encourage the use of slack capacities in local industry.

¹ Foders [1987] contrasts this heterodox policy with the orthodox policy option and concludes that the latter would be superior in the Peruvian context.

Finally, García announced a limit for debt service payments amounting to 10 percent of export revenues. At the beginning, the heterodox package seemed to be very successful. Real GDP grew by 10 percent in 1986 and 7.8 percent in 1987, and the inflation rate was reduced from 158 percent in 1985 to 63 percent in 1986. However, the fiscal deficit could not be controlled, which forced the inflation rate to increase again in 1987. Moreover, the exchange rate freeze led to a real appreciation of the Inti. The trade balance and the current account deteriorated, and international reserves became scarce as a result of very low fresh capital inflows which could not offset the current account deficit (see Table 21). The economy fell back into a deep recession - GDP declined by 8.5 percent and 12 percent in 1988 and 1989, respectively - accompanied by accelerated inflation.

The Zimbabwean economy experienced a period of moderate growth after the Unilateral Declaration of Independence (UDI) in 1970 and then - being subject to international sanctions since 1975 - fell into a recession that continued from 1976 to 1979 [Robinson, 1990]. When the country achieved independence in April 1980, the new government inherited an economy which was - as a result of the sanctions - diversified and industrialized and had a rather well-developed physical and administrative infrastructure, not only by African standards [Rukovo et al., 1991]. On the other hand, economic policymakers faced a number of difficulties like a very skewed distribution of income and a high degree of regulation. The "growth-with-equity" program introduced at independence achieved important early successes in terms of double-digit growth rates in 1980 and 1981 which were caused by expansionary monetary and fiscal policies, the lifting of sanctions, increasing world market prices for Zimbabwe's major agricultural and mining exports, and the inflow of foreign assistance [ibid.]. In 1982, real GDP growth slowed dramatically as a result of several factors: the global recession reduced the demand for Zimbabwe's exports and thus caused the balance-of-payments deficit to increase; measures to improve social services and to remove income inequalities as well as heavy subsidies to parastatals widened the budget deficit without generating growth; and finally, a severe drought cut into the country's ability to export agricultural commodities and necessitated food imports [World Bank, 1985]. Moreover, increased wages, rapid expansion of government spending and increased

domestic credit fueled inflation. In the following years, the economic performance was mixed. Low or negative growth rates in 1983, 1984 and 1987 again coincided with droughts and, the other way round, short booms in 1985 and 1988 profited from favorable weather conditions. This illustrates the close relationship between economic growth and agricultural performance and the heavy dependence of the latter on the climate. Obviously, policymakers were not able to overcome this dependence despite the relatively large and diversified manufacturing sector the country possesses.

b. Structure and Performance of Agriculture

Agriculture is still an important sector for all three economies, although its role is declining as in most LDCs. In 1987, about one third of the Peruvian and Malaysian workforce and even more than two thirds of the Zimbabwean workforce were employed in the agricultural sector (see Table 22). In terms of contribution to real GDP, agriculture still has a prominent position in Malaysia, where it was only recently overtaken by manufacturing. The share of Peruvian agriculture in real GDP (8 percent in 1989), by contrast, has rapidly fallen as a result of the strong bias against the sector caused by import substitution policies (see Sections D.II.2 and D.III). The priority given to industrialization also becomes apparent from the fact that most Peruvians (70 percent in 1989) live in urban areas, particularly in Lima. In the Zimbabwean economy, the agricultural share in GDP is rather low, but agricultural exports are still a main source of foreign exchange earnings and thus largely determine the country's ability to carry out essential imports like capital goods.

Malaysia's agricultural sector is predominantly export-oriented. Presently, about three quarters of agricultural output are attributable to the perennial export crops rubber, palm oil and cocoa [Rahman, 1990b]. Malaysia is the world's largest producer of natural rubber and the third largest producer of palm oil and cocoa.¹ Whereas its world market share

¹ Exact production figures for major Malaysian, Peruvian and Zimbabwean agricultural commodities for the period 1970-1987 are presented in Table A18. A comprehensive analysis of the cocoa industry is provided by Rahman [1990a].

Table 22 - Main Indicators of Agricultural Development, 1965-1989

	Malaysia	Peru	Zimbabwe
Share of agriculture in real GDP (percent)			
1965	28	18	18
1989	19	8	13
Share of agriculture in employment (percent)			
1970	54	47	77
1987	32	36	70
Share of urban population in total population (percent)			
1965	26	52	14
1989	42	70	27
Average annual growth of real GDP (percent)			
1965-1989	6.5	2.5	4.1
Average annual growth of agricultural production (percent)			
1965-1987	3.1	1.3	2.0
Average annual growth of food production (percent)			
1965-1987	3.4	1.6	2.4
Average growth of population (percent)			
1965-1987	2.5	2.6	3.3
Agricultural trade balance (US\$ mil.)			
1965/67(a)	+285.5	+229.5	+87.6
1986/88(a)	+2654.2	-303.8	+512.4(b)
Share of agricultural exports in total exports (percent)			
1965/67(a)	54.1	49.8	na
1986/88(a)	23.7	11.8	40.8
Share of agricultural imports in total imports (percent)			
1965/67(a)	29.7	17.0	na
1986/88(a)	11.4	19.2	3.9
Daily calory supply (per capita)			
1965	2307	2325	2044
1988	2686	2269	2232
(a) Average values for the three years. - (b) 1970/72. - na = not available.			

Source: FAO [c; e]; World Bank [1990; 1991]; own computations.

in rubber has declined from 50 percent in 1970 to 41 percent in 1987, world market shares in palm oil and cocoa have risen sharply in the same

period from 43 to 63 percent and from 1 to 9 percent, respectively. Rice is Malaysia's single most important food crop, the production of which has been subject to heavy public support since the First Malaysia Plan 1966-1970 in order to achieve a high degree of self-sufficiency. However, increasing costs of paddy production in the early 1980s, especially in marginal areas, led the government to concentrate paddy production in selected granary areas. As a consequence, output decreased in recent years and the self-sufficiency ratio was scaled down to about 60 percent [Rahman, 1990b].

From an aggregate viewpoint, the performance of Malaysia's agricultural sector can be regarded as rather satisfactory. In the period 1965-1987, overall output grew by 3.1 percent, on average, and the growth of food production exceeded population growth, thus indicating an increase in per capita domestic food supply (see Table 22). The improved nutritional standard of the country is also reflected in a higher daily calory supply per capita. The external position of the agricultural sector is characterized by an increasing surplus in the trade balance, as exports have grown far more rapidly than imports.

The agricultural indicators for Peru sharply contrast with those for Malaysia. Production expanded slowly during the period considered; in particular, food production could not keep pace with population growth. Output figures for all major Peruvian foodstuffs - potatoes, rice, maize, and wheat - almost stagnated between 1970 and 1987 (see Table A18). Even heavy food imports did not raise the food supply: in 1988, the daily per capita supply of calories was below its 1965 level and significantly below the average of all middle-income LDCs. Moreover, the increasing dependence on food imports has turned the agricultural trade balance into deficit. Opposite to what one would expect in an industrializing economy, the share of agricultural imports in total imports rose between 1965/67 and 1986/88. The agricultural trade situation was further exacerbated by a sluggish export performance. Sugar and cotton, Peru's most important export crops of the 1960s, experienced a dramatic decline during the last two decades. In 1983, Peru became a net importer of sugar. Since then, sugar exports were only made in order to take advantage of the premium prices offered within the US sugar quota [Bolling, 1989]. The world market share of cotton decreased from 4 percent in 1963 to 1.5 percent in 1986. Only coffee, which emerged as a

new export crop in the 1960s, somewhat increased its world market share from 1.2 percent to 1.9 percent [Herrmann et al., 1990].

Zimbabwe's agricultural performance has been mixed since 1965. On the one hand, total agricultural as well as food production growth fell short of the (very high) population growth, which may partly be explained by repeated droughts that caused extreme temporary output reductions for certain commodities, particularly maize (see Table A18). On the other hand, Zimbabwe's reliance on food imports is very weak. The country has achieved self-sufficiency for its main staple, maize, and does even produce a significant exportable surplus if weather conditions are favorable.¹ Wheat is the only major foodstuff that has to be imported regularly. Zimbabwe's single most important export crop, tobacco, currently accounts for about 50 percent of total agricultural export revenues and reached a world market share of 6.5 percent in 1987. Other major cash crops are cotton, sugar, tea, and coffee. Considerable agricultural exports together with low food imports are responsible for a surplus in Zimbabwe's agricultural trade balance.

A common feature of the agricultural sectors in all three economies is a certain degree of dualism. Such dualistic structures are most prominent in Zimbabwe as a result of the racial discrimination before independence. One can clearly distinguish two subsectors in that country: a modern, technologically advanced sector, comprising about 4,200 large-scale commercial farmers who own about 12.8 million hectares of land; and the traditional smallholder's sector, comprising over 800,000 farm families who account for about 16.4 million hectares of land [Rukovo et al., 1991]. Similar differentiations are possible in Peru between irrigated coastal agriculture and subsistence farming in the Highlands and, to a lesser extent, in Malaysia between the growing of rubber, palm oil and cocoa on estates and by smallholders, respectively.

A comparison of the agricultural and the general economic performance in the three countries reveals as an interesting peculiarity that the ranking is the same in both categories. Malaysia shows the highest growth rates of agricultural production and real GDP, followed by Zimbabwe and Peru (see Table 22). This result adds to the evidence that

¹ Only in 1984, Zimbabwe had to import maize as a result of an extremely bad harvest caused by a drought.

agriculture is an important sector in economic development and that industrialization at the expense of agriculture - like in Peru - can hardly be successful.¹

2. Agricultural, Trade and Macroeconomic Policies

Against the background of the general economic and agricultural indicators presented in the previous subsection, we will now provide a short survey of the policies adopted in the three economies which directly or indirectly affect the agricultural sector.

a. *Agricultural Pricing Policies*

Government interventions directed towards agricultural prices are widespread in DCs as well as LDCs and are justified by several reasons like food security and the securing of sufficient and stable farm incomes (see Chapter C).

In Malaysia, rubber and palm oil exporters have to pay a progressive export tax that is collected for revenue purposes and also smoothes out price fluctuations.² Moreover, both commodities are subject to a research cess, and an additional cess is imposed on rubber for replanting. Since these cesses are earmarked, they are, however, of indirect benefit to the rubber and palm oil sector. The NRPs reported in Table 23 thus overestimate the actual discrimination against the two export crops which appears to be rather modest, especially in the 1980s. The price of cocoa, Malaysia's third most important agricultural export commodity, is fully determined by world market conditions. By contrast, strict price regulations are at work in the rice market. Paddy farmers receive a GMP that usually lies above the world market equivalent, thus

¹ Hwa [1988] shows for a cross section of countries that there exists a significant linkage between agricultural and industrial development and that agricultural growth induces productivity increases and thereby facilitates overall economic growth.

² Jenkins and Lai [1989] provide a detailed description of the pricing policies towards Malaysia's major agricultural commodities.

Table 23 - Average NRPs for Major Agricultural Commodities, 1963-1989 (percent)

Malaysia	1970-1980	1981-1988
Rice	+22	+154
Smallholder rubber	-22	-12
Estate rubber	-17	-11
Palm oil	-13	-10
Cocoa	0	0
Peru	1963-1980	1981-1985
Maize	+2	+18
Wheat	+23	+31
Rice	-45	-49
Cotton	-72	-66
Coffee	-53	-65
Zimbabwe	1972-1979	1980-1989
Maize	-22	+30
Wheat	+11	+6
Cotton	-9	-4
Groundnuts	-22	-15
Soyabeans	-7	-24
Beef	+53	+100
Red sorghum	+18	+111
White sorghum	+18	+169

Source: Herrmann [1990b]; Rahman [1990b]; Rukovo et al. [1991].

reflecting the country's striving for self-sufficiency with regard to this staple food crop. In addition, the GMP is a means of poverty eradication among paddy farmers who are almost all Malays.¹ The price subsidization of rice production has steeply increased in the 1980s compared to the 1970s (see Table 23). Apart from the GMP, Malaysian paddy farmers also gain from input subsidies like cheap fertilizer and public drainage and irrigation projects.

Peru has continuously taxed its major export crops, coffee and cotton, since the beginning of the import substitution policy in the early 1960s. Although producer prices are generally intervention-free, they are dropped far below world market prices through high export duties. Moreover, export prices are closely related to volatile world market

¹ The improvement of the living standard, especially for the indigenous Malayan population, is a key objective of the new economic policy (NEP) which was implemented in 1970.

prices, while food prices are more effectively stabilized [Herrmann, 1990b]. Peru's food price policy has made use of consumer subsidies and a system of guaranteed producer prices. The price system is administered by two public enterprises that have generally granted favorable prices to wheat and maize farmers while taxing rice producers. During the 1980-1985 period, some steps were taken to eliminate price controls and food subsidies [Bolling, 1988]. In 1985, regulations were sharpened again. Producer prices for the major food crops were significantly raised in order to encourage import substitution in agriculture. In addition, production costs were kept low via subsidized credits and fertilizer. This policy mix could not be financed any longer in late 1988, so that prices were freed [see Corsepius, 1989].

The Zimbabwean government has treated the agricultural sector rather favorable, on average, at least compared to other countries in Sub-Saharan Africa. All agricultural prices, for consumers as well as producers, are fixed by state-owned marketing boards and do more likely reflect the bargaining power of the groups involved in the decision process than efficiency considerations [Jansen, 1982]. Extensive consumer subsidies together with sharply raised producer prices for some commodities (maize, beef, sorghum) led to severe losses of the marketing boards in the 1980s which had to be financed by the government and thus exacerbated the Zimbabwean budget deficit.¹

b. Trade and Macroeconomic Policies

Nonagricultural import protection as well as macroeconomic instruments like fiscal, monetary and exchange rate policies indirectly affect the agricultural sector via changes in the real exchange rate, either measured as the relative price between tradables and nontradables or as the relation of domestic to foreign inflation. Import tariffs raise the relative price of nontradables (see Section D.III), while expansionary public expenditure programs fuel domestic inflation. Both policies end up in a real appreciation and discriminate against agriculture, especially

¹ In 1984/85, for example, subsidies for the marketing boards accounted for 3.6 percent of the total government budget [Thomson, 1988].

agricultural exports, if they are not accompanied by sufficient nominal devaluations.

Malaysia initiated a first phase of import substitution in the mid-1960s. As a result, the average ERP for manufacturing rose from 25 percent in 1965 to 44 percent in 1970 [Ariff, Semudram, 1990]. After this early stage of import substitution was almost completed in the mid-1970s, the system of protection was curtailed stepwise, but it is still in force and works against exports except in the free trade zones, where producers have duty-free access to imported inputs and machinery and additionally receive several export incentives [ibid.].

Recent macroeconomic policies in Malaysia have to be viewed as a consequence of the resource boom in the 1970s. A large proportion of the windfall profits was spent on nontradables, e.g., in the construction sector whose relative price rose in the early 1980s. Moreover, the foreign exchange inflow led to a credit expansion that fueled inflation, and the heavy industrialization program widened the fiscal deficit which was mainly financed by foreign borrowing. Both effects contributed to a significant real appreciation of the Malaysian dollar between 1980 and 1984 (see Table 24). At the end of 1984, the Malaysian dollar was estimated to be overvalued by 20 percent [ibid.]. The adjustment package in 1985-1986 contained a fiscal and monetary restraint as well as a nominal devaluation. Consequently, the real exchange rate depreciated. In the following years, monetary policies were directed at the maintenance of price stability, the size of the public sector was reduced, and the exchange rate was geared to market forces [UNIDO, 1991]. For the agricultural sector, this meant a considerable reduction of indirect taxation (see Section D.IV).

Peru's economic policies since the 1960s have been dominated by an inward-looking industrialization strategy based on heavy import protection. Especially the military regime of General Velasco insulated the Peruvian economy from world markets. In 1978, the average tariff rate for imports amounted to 66 percent [World Bank, 1989].¹ After a short liberalization phase, that brought about a tariff reduction to 32 percent in 1981, balance-of-payments problems caused a return to more protectionist policies in 1984. This trend was continued by the García ad-

¹ This rate does, of course, not include nontariff barriers like the comprehensive import licensing scheme that restricts exports to Peru.

Table 24 - Real Exchange Rate Movements, 1980-1989

	Real exchange rate index									
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Malaysia(a)	90.6	91.0	96.7	101.3	105.3	100.0	83.9	79.6	72.2	70.9
Peru(b)										
Imports	100.0	83.8	87.1	89.9	86.8	109.7	89.4	72.2		
Exports	100.0	85.5	89.2	92.9	89.3	102.6	90.5	91.7		
Zimbabwe(c)	100.0	83.7	72.6	71.5	76.0	72.3	67.4	64.3		

(a) Real effective exchange rate as calculated by the IMF. An increase of the index indicates an appreciation. - (b) Real effective exchange rate as calculated by the Economic Commission for Latin America (ECLA) for exports and imports, respectively [see Corsepius, 1989]. An increase of the index indicates a depreciation. - (c) Real exchange rate defined as the relative price between tradables (approximated by the trade unit value index) and nontradables (approximated by the building materials price index). An increase of the index indicates a depreciation.

Source: Corsepius [1989] for Peru; IMF [1991] for Malaysia; Masters [1991] for Zimbabwe.

ministration, so that the average legal tariff rate had risen back to the 1978 level in 1987.

An important instrument of Peru's macroeconomic policy is the exchange rate. Between 1978 and 1985, the Sol was gradually devalued under a crawling peg system. However, a real appreciation of the currency could not be avoided, because expansionary demand policies fueled inflation (see Table 24). The García administration devalued the official exchange rate drastically and held it fixed after that. Moreover, the government introduced a system of multiple exchange rates which had the objective to support nontraditional exports and to subsidize priority imports, including the staples maize and wheat. With respect to agriculture, the multiple exchange rates caused a further discrimination against the traditional export crops and counteracted the endeavors to reduce the dependence on imported food. In view of a dramatic real appreciation of the Inti¹ (see Table 24), the government returned to a crawling peg in December 1986 and carried out several discretionary

¹ The Inti substituted the Sol as the Peruvian currency in 1986.

devaluations but could not offset the accelerated inflation that resulted from the demand-led growth model.

In the case of Zimbabwe, Masters [1991] has shown for the period 1966-1988 that the inflation differential between Zimbabwe and its major trading partners was almost fully compensated by nominal exchange rate changes, thus keeping purchasing power parity roughly constant. During the UDI period, the nominal exchange rate was more or less constant, while the money supply grew faster than nominal GDP and the government deficit exploded. The resulting inflationary pressure was suppressed by strict price controls and the rationing of imports. After independence, the now open inflation was stopped by fiscal and monetary restraints. In addition, the Zimbabwean dollar was substantially devalued in 1982 to regain the country's international competitiveness. However, the new government also introduced a national minimum wage. The following steep real wage increase pushed up the relative price of non-tradables. The nominal devaluation had only a temporary effect and could not stop this real appreciation (see Table 24) that led to a significant transfer out of the agricultural sector [ibid.].

III. The Incidence of Industrial Import Protection on Agricultural Exports in Malaysia, Peru and Zimbabwe

1. The Analytical Framework

The starting point for the empirical investigation of the incidence of protection is a simple general equilibrium model [Dornbusch, 1974] based on the following assumptions:

- (1) A small open economy with constant factor endowment and real income that produces and consumes three different types of goods - importables (M), exportables (X) and nontradables (N).
- (2) Home goods and both tradables are substitutable in production and consumption, whereas substitution possibilities between exportables and importables are ruled out.¹

¹ This assumption can be relaxed, as is shown by Greenaway and Milner [1988a], who discuss the case of intra-industry trade, where importables and exportables are substitutable.

- (3) In the initial (free-trade) situation, the trade balance is in equilibrium, and all prices (p_M, p_X, p_N) are set equal to unity.
- (4) Uniform import tariffs (t) and uniform export subsidies (s) are regarded as possible commercial policy instruments.
- (5) The exchange rate is fixed, but the relative prices of both traded goods in terms of home goods are flexible, i.e., market clearing is guaranteed.

According to the small country assumption, the prices of the tradables in domestic currency are determined by the world market price, the exchange rate and the policy interventions applied at home. The price for nontradables, however, is a function of domestic supply and demand, but is also affected by commercial policies.

Let us now suppose the introduction of a uniform tariff that disturbs the initial equilibrium via an increase in the relative prices p_M/p_N and p_M/p_X . This change in relative prices causes adjustments on the supply and demand side.¹ On the one hand, firms in the import-competing sector get incentives to increase their production and thereby divert resources from the other sectors. On the other hand, consumers shift from now more expensive import goods to nontradables and exportables. As a consequence of these substitution processes, the home good sector faces an excess demand and a subsequent price increase. To what extent must the price for nontradables rise in order to induce a new equilibrium?² Since the market for nontradables was initially cleared, a new general equilibrium requires an equiproportional change of both demand and supply, i.e.,

$$[77] \quad \hat{D}_N = \hat{S}_N.$$

Such changes in demand and supply are, in turn, a function of (relative) price movements. Thus,

¹ The price and quantity movements in response to the introduction of an import restriction are shown graphically in Section B.II.5 for all individual markets.

² Dornbusch [1974] has shown that equilibrium in the market for nontradables coincides with balanced trade. Hence, it is sufficient to investigate the equilibrium properties of either the home good or the tradable sector.

$$[78] \quad \hat{D}_N = \delta_X \hat{p}_X + \delta_N \hat{p}_N + \delta_M \hat{p}_M$$

and

$$[79] \quad \hat{S}_N = \epsilon_X \hat{p}_X + \epsilon_N \hat{p}_N + \epsilon_M \hat{p}_M$$

where ϵ and δ are the compensated supply and demand price elasticities for nontradables with respect to X, N and M, and a hat " $\hat{}$ " denotes a proportionate change. By setting Equation [78] equal to Equation [79], solving for \hat{p}_N and making use of the homogeneity constraint

$$[80] \quad \sum_i \epsilon_i = \sum_i \delta_i = 0,$$

one obtains the price increase that is necessary to clear the home good market as

$$[81] \quad \hat{p}_N = \omega \hat{p}_M + (1-\omega) \hat{p}_X$$

where

$$[82] \quad \omega = \frac{\delta_M - \epsilon_M}{\epsilon_N - \delta_N}.$$

The ultimate change of \hat{p}_N thus depends on the substitutability between home goods and importables in supply and demand. The more (less) elastic consumers and producers react to relative price changes, the higher (lower) must be \hat{p}_N to remove the disequilibrium in the market for nontradables. Apart from the two corner solutions, which are discussed in Section B.II.5, the new equilibrium has the following characteristics: the domestic price of importables has increased relative to the price of exportables by the full amount of the tariff. It has also risen relative to the price of home goods but by less than the full amount of the tariff. Finally, the price of exportables has declined relative to both other prices. In other words: only a part of the tariff turns out to be of advantage for the import substitution sector, the rest is shifted to the producers of exportables as an implicit tax. The extent of the shift

is measured by means of the incidence parameter, ω , that ranges between zero and unity and is the higher the closer the substitution of relationship between importables and home goods is (see section B. II. 5).

Having estimated the incidence parameter, it is possible to calculate true tariff and true subsidy rates [Greenaway, Milner, 1987]. The true tariff is defined as the change in the price of importables relative to home goods ($\Delta(p_M/p_N)$). Hence, it measures the incentives for resource reallocations between the import-competing and the nontradable sector but not the protection against foreign competitors which is analyzed by the conventional concepts like NPC and EPC.

Since the prices of importables and nontradables have increased to $1+t$ and $1+d$, respectively,¹ where d equals \hat{p}_N , the true tariff (t^*) is given by

$$[83] \quad t^* = \Delta \left(\frac{p_M}{p_N} \right) = \frac{1+t}{1+d} - 1 = \frac{t-d}{1+d}$$

where

$$[84] \quad d = \hat{p}_N = \omega \hat{p}_M + (1-\omega) \hat{p}_X \\ = \omega t + (1-\omega) s.$$

Analogously, the true subsidy (s^*) measures the relative price change of exportables in terms of nontradables ($\Delta(p_X/p_N)$). It is defined as

$$[85] \quad s^* = \Delta \left(\frac{p_X}{p_N} \right) = \frac{1+s}{1+d} - 1 = \frac{s-d}{1+d}.$$

The true tariff equals the nominal tariff (t) if importables and nontradables are not substitutable. In all other cases, it is lower and can even become zero if home goods and importables are perfect substitutes. Import protection also leads to true subsidies ranging below nominal subsidies (s) via an increase in the price of nontradables apart from the

¹ According to assumption (3), both prices were initially equal to unity. This implies, of course, that the relative price p_M/p_N was also unity.

situation where home goods and importables cannot be substituted. Put differently: the import substitution policy does, in general, only partly achieve its objective of creating incentives in the protected industries and, over and above that, discriminates against exports.

2. Empirical Results

Based on these theoretical considerations, we estimated incidence parameters and true incentives for Malaysia, Peru and Zimbabwe by applying the Equations [81], [83] and [85].

a. *The Incidence of Protection*

In order to obtain the appropriate regression equation, we rewrite Equation [81] as

$$[86] \quad (\hat{p}_N - \hat{p}_X) = \omega(\hat{p}_M - \hat{p}_X).$$

Since the theoretical model focuses on changes in relative prices, Equation [86] is further transformed into the double logarithmic form

$$[87] \quad \ln(p_N/p_X)_t = \text{constant} + \omega \ln(p_M/p_X)_t + u_t$$

where u_t is a stochastic disturbance term. Equation [87] shows that the incidence parameter has to be interpreted as the elasticity of the price of nontradables relative to exportables with respect to the price of importables relative to exportables. ω could now be estimated from Equation [83]. One must keep in mind, however, that the regression is based on time series data and thus the theoretical assumptions of constant real income and balanced trade appear to be unrealistic. Consequently, income (Y) - as measured by GDP per capita - and the balance of trade (BOT) are additionally included into the regression. That is,

$$[88] \quad \ln(p_N/p_X)_t = \text{constant} + \omega \ln(p_M/p_X)_t + \alpha \text{BOT}_t + \beta \ln Y_t + u_t.$$

Moreover, as shown by García [1981], the regression equation may be disaggregated to account for subsectors among exportables and importables. Then, the following specification is valid:

$$[89] \ln(p_N/p_{XA})_t = \text{constant} + \omega_1 \ln(p_M/p_{XA})_t + \omega_2 \ln(p_{XNA}/p_{XA})_t \\ + \alpha \text{BOT}_t + \beta \ln Y_t + u_t$$

where p_{XA} either denotes the price index for individual agricultural export commodities or a price index for all agricultural exports, and p_{XNA} is a price index for all exportables not included in p_{XA} . All export price indices are weighted by the export shares.

The results for the shift parameters, obtained by estimating Equations [88] and [89], are presented in Table 25.¹ In each case, the Cochrane/Orcutt iterative procedure was used, because the ordinary least square (OLS) estimates suffered from positive autocorrelation. The coefficient of determination was always satisfactory, and the incidence parameters appeared to be statistically different from zero at least at the 10 percent significance level.

The high values of the incidence parameters reported in Table 25 indicate that - with the exception of beef in Zimbabwe - a major part of import tariffs is shifted to the export sector as an implicit tax. This result holds true for all countries considered and for total exports as well as individual agricultural exports. It implies that home goods and importables are, in general, fairly close substitutes in production and consumption, while the relationship between exportables and home goods is weak. The imposition of a one percent uniform tariff on Malaysian imports, for example, would raise the price ratio between nontradables and total exports by 0.78 percent, the relative price of home goods in terms of palm oil even by 0.91 percent, thus creating strong incentives to divert resources from the export sector. Significant resource movements between the import substitution and the home good sector are, by con-

¹ The complete results of the regressions, including goodness of fit statistics and detailed information on the data sources applied, are provided by Herrmann et al. [1990] for Malaysia and Peru and by Wiebelt [1990b] for Zimbabwe. These authors also tested the sensitivity of the incidence parameter ω with respect to different model specifications.

Table 25 - Estimates of the Incidence Parameter ω (a) for Total Exports, Total Agricultural Exports and Individual Agricultural Exports in Malaysia, Peru and Zimbabwe, 1960-1987

	Malaysia(b)	Peru	Zimbabwe
	1960-1985	1970-1985	1966-1987
Total exports	0.78	0.88	0.76
Total agricultural exports			0.65
Individual agricultural exports			
Rubber	0.68		
Palm oil	0.91		
Cocoa	0.79		
Fishmeal		0.88	
Coffee		0.88	0.76
Cotton		0.85	0.65
Maize			0.65
Tobacco			0.68
Beef			0.43

(a) The incidence parameter ω is defined in Section B.II.5, Equation [41]. - (b) The regressions for Malaysia were run without income and balance-of-trade variables.

Source: Herrmann et al. [1990, Tables 2 and 4]; Wiebelt [1990a, Table 1].

trast, rather unlikely, because the import tariff does only slightly change the respective relative price.

The results discussed so far are all based on the regression Equations [88] and [89]. It may be, however, that the estimates for ω depend on the model specification chosen [see Smeets, 1989; Meester, 1986]. We, therefore, tried several alternative specifications: the balance-of-trade and income variables were omitted, different lag structures were introduced, the weights for the export price index for nonagricultural commodities (p_{XNA}) were changed, and various proxies were used for the home good price index [see Herrmann et al., 1990; Wiebelt, 1990a].

As can be seen from Table 26, which shows the range of ω estimates, the incidence parameters are fairly stable across different model specifications. Except for beef in Zimbabwe, they always rank above 0.5 and in some models even lie around unity. Hence, the sensitivity analy-

Table 26 - The Sensitivity of the Incidence Parameter ω to Different Model Specifications, 1960-1987

	Malaysia	Peru	Zimbabwe
	1960-1985	1970-1985	1966-1987
Total exports	0.78	0.72-0.92	0.66-0.82
Total agricultural exports			0.53-0.70
Individual agricultural exports			
Rubber	0.68-0.86		
Palm oil	0.91-1.03		
Cocoa	0.75-1.12		
Fishmeal		0.57-1.01	
Coffee		0.55-1.07	0.65-0.84
Cotton		0.64-1.05	0.59-0.68
Maize			0.57-0.76
Tobacco			0.55-0.73
Beef			0.29-0.47

Source: Wiebelt [1990a, Table 3].

sis confirms our conclusion that total exports and individual agricultural exports bear a major burden of import protection in Malaysia, Peru and Zimbabwe.

b. True Incentives

The similarity of the incidence parameters for all three countries does not imply that agricultural exports are treated similarly. In order to assess whether, and to what extent, agricultural exports are discriminated against, we must additionally know the nominal protection for manufacturing and the agricultural export crops. The estimated shift parameters can then be combined with nominal tariffs and nominal export subsidies to calculate true tariffs and true subsidies according to Equations [83] and [85].

The true protection concept focuses on relative price changes of importables and exportables caused by trade restrictions, both in terms of nontradables. Import tariffs as well as export subsidies can raise the price of nontradables. In our analysis, however, we assume the in-

roduction of an import tariff at given export subsidies, thus ruling out repercussions from export subsidies or export taxes on home good prices.¹ As a consequence, Equation [84] reduces to

$$[90] \quad d = wt.$$

The true tariffs and true subsidies calculated in this way reflect upper bounds - in the presence of nominal export subsidies - or lower bounds - in the presence of nominal export taxes - for the actual incentives.

Table 27 contains average true tariff and true subsidy rates for Malaysia, Peru and Zimbabwe. Peru exhibits by far the highest industrial protection level which reflects the country's strong priority given to an inward-looking development strategy. In Malaysia and Zimbabwe, import protection appears to be rather moderate in the period considered. With regard to the true incentives for manufacturing, the difference between the three countries almost disappears: in each case, import protection is followed by a price increase for nontradables which is nearly as large as the price increase for importables. The close substitutability between home goods and importables thus prevents the intended creation of significant incentives for resource reallocations between both sectors, as is indicated by very low true tariffs. An impressive example for this phenomenon is given by Peru, where a nominal tariff of 71 percent turns into a true tariff of 7 percent only.

Government interventions with regard to agricultural exports are extremely different in the three countries considered:² Malaysia, traditionally being export-oriented, taxes its major export crops, rubber and palm oil, but on a rather low level.³ Cocoa, the third important Malaysian agricultural export commodity, is not subject to government interventions. Zimbabwean policymakers tend to subsidize the agricultural

¹ For a discussion of the conflict arising from simultaneous import protection and export promotion, see Greenaway and Milner [1987] or Greenaway [1989].

² The values in Table 27 are unweighted averages and thus do not cover the variations of export subsidies from year to year. Yearly figures are provided by Wiebelt [1990a] for Zimbabwe and by Herrmann et al. [1990] for Malaysia and Peru.

³ The policy instruments used are surveyed in Section D. II.

Table 27 - Estimates of True Tariffs and Subsidies for Malaysia, Peru and Zimbabwe, 1980-1987 (percent) (a)

	Malaysia	Peru	Zimbabwe
	1980-1985	1980-1985	1981/82-1986/87
Nominal protection on manufacturing (t)(b)	17	71	28
Incidence parameter (ω)	0.78	0.84	0.75
True tariff (t*)(c)	3.5	7	6
Nominal subsidies (s)			
Estate rubber	-15		
Smallholder rubber	-16		
Palm oil	-9		
Cocoa	0		
Coffee		-60	
Cotton		-77	-2
Maize			46
Beef			108
True subsidies (s*)(c)			
Estate rubber	-24		
Smallholder rubber	-25		
Palm oil	-21		
Cocoa	-13		
Coffee		-75	
Cotton		-86	-17
Maize			21
Beef			86

(a) Unweighted averages. - (b) The NRP is an unweighted average of implicit import tariffs for total manufactures as calculated by Erzan et al. [1989] and includes all import charges but no nontariff barriers. - (c) The true tariff rate and the true subsidy rate are defined in Equations [83] and [85]. True subsidies and true tariffs are calculated with the incidence parameters reported in Table 25.

Source: Thiele [1991a, Table 4]; Wiebelt [1990a].

sector. There is, however, an enormous range of protection for individual goods running from moderate taxation to heavy subsidization. By contrast, Peru is characterized by a very unfavorable treatment of its major export crops, coffee and cotton, which must be viewed as a consequence of the country's industrialization strategy.

The true subsidies lie substantially below nominal subsidies, thus reflecting that import restrictions do not only, for the most part, miss their original objective of changing relative prices in favor of import-substituting activities but also impose an implicit tax on agricultural

exports. The tax on Malaysian palm oil, for example, more than doubles when indirect effects resulting from import protection are included. Malaysian cocoa and Zimbabwean cotton, which are neither taxed nor subsidized by agricultural price policies, receive significant negative true subsidies. These two examples illustrate that there may occur inconsistencies between sector-specific and economy-wide policies. Hence, successful agricultural planning is hardly possible without consideration of commercial policies, as is indicated by the high incidence of import protection. Along the same lines, one can argue that an improvement of the production incentives for agricultural export commodities in Peru, for example, requires both price adjustments and a trade liberalization.

IV. The Effects of Agricultural and Macroeconomic Policies on Agricultural Incentives in Malaysia

The import substitution bias in Malaysian industrial policy and the resulting appreciation of the real exchange rate (measured as the relative price between tradables and home goods) discussed in the previous sub-section indirectly affected the prices of agricultural commodities relative to nontradable goods. Moreover, the "export boom" of the 1970s, reflecting massive increases in foreign exchange inflows from the export of petroleum, palm oil, electronics, textiles and timber, and the more traditional commodities (rubber, tin, etc.), has also caused important shifts in the expenditure patterns, resource flows, employment, and the structure of domestic production and imports.¹ Evidence suggests that the failure of the exchange rate to adjust appropriately has had adverse effects on agriculture and, with escalating costs in the sector, may have lowered returns for a major part of traditional agricultural commodity production. This, in turn, has led to a fall-off in investment in the sector and to the initiation of specific interventions to offset the biased structure of macroeconomic incentives. Because the domestic terms of trade have moved strongly against agriculture as a result of macro level

¹ The export boom of the 1970s is described in World Bank [1984]. The transmission mechanisms by which the oil boom and trade policy affected agricultural incentives in Malaysia are investigated by Wiebelt [1991a; 1991b] using a multisectoral, general equilibrium model.

developments, it is possible that a number of micro level policy interventions would be redundant, once corrective actions are taken to the government's overall macro stance.

This question will be investigated more thoroughly in this subsection. Following the framework set forth in Krueger et al. [1988], which is outlined in Section B. II.6, the effects of agricultural trade and pricing policies (direct effects) are quantified in terms of NRPs and ERPs for major agricultural commodities, calculated using historical nominal exchange rates in determining border prices. The (indirect) effects of overall trade policy and appreciation of the real exchange rate are then included in measures of the total effects on prices and value added by using free-trade equilibrium real exchange rates. The analysis extends earlier work on Malaysia by Jenkins and Lai [1989] in several areas.

The period of investigation is extended to include the total macro-economic expansion period 1981-1984 as well as the adjustment period 1985-1986 and the recovery period 1987-1988. The commodity coverage is also extended to include cocoa as another important cash crop. Moreover, variable input coefficients from different input-output tables are used to compute ERPs. And finally, an attempt is made to isolate the indirect effects resulting from trade policy and those emanating from macro policies.

1. Measures of Intervention

a. Direct Effects on Output Prices: Nominal Rates of Protection

Agricultural trade and price policies (including trade taxes, quotas, administered prices, and marketing and processing subsidies) have a direct effect on output prices. NRPs measure these direct effects on output prices by comparing actual domestic prices with free-trade prices that would prevail in the absence of government intervention, i.e.,

$$[91] \hat{=} [1] \text{NRP}_i = (p_i - p_i^*)/p_i^*$$

where NRP_i is the NRP on good i , p_i is the domestic producer price of good i , and p_i' is the border or world market price of good i adjusted for transport and other marketing costs. Since the interest in this section is in incentives at the producers' level, NRPs are calculated based on prices received by farmers. For the export crops - rubber, palm oil and cocoa - p_i is derived by adjusting the fob prices by all relevant charges between the farm gate and the point where the fob price is quoted. These include local marketing and transport costs and export taxes. For paddy, the only food crop included, the producer price is the GMP. In general, for an exportable good, the border price measured at the farmgate (export parity price) is defined as the fob price less the cost of export handling, transport and marketing. For paddy, the border (import parity) price is obtained by deducting the estimated miller's overhead costs and profits from the cif price and converting it to paddy equivalents using the conversion factor of 0.65 for paddy/rice. The cost of milling and drying the paddy and transporting the wet paddy to the drying centre are then deducted.¹

b. Indirect and Total Effects

NRPs, calculated using the official exchange rate, measure only the direct effects of agricultural policy. However, trade policies and exchange rate policies affect border prices and the opportunity costs of production and consumption. In order to capture these indirect effects of misalignment of the exchange rate, the indirect effects of trade on non-agriculture and of exchange rate policies on farm prices can be measured as (see Section B. II. 6):

$$[92] \hat{=} [48] \quad NRP_I = \frac{p_i'/p_{NA}}{p_i^*/p_{NA}^*} - 1 = \frac{p_i'/p_{NA}}{(e^*/e_0)(p_i^*/p_{NA}^*)} - 1 = \frac{e_0/p_{NA}}{e^*/p_{NA}^*} - 1$$

where p_i' is the border price of a commodity evaluated at the official exchange rate and p_i^* at the equilibrium exchange rate. p_{NA} is the actual

¹ A more detailed description of the price calculations together with the relevant data sources is provided by Rahman [1990b].

price index of nonagriculture as defined in Equation [49]. P_{NA}^* is the price index of nonagricultural products evaluated at the equilibrium exchange rate and in the absence of trade policy measures affecting nonagricultural tradables. This price index is defined as (see Section B. II. 6):

$$[93] \quad \hat{=} [50] \quad P_{NA}^* = \alpha \cdot \frac{P_{NAT} \cdot e^*}{(1+t_{NA}) \cdot e_0} + (1-\alpha) \cdot P_{NAH}$$

In Equations [92] and [93], e^*/e_0 measures the exchange rate adjustment necessary to eliminate any prevailing current account imbalances and any impact on the exchange rate of trade and pricing policies.¹ The exchange rate adjustment is estimated as follows:

$$[94] \quad e^*/e_0 = \frac{Q_0 + [t_m/(1+t_m)] \cdot \eta_D \cdot Q_D - [t_x/(1-t_x)] \cdot \epsilon_S \cdot Q_D}{\epsilon_S \cdot Q_S + \eta_D \cdot Q_D} + 1$$

where e^* and e_0 are defined as above.

Q_0 = unsustainable deficit in the current account,

η_D = the elasticity of demand for foreign exchange (the elasticity of demand for imports),

Q_D = the demand for foreign exchange (the level of import demand),

ϵ_S = the elasticity of supply of foreign exchange (the elasticity of supply of exports),

Q_S = the supply of foreign exchange (the level of exports),

t_M = the average implicit tariff rate,

t_X = the average implicit export tax rate.

The above measure of indirect protection (Equation [92]) ignores changes in the price of agricultural tradables. However, long-term investments in agriculture are a function of the relative prices of agricultural and nonagricultural goods (the domestic terms of trade of agri-

¹ For the definition of the other variables and parameters of Equation [93], see Section B. II. 6.

culture). Thus, the ratio of the output price of a commodity to the price of nonagricultural goods is the appropriate measure of the incentives:

$$[95] \hat{=} [46] \text{NRP}_T = \frac{P_i/P_{NA}}{P_i^*/P_{NA}^*} - 1$$

This equation measures the combined effect of sectoral and economy-wide price interventions on agricultural prices and is a measure of the price incentives used in the empirical analysis; the total effect on output prices can thus be interpreted as foreign protection adjusted by sectoral and economy-wide policies. The difference between Equations [95] and [92] yields another direct protection rate (see Section B. II. 6)

$$[96] \hat{=} [47] \text{NRP}_D = \frac{P_i/P_{NA} - P_i^*/P_{NA}^*}{P_i^*/P_{NA}^*},$$

measuring the impact of direct policies as a percentage of the relative price which would prevail in the absence of all interventions.

Finally, for an in-depth analysis of the impact of economy-wide policies it may be useful to separate the effects of indirect protection in Equation [92] into those arising from

- trade policy with respect to nonagricultural goods and from
- those policies which cause the unsustainability of the current account.

Analogously to Equation [92], the indirect effect of exchange rate misalignment can be derived from Equation [92] as

$$[92'] \text{NRP}_{IO} = \frac{P_i^*/P_{NA}^*}{P_i^*/P_{NA}^*} - 1 = \frac{P_i^*/P_{NA}^*}{(e^*/e_0)(P_i^*/P_{NA}^*)} - 1 = \frac{e_0/P_{NA}^*}{e^*/P_{NA}^*} - 1$$

where

$$[93'] P_{NA}^* = \alpha \cdot \frac{P_{NAT}}{(1+t_{NA})} + (1-\alpha) \cdot P_{NAH}$$

captures only those effects on the price index for nonagricultural goods which result from nonagricultural trade policies, while ignoring the ad-

justment of the exchange rate. Subtracting Equation [90'] from Equation [90] yields

$$\begin{aligned}
 [92''] \quad NRP_{IT} &= NRP_I - NRP_{IO} = \frac{P_i/P_{NA} - P_i'/P_{NA}'}{P_i^*/P_{NA}^*} = \frac{P_i/P_{NA} - P_i'/P_{NA}'}{(e^*/e_0)(P_i^*/P_{NA}^*)} \\
 &= \frac{e_0/P_{NA} - e_0'/P_{NA}'}{e^*/P_{NA}^*}
 \end{aligned}$$

which measures that part of indirect protection resulting from non-agricultural trade policies. From the last expressions of the right-hand side of Equations [92], [92'] and [92''], it is clear that the indirect effects are the same for all tradables.

2. Magnitude, Structure and Instability of Agricultural Incentives

a. Output Price Effects

In estimating the direct and total NRPs caused by agricultural, trade, and exchange rate policies, import parity prices are used as world market prices for paddy (rice converted into paddy equivalents) and export parity prices for rubber, palm oil and cocoa. The producer prices are measured at the farmgate. In the case of paddy, the relevant producer price is the GMP. For exportables, farmgate prices have been calculated from the relevant fob prices by subtracting marketing and transport cost as well as the different export taxes. Details of the calculations are given in Rahman [1990b].

Table 28 presents the results of

- the effect of agricultural policies on nominal protection: NRP_i ;
- the direct effect of agricultural policies on nominal protection of agricultural exportables relative to paddy: NRP_{Pi} ;
- the direct effect of agricultural policy on the relative protection of agricultural tradables to nonagriculture: NRP_{Di} ;
- the indirect effect of nonagricultural protection on the relative protection of agricultural tradables to nonagriculture: NRP_{IT} ;

Table 28 - Direct, Indirect and Total Nominal Protection to Producers of Agricultural Commodities in Malaysia, 1960-1988 (percent)

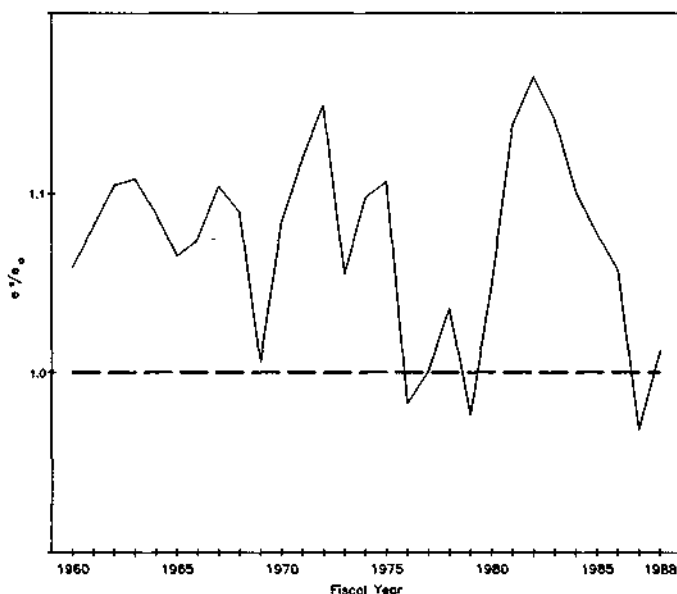
	Annual average						
	1960-1969	1970-1975	1976-1980	1981-1984	1985-1988	1960-1988	
NRP _I : Paddy	10	1	48	112	196	54	
	Estate rubber	-8	-10	-26	-14	-8	-12
	Smallholder rubber	-15	-18	-27	-15	-8	-17
	Palm oil	-8	-13	-13	-8	-13	-10
	Cocoa	0	0	0	0	0	0
NRP _{Pi} : Estate rubber	-13	-9	-49	-56	-68	-32	
	Smallholder rubber	-20	-17	-50	-57	-68	-36
	Palm oil	-14	-12	-39	-51	-67	-30
	Cocoa	-6	2	-31	-49	-65	-23
NRP _{Di} : Paddy	9	1	46	101	188	51	
	Estate rubber	-7	-9	-25	-12	-8	-11
	Smallholder rubber	-14	-16	-26	-13	-8	-15
	Palm oil	-7	-12	-12	-7	-12	-10
	Cocoa	0	0	0	0	0	0
NRP _I : NRP _{IT}	-4	-4	-3	-2	-3	-4	
	NRP _{IO}	-5	-6	-1	-8	-1	-4
	NRP _I	-9	-10	-4	-10	-4	-8
NRP _{Ti} : Paddy	0	-9	43	91	184	43	
	Estate rubber	-16	-19	-29	-22	-12	-19
	Smallholder rubber	-23	-26	-30	-23	-12	-23
	Palm oil	-16	-22	-16	-17	-17	-17
	Cocoa	-9	-10	-4	-10	-4	-8

Source: Own computations based on Rahman [1990b].

- the indirect effect of exchange rate over-/undervaluation on the relative protection of agricultural tradables to nonagriculture: NRP_{IO} ;
- the total indirect effect: $NRP_I = NRP_{IT} + NRP_{IO}$;
- the total (direct and indirect) effect of agricultural price, non-agricultural trade and exchange rate policies on the relative protection of agricultural tradables to nonagriculture: $NRP_{Ti} = NRP_{Di} + NRP_I$.

From Equations [92], [92'] and [92''], it is clear that the indirect effects are the same for all tradables. For every year from 1960 to 1988, the total indirect effects of trade policies (NRP_I) have been detrimental to the domestic relative price of the agricultural tradables (Table 28).

Figure 7 - Ratio of the Equilibrium Exchange Rate to the Nominal Exchange Rate (e^*/e_0), 1960-1988



Source: Derived from basic data in Rahman [1990b].

This has arisen for two reasons. First, the impact of the exchange rate overvaluation in Malaysia has a greater impact on the agricultural sector, which is entirely traded, than it has on the nonagricultural sector which is only partially traded. This indirect effect (NRP_{IO}) was most pronounced in 1981-1984, when an expansive fiscal policy created severe fiscal and external imbalances that were financed mainly by heavy foreign borrowing, thereby leading to a drastic appreciation of the Malaysian dollar (Table 28, Figure 7). Second, trade restrictions in the nonagricultural sector have served to make investment in nonagriculture relatively more attractive than it would have been otherwise. The indirect effects of trade restrictions (NRP_{IT}) on nonagricultural imports were more important during the import substitution phase 1960-1975 (Table 28). More recently, these indirect effects on the real exchange rate decreased substantially as a result of the marked depreciation of the Malaysian dollar and additional measures to curb inflation.

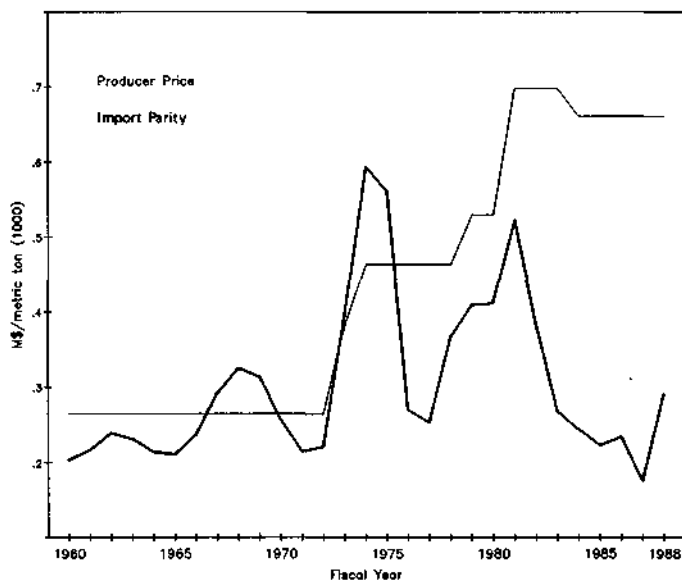
Summing up, the indirect effect of exchange rate policy and trade policy was negative for all agricultural tradables over the period 1960-

1988. Whether individual agricultural tradables are ultimately taxed or subsidized then depends on the direct effects of agricultural policies. These direct effects together with the total effects will now be investigated for the most important agricultural commodities.

Paddy

The direct effect of agricultural price policy (NRP_i) on paddy was small in the 1960s and the first half of the 1970s which comprises also the 1973-1975 period of the world food crises when world rice prices were abnormally high (Table 28, Figure 8). On average, domestic producer prices exceeded import parity prices by 10 percent in 1960-1969 and 1 percent in 1970-1975 when evaluated at the official exchange rate. If evaluated with respect to nonagricultural prices, this effect drops to 9 and 1 percent, respectively. Including the indirect effects of the appreciation of the real exchange rate, however, the total effect of government policy on farmgate prices (NRP_{Ti}) of paddy averaged zero in

Figure 8 - Producer and Parity Prices, 1960-1988: Paddy



Source: Derived from basic data in Rahman [1990b].

1960-1969 and even became negative (-9 percent) in the 1970-1975 period.

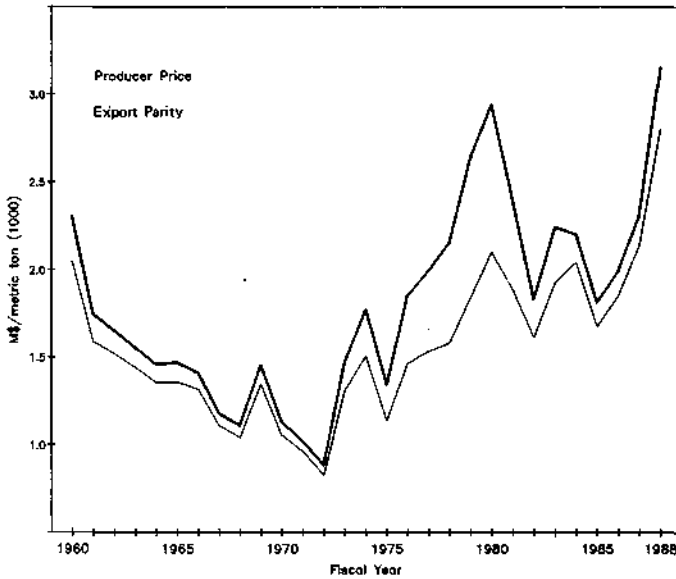
After the mid-1970s and particularly during the 1980s, the GMP was kept substantially above import parity prices measured at the official exchange rate (Figure 8). The direct effect of rice policy is slightly lower when measured as a percentage of the relative price which would prevail in the absence of all interventions. Even if the negative indirect effects of the overvaluation of the real exchange rate are taken into account, total protection, on average, exceeds 100 percent indicating substantial assistance through the paddy price support. Although the GMP was reduced from M\$698/mt to M\$661/mt after 1983, total subsidization increased over the 1985-1988 period as a result of decreasing world prices and diminishing indirect discrimination against tradables.

Except for 1968-1970 and 1974-1975 - when import parity prices were abnormally high (Figure 8) - the effect of direct pricing policies on exportables and paddy has been to provide negative relative protection to producers of exportables (NRP_{P_i}). In the 1960s, the relative dis-protection was in the range of -6 percent for cocoa producers to -20 percent for rubber smallholders. This ratio of disincentives increased steadily from the mid-1970s to reach a peak of over -65 percent in 1985-1988.

Rubber

Rubber production has been discriminated against by direct and indirect policies over the whole period of investigation. The direct impact of the various export taxes (duty and cess payments) was the largest during the commodity price boom of the late 1970s and early 1980s (Table 28, Figures 9 and 10). The nominal discrimination was higher for smallholder rubber than for estate rubber due to higher marketing and transport costs and the replanting cess which was collected only from smallholdings before 1975. The total export taxes paid by estates for 1960-1974 did not include the replanting cess, because this cess was refunded to the estates without any proof of replanting being required for refunding. However, this practice was changed in 1975, and estates like smallholdings were required to submit proof of replanting to qualify for the refund. As a result, NRPs differ only slightly after 1975.

Figure 9 - Producer and Parity Prices, 1960-1988: Estate Rubber



Source: Derived from basic data in Rahman [1990b].

Figure 10 - Producer and Parity Prices, 1960-1988: Smallholder Rubber



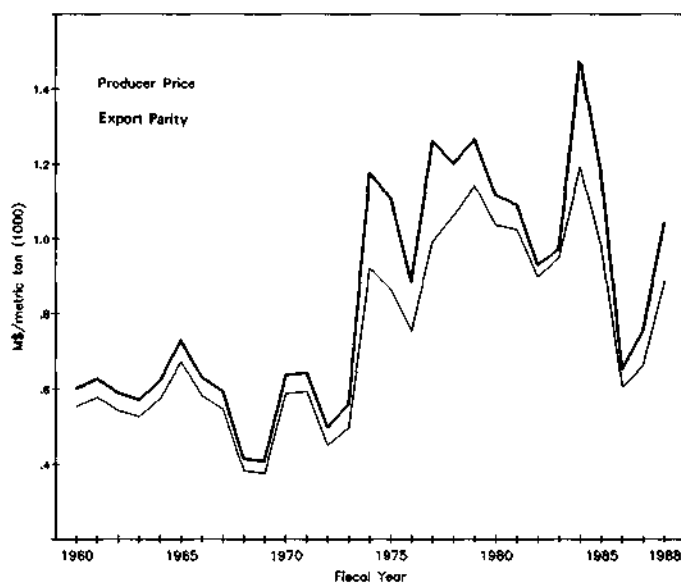
Source: Derived from basic data in Rahman [1990b].

The indirect effect of the appreciation of the real exchange rate augmented the direct effect of trade policy, so that farmgate prices for estate rubber and smallholder rubber were, on average, only 81 and 77 percent of the equilibrium exchange rate border prices from 1960 to 1988.

Palm Oil

Palm oil received negative nominal protection over the entire period under study. This was due to the progressive export duty and the surcharge that were levied against exports up to 1988. On average, domestic producer prices were 10 percent lower than the export parity prices when evaluated at the official exchange rate (Table 28, Figure 11). If the indirect effects of the appreciation of the real exchange rate are taken into account, average total discrimination against palm oil producers is raised to 17 percent. It is interesting to note that in the 1960s the indirect effect caused by overvaluation (-9 percent) dominated the direct effect caused by export taxation (-8 percent).

Figure 11 - Producer and Parity Prices, 1960-1988: Palm Oil

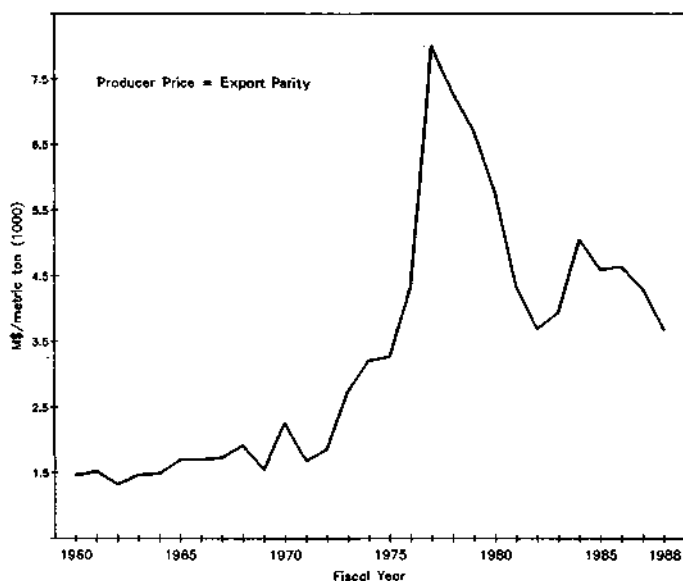


Source: Derived from basic data in Rahman [1990b].

Cocoa

Cocoa is the only export commodity which is not discriminated against by direct agricultural policies (Figure 12), yet, the indirect effects of trade and exchange rate policy resulted in average total negative protection of -9 percent in 1960-1988 (Table 28).

Figure 12 - Producer and Parity Prices, 1960-1988: Cocoa



Source: Derived from basic data in Rahman [1990b].

b. Effective Rates of Protection

Trade and exchange rate policies do not only affect the relative prices of final goods but also the prices of tradable inputs and, therefore, value added in agricultural and nonagricultural activities. The direct effects on value added per unit of output of commodity i (value of output less value of nonfactor inputs) relative to free-trade value added are measured by the ERP (see Section B.II.3), defined as

$$[97] \hat{=} [26] \text{ERP}_i = (VA_i - VA_i^*)/VA_i^*$$

where VA is the value added. Total effects (including indirect effects of trade and exchange rate policies) can be measured as

$$[98] \text{ ERP}_{Ti} = (VA_i/VA_{NA} - VA_i^*/VA_{NA}^*) / (VA_i^*/VA_{NA}^*)$$

where V_{NA} represents value added in the nonagricultural sector and the asterisks indicate that the value added is measured using border prices evaluated at the equilibrium exchange rate. One common approach to measure the impact of government policies on value added is to derive the value-added ratios for the individual product categories from the input-output tables and to multiply them by the actual and distortion-free prices to generate series for value added. In order to calculate the indirect effects of policies on relative effective protection of agricultural tradables and nonagricultural goods, free-trade series of value added need to be calculated similarly to the procedure above.

In order to measure the effective protection of rubber, palm oil and paddy, Jenkins and Lai [1989] have taken the value-added coefficients of the respective sectors from the 1971 input-output table for Malaysia [Malaysia, 1973]. These coefficients are kept constant for the entire 1960-1988 period. The adoption of fixed value-added shares appears rather stringent, especially given the availability of three mutually consistent tables for 1971, 1978 and 1983. A cursory review of the three comparable tables reveals that the value-added ratios have changed over time (see Table 29).

It may be discerned that the value-added shares of estate and smallholder rubber tended to increase over the 1970s and subsequently

Table 29 - Value-Added Ratios 1971, 1978 and 1983

	1971	1978	1983
Estate rubber	0.845	0.871	0.873
Smallholder rubber	0.855	0.869	0.863
Palm oil	0.843	0.786	0.777
Estate cocoa	0.850	0.862	0.869
Smallholder cocoa	0.841	0.844	0.863
Paddy	0.902	0.864	0.829
Nonagriculture	0.526	0.505	0.449

Source: Malaysia [1973; 1982; 1988].

stagnated. In the case of palm oil, the value-added coefficient has shown a gradual, albeit small, decline since 1971. This could have had a dampening impact on the growth of the sector. On the other hand, the productivity increase, which has occurred in both estate and smallholder cocoa as a result of intensified research and technology development, has obviously led to an improved value-added share over time. To a large extent, this could have been responsible for the strong expansion of this sector over time. In the case of paddy, there has been a clear deterioration in its value-added ratio since 1971. Indeed, it is widely accepted that the labor and land productivity of paddy has declined sharply, especially in recent years, owing to ageing labor force and deteriorating irrigation facilities, especially outside the granary areas. The above set of value-added ratios has been applied in the empirical analysis of effective protection to approximate the value-added coefficients for the periods 1960-1977, 1978-1982 and 1983-1988.

Table 30 presents results of calculations of the direct, indirect and total ERPs for paddy, estate rubber, smallholder rubber, palm oil, and cocoa. The estimates of the direct effects are qualitatively the same as those for the nominal rates. The trend in effective protection over the period 1960-1988 is also similar to that of nominal protection. Because value added of rice at world prices was small in the second half of the 1980s, the ERPs estimated are extremely large. During the whole period, the indirect effects tended to provide a negative effective protection to the agricultural sector of approximately 9 percent. In recent years, this negative protection diminished as a result of the macroeconomic adjustment measures.

The total effective protection *viv-à-vis* the nonagricultural sector was negative for rubber, palm oil and cocoa, but positive for local paddy. Total effective protection for estate rubber varied between -9 and -36 percent and averaged -21 percent. The effective discrimination against smallholder rubber was slightly larger and the discrimination against palm oil was somewhat lower.

Evidently, agricultural pricing policies have not produced any direct effect on the prices of estate and smallholder cocoa relative to border prices and to nonagricultural goods. This is simply because there is no export tax imposed on cocoa. Consequently, the total effects of policy interventions, though negative, have tended to remain fairly low

Table 30 - Direct, Indirect and Total Effective Protection to Producers of Agricultural Commodities in Malaysia, 1960-1988

	Annual average					
	1960-1969	1970-1975	1976-1980	1981-1984	1985-1988	1960-1988
ERP _i : Paddy	11	1	58	212	480	110
Estate rubber	-9	-12	-29	-15	-9	-14
Smallholder rubber	-17	-21	-30	-16	-10	-19
Palm oil	-9	-15	-15	-10	-16	-12
Cocoa	0	0	0	0	0	0
ERP _{Di} : Paddy	10	1	49	115	261	64
Estate rubber	-8	-10	-27	-12	-9	-12
Smallholder rubber	-16	-18	-28	-14	-10	-17
Palm oil	-8	-13	-14	-9	-15	-11
Cocoa	0	0	0	0	0	0
ERP _I : All commodities	-8	-13	-6	-12	-5	-9
ERP _{Ti} : Paddy	2	-12	42	103	256	55
Estate rubber	-17	-23	-33	-24	-14	-21
Smallholder rubber	-24	-31	-35	-26	-15	-26
Palm oil	-17	-26	-21	-21	-20	-20
Cocoa	-8	-13	-6	-12	-5	-9

Source: Own computations based on Rahman [1990b].

over time. It may be inferred that government policies have not intended to discriminate cocoa since 1960. Nevertheless, these policies have provided a deliberate support for nonagriculture, thereby discriminating against cocoa producers. However, though cocoa production may not be attractive when compared with the production of nonagricultural goods, it is relatively more lucrative than either rubber or palm oil. This could have explained the rapid investment in cocoa and, concomitantly, the significant disinvestment in rubber since the early 1970s.

While the direct and total ERPs were negative for the export commodities, they were in turn extremely positive for local paddy. Protection was negative only during the world food crisis. In more recent years, the total effective protection reached very high levels, as reported in Table 30. After 1984, the total ERP averaged about 250 percent, with a rate of 423 percent in 1987, primarily due to the fact that the price of rice in the world was severely depressed.

Apart from the objective of influencing investment decisions, one of the reasons why the Malaysian government intervenes in agricultural markets is to provide greater year-to-year price stability for both producers and consumers. Table 31 presents the coefficients of variation for real agricultural prices (nominal prices deflated with an index of non-agricultural prices, P_{NA} or P_{NA}^*). Agricultural trade and price policies have resulted in greater stability only for paddy producers, whereas the coefficients of variation of border prices, which were calculated by use of equilibrium exchange rates, are approximately the same or lower than the coefficients of variation of actual domestic prices for all exportables. It can be concluded that agricultural pricing policies not only discriminated against cash crops relative to paddy but also were ineffective in stabilizing producer prices of exports.

Table 31 - CVs of Relative Producer Prices in Malaysia, 1960-1988

	P_i/P_{NA}	P_i^*/P_{NA}	P_i^*/P_{NA}^*
Paddy	12.55	38.60	39.26
Estate rubber	25.15	25.50	25.09
Smallholder rubber	26.00	27.07	26.68
Palm oil	22.78	25.81	25.41
Estate cocoa	46.18	46.65	41.80
Smallholder cocoa	46.76	46.76	41.91

Source: Own computations.

V. Comparison with Other Studies

1. The Impact of Agricultural and Economy-Wide Policies

A number of studies have endeavored to estimate shift parameters for LDCs' exports using the type of methodology described in Section D. III. A summary of results from these studies is presented in Synoptical Table 2. The time periods covered are usually quite extensive. In the cases of Malaysia, Peru and Zimbabwe, we used yearly data, whereas in many other cases quarterly (e.g., for Cameroon) or monthly data (e.g., for

Colombia) were taken. Conventions with respect to the construction of price indices also vary from study to study. In many cases, single product indices are relied upon, in others, multi-product indices are deployed. Also, exportables refer in some cases to traditional exports and nontraditional exports, agricultural exports and industrial exports, in others to a composite of both. The results encompass a variety of countries and time periods and rely upon alternative data bases.

As can be seen from Synoptical Table 2, estimates of the proportion of import protection, which is shifted in the form of an implicit export tax, vary from 48 percent (in the case of Pakistan lower estimate) to 100 percent (in the cases of Ghana and Zimbabwe upper estimate) with the unweighted mean being 74 percent. Our results for Malaysia, Peru and Zimbabwe are not crucially different from these findings. The estimated (unweighted average) shift parameters for total exports are slightly higher than the mean in Malaysia (0.80) and Peru (0.82) and equal to the mean in Zimbabwe (0.74). The studies consistently indicate in fact that a substantial proportion (at least three quarters) of the protection conferred on import-substituting activities is shifted in the form of an implicit export tax.

Generally, the shifting of protection is higher for traditional exports as well as for total agricultural and individual agricultural exportables than for nontraditional exports, reflecting the lower substitutability in production between these resource-based activities and nontradables. By contrast, the estimated ranges of incidence parameters for total exports (0.66-0.83) are higher than those for total agricultural exports (0.53-0.70) and individual agricultural exportables (0.36-0.84) in Zimbabwe [Wiebelt, 1990a]. This implies that a tariff will decrease the relative price of total exports, but the relative price of agricultural (nonagricultural) exports will fall marginally less (more) than total exports. Obviously, technological and demand characteristics are such that there is less substitutability between nonagricultural exportables and home goods than between agricultural exportables and home goods. This pattern of incidence contrasts with empirical evidence for other LDCs in Synoptical Table 2, where agricultural exportables exhibit a larger degree of incidence than nonagricultural exportables. It accords well with a priori theorizing, since production in nonagricultural sectors is

Synoptical Table 2 - Important Findings on the Incidence of Protection:
Evidence from Country Studies in LDCs

	Estimates of Sjaastad's incidence parameter ω
Cameroon: Milner [1990]	0.73-0.96 (agricultural exports), 0.62-0.81 (industrial exports) for I/1976-I/1984 with quarterly data
Colombia: García [1981]	0.93-0.97 (total exports), 0.95-0.98 (coffee), 0.96-1.00 (nontraditional exports) for the period March 1970-October 1979 with monthly data
Ghana: Miethbauer [1990]	0.64-1.00 (total exports), 0.68-0.95 (cocoa) for 1969-1980
Ivory Coast: Greenaway [1989]	0.65-0.82 (traditional exports), 0.55-0.69 (non-traditional exports) for 1960-1984
Malaysia: Herrmann et al. [1990]	0.80 (total exports), 0.68-0.86 (rubber), 0.91-1.03 (palm oil), 0.75-1.12 (cocoa) for 1960-1985
Mauritius: Greenaway, Milner [1987]	0.85 (traditional exports), 0.59 (nontraditional exports) for July 1976-December 1982 and with monthly data
Nigeria: Oyejide [1986]; Zachäus [1990]	0.55-0.90 (total exports), 0.82-0.84 (agricultural exports), 0.83-0.86 (cocoa), 0.61-0.82 (groundnuts), 0.66-0.79 (palm kernels) for 1960-1982; 0.65-0.73 (total exports), 0.56-0.98 (total agricultural exports), 0.37-0.67 (cocoa), 0.54-0.87 (palm kernels), 0.36-0.44 (groundnuts) for 1960-1988
Pakistan: Dorosh, Valdés [1990]	0.48-0.68 (total exports) for 1972-1987 with quarterly data
Peru: Herrmann et al. [1990]	0.72-0.92 (total exports), 0.55-1.07 (coffee), 0.57-1.01 (fishmeal), 0.64-1.05 (cotton) for 1970-1985
Philippines: Bautista [1987]	0.85-0.87 (total exports), 0.66 (traditional agricultural exports) for 1950-1980
Zaire: Tshibaka [1986]	0.52 (total exports), 0.41 (agricultural exports), 0.72 nonagricultural exports) for 1970-1982
Zimbabwe: Mlambo [1989]; Wiebelt [1992]	0.79-1.00 (total exports), 0.83 (coffee), 0.88 (beef) 0.97 (maize), 0.90 (cotton), 0.71 (tobacco), 0.66-0.83 (total exports), 0.53-0.70 (agricultural exports), 0.57-0.76 (maize), 0.66-0.84 (coffee), 0.36-0.68 (cotton), 0.55-0.73 (tobacco) for 1966-1987

Source: Compiled from the sources given in the synoptical table.

more import-dependent, and adjustment is hampered by the rigid foreign exchange allocation system dominating in Zimbabwe.

If for illustrative purposes we take the unweighted average total import charges as calculated by Erzan et al. [1989] for most of the LDCs contained in Synoptical Table 2 as a proxy for the appropriately weighted implicit nominal tariff and the unweighted average of the shift parameters, and neglect interventions on export markets, then the average true tariffs and subsidies can be calculated from Equations [83], [85] and [90]. Since the direct and indirect effects of export price policies on agricultural producer prices and nontradables prices are suppressed, the true incentive measures indicate only the indirect effects of industrial import substitution policies. The major results can be summarized as follows (Table 32):

- (1) Import charges on manufactures are high in Cameroon, Colombia, Mauritius, Pakistan, and Peru. This observation is a qualified one, however, since nontariff measures are excluded from the analysis due to data considerations and the actual application of nontariff measures, and their restrictiveness could vary significantly across countries.
- (2) The average true tariffs on manufactures are substantially below the nominal tariff rates depending on the size of the incidence parameter. The discrepancy is the largest in Colombia, where manufactures are truly protected by only 2.5 percent despite nominal protection of 88 percent. By contrast, the discrepancy is the lowest in Mauritius and Pakistan. This observation is also a qualified one, however, since incentives for exportables were neglected in the calculation of true tariffs. Where export subsidies (taxes) are quantitatively important, the true tariffs are overestimated (underestimated).
- (3) Of course, exportables, whether agricultural or nonagricultural, are indirectly taxed by import protection. In some cases, these indirect taxes may be more than offset by direct subsidization. However, because export subsidies also induce negative indirect effects, these export subsidies have to be large to compensate for indirect effects.

Peru, one of our case studies and a country with a poorly performing agricultural export sector, protected its manufacturing sector much more strongly than most other countries. With an incidence parameter

Table 32 - Estimates of True Tariffs and Subsidies Resulting from Import Changes on Manufactures (a)

	Unweighted average total import charges on manufactures(b)	Unweighted true tariffs on manufactures(c)	Unweighted true subsidies on categories of exports(d)
Cameroon	70	10.0	-37.2 (agricultural exports), -33.4 (industrial exports)
Colombia	88	2.5	-45 (total exports), -46.0 (coffee), -46.4 (nontraditional exports)
Ghana	30	4.4	-19.7 (total exports), -19.7 (cocoa)
Ivory Coast	27	6.3	-16.5 (traditional exports), -14.5 (nontraditional exports)
Malaysia	17	3.5	-12.3 (total exports), -11.9 (rubber), -14.2 (palm oil), -13.8 (cocoa)
Mauritius	86	23.7	-42.2 (traditional exports), -33.8 (nontraditional exports)
Nigeria	38	8.2	-21.6 (total exports), -24.0 (agricultural exports), -24.5 (cocoa), -21.0 (groundnuts), -21.6 (palm kernels)
Pakistan	93	25.3	-35.1 (total exports)
Peru	71	8.2	-36.7 (total exports), -36.5 (coffee), -35.7 (fishmeal), -37.5 (cotton)
Philippines	39	4.1	-25.1 (total exports), -20.6 (traditional agricultural exports)
Zaire	35	14.4	-15.3 (total exports), -12.3 (agricultural exports), -20.0 (nonagricultural exports)
Zimbabwe	28	6.2	-17.0 (total exports), -14.9 (coffee), -15.6 (beef), -16.7 (maize), -12.7 (cotton), -14.9 (tobacco)

(a) True tariffs and true subsidies are calculated on the basis of an unweighted average incidence parameter calculated from the extreme values given in Synoptical Table 2. - (b) The implicit tariff rate is an unweighted average of the total import charges on total manufactures as calculated by Erzan et al. [1989] except for Mauritius and Cameroon, where tariffs are taken from Greenaway and Milner [1987] and Milner [1990], respectively. - (c) Calculated with Equation [83]. - (d) Calculated with Equation [85] under the assumption of no nominal subsidies/taxes on exports.

Source: Own computations based on Erzan et al. [1989], Greenaway and Milner [1987] and the results given in Synoptical Table 2.

above the mean of the total sample, this implies that the indirect discrimination against exports is heavier than the average. As shown in Section D.III, agricultural exportables are also heavily taxed by direct policies, thereby aggravating the discriminatory effects of trade policy. The Zimbabwean trade policy also leads to an indirect taxation of agricultural exportables. However, as shown in Section D.III, this negative indirect effect is more than offset by direct subsidies in the case of maize and beef. Malaysia shows the lowest NRP on manufactures. With an incidence parameter near the mean of the total sample, this implies that the indirect discrimination in Malaysia is lower than in all other countries considered.

This result is reconfirmed if the more comprehensive estimates of direct and indirect protection undertaken in Section D.IV are compared with those for a sample of 18 LDCs (including Malaysia) of the World Bank [Krueger et al., 1988]. Table 33 summarizes the results from the individual country studies and contrasts them with our results for Malaysia's most important agricultural commodities from Section D.IV.2. From Table 33, it can be seen that all agricultural exportables except cocoa have been taxed directly more heavily than the average of the total sample in the period 1975-1979. However, since indirect taxation in

Table 33 - Direct, Indirect and Total Nominal Protection to Agricultural Producers in Malaysia and a Sample of 18 LDCs, 1975-1984 (percent)

	1975-1979			1980-1984		
	direct	indirect	total	direct	indirect	total
Average of 18 LDCs(a)						
Exportables	-11	-25	-36	-11	-29	-40
Importables	20	-25	-5	21	-27	-6
Malaysia						
Smallholder rubber	-24	-4	-28	-15	-10	-25
Estate rubber	-23	-4	-27	-15	-10	-25
Palm oil	-15	-4	-19	-6	-10	-16
Cocoa	0	-4	-4	0	-10	-10
Rice	38	-4	34	86	-10	76

(a) Including Malaysia.

Source: Krueger et al. [1988]; Rahman [1990b].

Malaysia was substantially below the average, total taxation of all Malaysian agricultural exportables was below the average. The picture somewhat changed in the period 1980-1984. As a result of expansionary fiscal policy and increasing foreign borrowing, the indirect effect more than doubled in Malaysia. Although direct taxation was reduced, total taxation remained nearly constant and was substantially below the average for the sample of 18 LDCs.

Food policy in Malaysia always favored rice producers. Direct subsidies in both periods were substantially above the average. Moreover, indirect taxation caused by trade policies for nonagricultural commodities and macro policies only had a marginal impact if compared to rice policy. As a result, total nominal protection of rice was substantially above the average for the most important imported food products in the 18 LDCs.

2. Food-Crop Protection versus Cash-Crop Discrimination?

One of the major results of the cross-country analysis in Chapter C was that both food producers (of wheat and rice) and exporters (of coffee) are discriminated against in LDCs if the indirect effects of overvalued exchange rates are taken into account. To measure the indirect and total effects of agricultural trade and macro policies for food and cash crops was also a major objective in the individual country studies of the World Bank's project on "The Political Economy of Agricultural Pricing Policy" [Krueger et al., 1988].

Table 34 summarizes the results of these country studies for important food and cash crops. Several findings are noteworthy. First and foremost, whereas import-competing food crops were protected by agricultural policies, on average, these direct policies discriminated against agricultural exports over most of the period investigated. Indeed, the degree of discrimination against exportables and the protection of import-substituting crops is remarkable even for the same commodities: contrast rice exporters who are taxed at the equivalent of 14, 37 and 27 percent over the three time periods, with rice importers, receiving the equivalent of 8, 24 and 59 percent nominal protection (relative to nonagricultural products). Second, the impact of indirect interventions is even stronger than the direct ones for both exportables and importables. In

Table 34 - Direct and Total Nominal Protection of Agricultural Exports and Imported Food Crops, 1965-1985 (percent)

Product(a)	1965-1970		1971-1979		1980-1985	
	direct	total	direct	total	direct	total
Agricultural exports(b, c)	6	-15	-16	-47	-9	-39
Coffee	-11	-20	-12	-33	-15	-46
Cotton	-13	-35	-19	-47	-10	-47
Rice	-14	-44	-37	-61	-27	-54
Cocoa	2	-28	10	-28	12	-37
Sugar	81	68	-18	-40	4	-23
Rubber	-10	-20	-18	-27	-18	-28
Imported food crops(b, d)	10	-14	4	-16	21	-11
Wheat	27	2	-7	-19	-9	-23
Rice	8	-11	24	6	59	28
Maize	-5	-33	-6	-35	12	-39

(a) Only those commodities were included which are produced in at least 2 of the 18 countries; not recognized are commodities which are produced in Argentina, Brazil, Ivory Coast, Morocco, Sri Lanka, and Turkey either because the studies are not published yet or because the country's products appear only once in one of the above categories. - (b) Calculated as an unweighted average of the protection rates for individual crops. - (c) The countries included are for the individual commodities: coffee (Colombia, Dominican Republic), cotton (Colombia, Egypt, Pakistan, Zambia), rice (Colombia, Egypt, Pakistan, Thailand), cocoa (Ghana, Malaysia), sugar (Dominican Republic, Pakistan, Philippines, Thailand), rubber (Malaysia, Thailand). - (d) The countries included are for the individual commodities: wheat (Chile, Colombia, Egypt, Pakistan, Portugal), rice (Dominican Republic, Ghana, South Korea, Malaysia, Philippines, Portugal), maize (Egypt, Ghana, Philippines, Portugal, Thailand, Zambia).

Source: Computed from Avillez et al. [1988], Dethier [1989], García and Llamas [1989], Greene and Roe [1989], Hamid et al. [1990], Intal and Power [1990], Jansen [1988], Jenkins and Lai [1989], Moon and Kang [1989], Rahman [1990b], Siamwalla and Setboonsarng [1989], Stryker [1990], and Valdés et al. [1990].

the case of agricultural exports, the effective taxation by indirect policies exacerbates the negative direct protection, often resulting in extremely large total negative protection equivalents. Rice exporters, for example, are estimated to receive about one third the price they would have received in a free-trade regime at realistic exchange rates with no direct intervention in 1971-1979 and about half in 1980-1985.

In the case of imported food crops where the governments' intention, as may be concluded from the direct effects, was to protect

domestic producers, the impact of indirect policies was sufficiently strong to overcompensate direct protection. On average, the most important food crops are effectively discriminated against by government policy. One remarkable exception is rice, where direct protection is very high and the impact of indirect policies in net-importing countries like South Korea and Malaysia is not large by comparison.

Overall, the results from these country studies reconfirm the findings of Section C.III that exportables are directly taxed, whereas food crops are subsidized in LDCs. They also confirm that individual crops are directly taxed in net-exporting countries and directly subsidized in net-importing countries.¹ Most importantly, however, they stress once again the quantitatively important negative effect of trade and macroeconomic policies on relative incentives for agriculture.

¹ This holds also true for wheat exports in Argentina, the direct NRPs being -10 (1965-1970), -32 (1971-1979) and -13 (1980-1985).

E. Summary and Conclusions

I. Summary and Major Findings

It is a central issue in development economics which role agriculture plays in economic development and which role it should play. There is a wide consensus that agriculture is a key sector in the early stages of development with regard to its contribution to income, employment and foreign exchange. There is a severe dissension, however, on the appropriate agricultural development strategy. Beyond this normative issue, not many quantitative studies on agricultural incentives appeared up to the very recent past which were either comprehensive as detailed country studies for total agriculture or as cross-country studies for individual important agricultural products.

The main focus of our analysis has been on the positive rather than normative analysis of agricultural policy in LDCs. This study is supposed to contribute to a sounder and more comprehensive empirical evidence on agricultural incentives in LDCs. The magnitude, the structure, the development, and the instability of agricultural protection in LDCs have been elaborated. In particular, the focus of our study has been

- (1) to provide an up-to-date survey of the different concepts that can be applied to measure agricultural protection and to discuss the pros and cons of these concepts;
- (2) to review the empirical literature which is available on agricultural protection in LDCs and to elaborate its strengths and weaknesses;
- (3) to contribute to the quantitative literature on agricultural protection in two respects:
 - by quantifying the extent and the variability of agricultural price protection in the wheat, rice and coffee markets on a broad data basis covering a wide cross section of producer countries and a rather long time period;
 - by elaborating in case studies for Malaysia, Peru and Zimbabwe how and to what extent economy-wide policies influence the agricultural sector and whether those indirect agricultural policies are more or less important than direct agricultural policies.

The survey of the measurement concepts has shown that various techniques have been developed in order to measure the level of agricultural protection as well as the influence of direct agricultural policies and macroeconomic policies on agricultural incentives. The review of the empirical evidence has revealed two key results. First, LDCs seem to discriminate against export crops compared with food crops. Second, indirect agricultural policies seem to dominate direct agricultural policies in their importance for agricultural incentives. These important results were derived recently in 18 country studies of the World Bank's project on "The Political Economy of Agricultural Pricing Policy" [Krueger et al., 1988]. There is, however, a lack of cross-country studies for important agricultural products as well as of country studies utilizing other methodologies which support this evidence.

In our empirical analysis, the main emphasis has been put on the comparison of policies towards food crops and cash crops and on the distinction of direct and indirect policies affecting agriculture. The results may serve as a basis for policy recommendations to reduce the distortions within agriculture and between agriculture and the rest of the economy.

In the cross-section analysis, we calculated gross and net NPCs for major wheat, rice and coffee suppliers for the period 1969-1985. Net NPCs were obtained by adjusting gross NPCs for exchange rate distortions, and transport costs were explicitly taken into account. Exchange rate distortions were measured as the ratio between official and black market rates and were regarded as a proxy for the effects of exchange rate policies. In order to assess whether producer prices were stabilized in view of volatile world market prices, we first conducted a variance decomposition of the NPCs into its components, producer and world price variations, both measured in US dollars. In a second step, dollar price variations were decomposed into exchange rate fluctuations and movements of producer prices in home currency. Stabilization efforts were regarded as successful if producer prices in domestic currency varied less than world market prices. The results with respect to the level and instability of nominal protection can be summarized as follows:

- (1) On average, producer prices for both food crops and wheat and rice were above world market equivalents, thus indicating a subsidization

of the farmers, while producer prices for coffee, a typical cash crop, were generally below world market prices.

- (2) When exchange rate distortions were taken into account, producer prices for wheat were neither higher nor lower than border prices, on average, whereas prices granted to rice and coffee farmers were below world market prices.
- (3) In net rice and wheat importing LDCs, producer prices exceeded world market prices, on average, but were dropped below them as soon as exchange rate distortions were taken into account.
- (4) Net rice and wheat exporters received lower prices, on average, than they would have reached in the world market. Prices diverged further when exchange rate overvaluations were considered.
- (5) The DCs included in our sample generally subsidized their wheat and rice farmers independent of the trade status. Furthermore, exchange rate distortions could almost be neglected in the DCs.
- (6) In most cases, the variance of producer prices in home currency lay below the variance of border prices, thus indicating a widespread tendency to stabilize producer prices.
- (7) Stabilization efforts were, on average, more successful towards the two food crops than towards coffee. Among the food producers, those in DCs received the most stable prices.
- (8) Only in some highly inflationary countries, producer prices varied even more than world market equivalents.

In the country studies, we analyzed the effects of import restrictions on the agricultural export sector by means of the concept of true protection. This concept focuses on relative price changes between tradables and nontradables and thus measures the incentives for resource reallocations between domestic sectors rather than protection against foreign competition. Incidence parameters, which quantify the proportion of an import tariff that is shifted to exportables as an implicit tax, were calculated for total exports as well as individual agricultural exports of Malaysia, Peru and Zimbabwe. The incidence parameters were then combined with nominal import tariffs for manufacturing and nominal agricultural subsidy rates in order to obtain "true tariffs" and "true subsidies" which measure the price changes of importables and exportables, respectively, both relative to nontradables. Major findings of this analysis are:

- (1) A large proportion of import tariffs - generally more than 50 percent and in some cases even about 100 percent - was shifted to exportables as an implicit tax due to a close substitutability between import-competing manufactured goods and nontradables.
- (2) "True tariffs" were in all three countries significantly below nominal rates, thus indicating that the intended incentives for resource re-allocations in favor of the manufacturing sector were only partly effective.
- (3) "True subsidies" were always lower than nominal subsidies reflecting the discriminatory effects of trade policy on agricultural exports. In some cases, e.g., Malaysian cocoa, the indirect effects resulting from import restrictions counteracted the incentives given by agricultural policies.

For Malaysia, we finally adopted a more comprehensive measure of protection including the contributions of agricultural as well as trade and macroeconomic policies. Following the methodology of the World Bank's project on "The Political Economy of Agricultural Pricing Policy" [Schiff, 1989], direct, indirect and total NRPs and ERPs relative to nonagriculture were calculated for the major Malaysian agricultural commodities. Moreover, the indirect effects were split up into one part that is due to trade policies and another part that reflects macroeconomic policies. In order to assess the relative incentives between food crops and export crops, direct NRPs for exports were also calculated relative to paddy. The analysis led to the following main results:

- (1) Paddy farmers have been subsidized so heavily since the mid-1970s that the negative indirect effects have been overcompensated by far.
- (2) The weights of indirect and direct effects in the total NRPs of the export crops varied over time largely depending on the government's macroeconomic policy stance but also because of fluctuating export taxes and cesses, especially for rubber. The overall taxation of Malaysia's export crops has significantly decreased since 1985 due to a reduction in both direct and indirect taxation.
- (3) The relative prices within agriculture have continuously changed in favor of paddy.

II. Implications for Policy Reform

The analysis of this study suggests that agricultural price distortion is not only a result of agricultural policies but also of economy-wide policies. Trade, exchange rate and other macroeconomic policies all have a significant negative influence on the domestic relative price between agriculture and nonagriculture in most LDCs. However, the costs of adopting policies that discriminate against agriculture are not borne by that sector alone. Ironically, it is those countries such as South Korea and Malaysia, which did not or did only slightly discriminate against agriculture relative to industry, that experienced very high industrial growth rates. By contrast, the low-growth syndrome has been exemplified by many countries in Sub-Saharan Africa and some in Latin America and South Asia, where taxation of the agricultural sector is a widespread phenomenon.

Since it has been revealed that economy-wide distortions are prevalent in many LDCs, agricultural pricing reforms should first and foremost begin with macroeconomic policy reforms to correct for the real overvaluation resulting from inappropriate macro policies. Monetary policies, public sector policies and exchange rate and trade policies are indeed a very significant element in many of the reform programs recommended by the World Bank and the IMF [IMF, 1986].

A devaluation of the official exchange rate will reduce most of the discriminatory effects facing LDCs' agricultural producers. By increasing the price in domestic currency terms of traded goods relative to non-traded goods (the real exchange rate), a nominal devaluation will induce a reallocation of resources from nontraded goods producing sectors to import-substituting and export-oriented activities. Since agricultural goods are mostly traded, a devaluation will benefit agricultural producers. The argument for devaluation is particularly appealing in view of the price and wage rigidities which normally prevail in markets, limiting the scope for absolute decreases in the nominal price of non-traded goods. Given these circumstances, the only practical means of securing a real devaluation is often an upward adjustment of the price for traded goods. Of course, the ultimate success of the strategy depends on sufficient monetary restraint to prevent the erosion of the

devaluation-induced change in relative prices by subsequent increases in the prices of nontraded goods.

Once the exchange rate reforms were achieved, such that net NPCs and gross NPCs, discussed in Chapter C, were made equivalent, the next step would be to reform direct government interventions in agricultural and nonagricultural price determination. The interesting observation from our cross-country analysis on wheat, rice and coffee is that once exchange rates are realigned to their true values, NPCs for the two food crops are above 1.0 in the group of LDCs indicating that direct price protection policies vis-à-vis foreign competitors prevail. Thus, recommendations for increased agricultural prices may not be necessary if exchange rate reforms are successful. In fact, if the objective is to achieve efficiency in resource allocation, policymakers may wish to lessen direct support programs, once exchange rates have been devalued.

Whereas a devaluation more than offsets overall disprotection in the cases of wheat and rice, it is insufficient to eliminate overall discrimination against coffee producers. To the extent that demand for a country's coffee exports is inelastic, the domestic producers may be successful in shifting the burden of the export duty to the foreign consumers of coffee. More commonly, however, coffee-exporting countries are price takers in the international market, and coffee producers must bear the tax. In such a case, domestic prices for coffee should be raised from an efficiency point of view.

This highlights that agricultural producer price distortions cannot be corrected by blanket policy reform. For many countries, the trade categories differ between agricultural commodities which create inconsistent distortions and sources of distortion. Moreover, trade policies in nonagriculture affect the relative prices between traded agricultural and nonagricultural goods and between traded and nontraded goods. In general, given undistorted exchange rates and liberalized nonagricultural markets, wheat and rice would require a lessening of support to achieve border price equivalents, whereas coffee would require an increase in domestic prices to achieve border price equivalents.

A final implication of the cross-country analysis on wheat and rice, which can be generalized [see World Bank, 1986], is that DCs and LDCs tend to follow exactly opposite policies. DCs protect their agricultural

sector and produce too much, LDCs discriminate against agriculture and produce too little from a worldwide efficiency point of view. The patterns of world agricultural production and exports would change in favor of LDCs if both groups of countries followed efficient policies. Just as a country gains by allocating its resources to where they can be most productive, the world as a whole would certainly gain if more were produced in LDCs for both domestic use and exports. This would require much freer trade and domestic policies not only in LDCs but also in DCs.

Much of the bias against agriculture in Peru and Zimbabwe arises from policies to promote industry behind high trade barriers. Inward-looking industrialization strategies accelerated the shift of resources out of agriculture by lowering agriculture's profitability vis-à-vis the industrial sector in both countries. Agricultural exports suffered, as did food production that competes with imports. This is not just because domestic agricultural prices became lower relative to the prices of protected industrial products but also because the protectionist policies resulted in an appreciation of the real exchange rate. As a result, traded agricultural goods also became less profitable than nontraded goods. Given the need to raise export earnings in these countries and agriculture's potential in this respect, as well as the dependence of the rest of the economy on the performance of the agricultural sector, it would seem advisable to continue and reinforce the currently adopted devaluation policy combined with a reduction of import restrictions.

Since the prices of most agricultural commodities in the two countries are controlled through marketing and stabilization boards, this policy must be supported by direct pricing policies. For the agricultural producer, the relevant real exchange rate is the ratio of the prices for agricultural goods to the prices of nontraded goods. Therefore, the producer price of the affected commodity must be raised - in principle, *pari passu* with the currency depreciation - in order to facilitate the required drop in the real exchange rate. Recent experience with adjustment policy in Peru seems to indicate that an important factor in the failure of the depreciation to increase (agricultural) export supply is the inability of the authorities to ensure that the real exchange rate falls significantly and remains at its depreciated rate for a period long enough to permit adjustment of supply. Invariably, this is due to a failure to

pass on price increases to exporters and import-substituting activities - where such prices are regulated - or an incapacity for various social and political reasons to restrain budgetary deficits and monetary expansion sufficiently to abate domestic inflation.

In Malaysia, the general thrust of government agricultural policy has been to encourage self-sufficiency in rice and diversification in exports. Indirect effects, which, by definition, had the same net impact on rice and exports, were remarkable low by international comparison. During the import-substituting phase (1965-1975), indirect discrimination was largely a result of industrialization policy, whereas indirect discrimination in the 1980s largely stemmed from expansive fiscal policies.

Consistency in output pricing has not yet been adopted as a principle of policy in agriculture in all three countries, as witnessed in the variations observed both in levels of protection afforded different crops in different years and protection for the same crop over time. Partly, the cause of this variation is the use of inappropriate instruments (e.g., administered prices) to provide product incentives, and partly it is the result of the numerous ad hoc interventions that were introduced over time without an adequate consideration of the multiple consequences that would result. Consequently, the task policymakers are facing is to modify the pricing policy requirements, so that more consistent long-term signals are given to producers, while at the same time correcting for specific distortions that lower returns to particular crops.

III. Open Questions for Further Research

As argued above, the results of this study suggest that welfare-increasing economic policies should

- (1) dismantle the indirect and invisible burden arising from exchange rate distortions for agricultural incentives and
- (2) reverse the distorted price ratio between export and food crops to the favor of export crops.

Beyond this general conclusions, it was not possible to answer all related questions, and our study raises some issues for future research.

A first and important point is that this study has not been intended to provide an optimal agricultural development strategy. Only some im-

portant policy conclusions have been drawn which can be immediately derived from our results with the theory of economic distortions. In order to design optimal strategies, analytical studies for individual countries remain necessary which might utilize the theory of optimal taxation as derived in modern public finance.¹ Additional aspects would have to be covered in such studies, like differential price and income elasticities for rural and urban goods or the equity efficiency trade-off in the social welfare functions.

A second area for further research is the importance of nonprice factors for agricultural incentives. Such nonprice factors are infrastructure, the functioning of credit markets in rural areas or the adoption of technology. It has been shown in several studies [Krishna, 1982; Beynon, 1989] that the supply response in agriculture is strongly dependent of nonprice factors as well as of the price factors which are often stressed within the "getting-prices-right" argument [Timmer, 1986]. A comprehensive policy analysis and proposal would have to identify important nonprice factors limiting a successful agricultural development strategy in an individual country.

The third point is also a major topic in the context of structural adjustment [Panagariya, Schiff, 1990; Imran, Duncan, 1988; Koester et al., 1990]. It was elaborated above that price incentives within agriculture in LDCs are distorted against export crops to the favor of food crops and argued that this price ratio should be changed. A major argument against a joint liberalization of LDCs' policies towards export crops is that world prices would be depressed and total earnings would be reduced.² A comprehensive analysis of optimal policies in individual LDCs would have to judge the validity of the price-decreasing impact for the relevant export markets of the countries under consideration. This is a task for further research. It has to be borne in mind in such analyses, however, that a major difference exists between the aggregate view of all exporters and the individual country's point of view. Export demand for the individual country's products will usually be much more price elastic than aggregate world demand, and the individual country

¹ Important contributions along these lines include the papers of Stern, Newbery, Atkinson, Heady and Mitra, and Sah and Stiglitz in Newbery and Stern [1987].

² Some evidence is provided by Mabbs-Zeno and Krissoff [1990].

may well find it attractive to expand even on a market which seems to be "saturated" from a world market point of view.

Appendix Tables

Table A1 - PSEs in OECD Countries, by Country or Country Group and by Commodities, 1979-1990 (a)

	Percentage PSEs				
	1979-1986	1987	1988	1989(b)	1990(c)
PSEs for all agricultural products in various OECD countries(a)					
Australia	12	11	9	10	11
Austria	32	48	47	39	46
Canada	32	49	42	37	41
EC	37	49	46	41	48
Finland	58	72	73	70	72
Japan	66	76	74	71	68
New Zealand	25	14	7	5	5
Norway	72	76	76	75	77
Sweden	44	57	52	52	59
Switzerland	68	80	78	73	78
USA	28	41	34	29	30
Average	37	50	46	41	44
Average PSEs for individual agricultural products in the OECD(a)					
Wheat	31	61	46	30	47
Coarse grains	28	56	43	35	39
Rice	74	90	85	82	83
Oilseeds	15	33	27	27	31
Sugar (refined sugar equivalents)	49	73	62	47	53
Milk	60	70	62	60	68
Beef and veal	41	44	49	44	43
Pigmeat	13	15	17	14	12
Poultry	15	26	23	19	20
Sheepmeat	49	63	67	63	64
Wool	14	7	5	6	9
Eggs	11	11	17	17	9
Crops	36	62	51	43	49
Livestock production	37	43	43	40	42
(a) The PSE estimates are based on net percentage PSEs for livestock production and on gross percentage PSEs as defined by Equation [19] for crops. Net PSEs are computed by subtracting the amount of input taxation, i.e., the farm feed adjustment, from the gross PSEs of livestock production. - (b) Estimated. - (c) Provisional.					

Source: OECD [c].

Table A2 - Unadjusted NPCs for 32 Wheat-Producing Countries, 1969-1985

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Net importers									
Brazil	2.23	2.31	2.02	1.83	1.29	0.99	1.80	1.51	2.39
Chile	0.88	0.84	1.16	0.96	0.25	0.51	0.78	0.68	1.47
Mexico	2.58	1.67	2.50	2.32	1.71	1.21	1.31	0.72	2.04
Italy	1.51	1.59	1.55	1.49	1.24	0.98	0.98	1.20	1.35
UK	1.17	1.21	1.19	1.32	1.40	0.72	0.74	0.90	1.02
West Germany	1.02	1.15	1.10	1.17	1.09	0.91	0.89	0.97	1.38
Algeria	1.33	1.50	1.58	2.18	1.31	0.85	0.68	0.85	1.19
Egypt	1.01	1.29	0.99	0.97	0.89	0.48	0.62	0.68	0.89
Kenya	1.83	1.80	1.68	1.00	0.68	0.58	1.02	0.62	1.08
Morocco	1.25	1.20	1.29	1.36	1.19	0.91	1.16	1.14	2.08
Nigeria	1.41	1.74	2.56	1.93	1.61	1.05	1.24	1.30	1.30
Tanzania	1.18	1.29	1.56	1.57	0.91	0.66	0.78	0.99	1.17
Tunisia	1.51	1.38	1.42	1.62	1.06	0.89	1.20	1.28	1.54
India	2.59	2.80	2.44	2.54	1.57	1.67	1.33	1.24	1.25
Japan	2.32	2.46	2.60	3.16	2.26	1.50	1.91	2.26	4.77
Pakistan	1.53	2.50	2.53	1.24	0.99	0.65	0.62	0.80	0.94
South Korea	1.26	1.18	1.27	1.45	0.77	0.72	0.90	1.23	1.64
Syria	1.23	0.91	0.88	1.05	1.01	0.50	0.69	0.80	1.06
Poland	0.93	0.93	0.97	1.03	1.05	0.87	0.66	0.83	1.09
Yugoslavia	1.37	1.19	1.86	2.13	0.76	0.87	0.90	1.26	1.44
Net exporters									
Australia	1.30	1.40	1.51	1.48	2.67	1.20	0.86	0.84	1.04
Argentina	0.74	0.68	0.61	0.44	0.60	0.44	0.24	0.49	0.85
Canada	2.57	3.06	2.93	3.11	3.10	1.48	1.40	1.49	1.96
Uruguay	0.82	na	0.73	0.94	0.86	0.61	0.73	0.78	1.07
USA	2.41	2.55	2.40	2.56	2.27	1.42	1.43	1.37	1.62
France	1.43	1.41	1.24	1.35	1.08	0.92	1.08	1.09	1.01
Greece	1.84	1.69	1.91	2.01	1.22	0.82	0.91	1.42	1.90
Spain	2.35	2.70	1.09	2.53	1.35	0.71	0.56	0.78	1.06
Sweden	1.72	1.68	1.59	1.82	1.33	0.72	1.01	1.13	1.58
South Africa	1.10	1.41	1.40	1.22	1.01	0.95	0.84	0.82	1.08
Turkey	1.63	1.39	1.00	1.42	1.21	0.83	0.84	1.08	1.62
Hungary	0.98	0.93	0.75	0.74	0.52	0.44	0.44	0.52	0.58

Table A2 continued

	1978	1979	1980	1981	1982	1983	1984	1985
Net importers								
Brazil	1.74	1.28	0.82	1.16	1.41	1.14	1.30	1.65
Chile	1.13	0.96	1.06	1.15	1.07	1.24	1.32	1.38
Mexico	1.65	1.43	1.41	1.61	1.14	1.65	2.13	3.12
Italy	1.23	1.22	1.14	1.09	1.10	1.09	1.06	1.04
UK	0.97	1.02	1.01	0.97	1.00	1.04	1.01	1.02
West Germany	1.04	1.38	1.17	0.93	1.31	1.24	1.14	0.86
Algeria	1.60	1.65	1.44	1.09	1.45	1.65	1.84	2.18
Egypt	0.99	0.56	0.61	0.52	0.48	0.77	na	na
Kenya	1.01	0.65	0.82	0.91	0.90	0.90	0.96	1.01
Morocco	1.91	1.83	1.97	1.94	1.41	1.57	1.49	1.62
Nigeria	1.80	2.21	2.10	2.33	1.88	0.92	1.72	1.97
Tanzania	1.12	1.01	0.89	1.21	1.25	1.31	1.46	1.86
Tunisia	1.46	1.14	0.96	1.04	1.25	1.20	1.16	1.35
India	0.89	0.81	0.87	1.19	1.38	1.32	na	na
Japan	5.49	4.42	3.84	3.86	3.93	4.18	4.35	4.48
Pakistan	1.11	0.87	0.82	0.78	0.66	0.79	0.59	0.68
South Korea	1.82	1.53	2.20	2.10	2.27	2.42	2.27	2.17
Syria	1.37	1.37	1.25	1.24	2.29	1.67	1.87	2.08
Poland	1.00	0.71	0.53	0.83	0.87	1.38	1.16	1.03
Yugoslavia	1.24	1.35	1.39	1.66	1.54	1.26	1.39	1.31
Net exporters								
Australia	1.57	1.44	1.21	1.06	1.15	1.07	1.16	1.00
Argentina	1.07	0.96	1.02	0.98	2.82	na	2.65	1.96
Canada	2.22	1.83	1.62	1.45	1.52	1.63	1.57	1.46
Uruguay	0.85	1.05	1.35	1.89	1.38	1.03	1.04	0.57
USA	1.64	1.51	1.38	1.32	1.38	1.44	1.47	1.47
France	1.00	1.07	1.06	1.07	1.12	1.12	0.98	1.01
Greece	2.00	2.04	1.72	1.26	1.60	1.37	1.28	1.23
Spain	1.05	2.19	0.94	1.09	1.52	1.49	0.91	1.00
Sweden	1.39	1.26	1.12	1.14	1.34	1.28	1.16	1.20
South Africa	1.06	1.30	1.52	1.30	1.44	1.48	1.32	1.07
Turkey	1.52	1.39	0.91	0.87	0.85	0.80	0.87	0.82
Hungary	0.57	0.51	0.59	0.56	0.63	0.66	0.64	0.66
na - not available.								

Source: Own computations with data from FAO [d] for domestic prices, FAO [e] for border prices and Taylor [1989] as well as World Atlas Agricultural Committee [1973] for internal transportation costs.

Table A3 - NPC's for Wheat-Producing Countries Adjusted for Exchange Rate Distortions, 1969-1985

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Net importers									
Brazil	2.00	2.07	1.77	1.60	1.17	0.87	1.45	1.15	1.92
Chile	0.60	0.43	0.25	0.09	0.03	0.36	0.66	0.60	1.31
Mexico	2.58	1.67	2.50	2.32	1.71	1.21	1.31	0.70	1.99
Italy	1.47	1.55	1.54	1.45	1.14	0.89	0.93	1.11	1.33
UK	1.16	1.20	1.19	1.31	1.40	0.72	0.73	0.89	1.03
West Germany	1.03	1.15	1.10	1.17	1.10	0.91	0.89	0.97	1.39
Algeria	0.86	1.04	1.16	1.36	0.82	0.53	0.42	0.48	0.56
Egypt	0.49	0.62	0.52	0.52	0.53	0.30	0.35	0.36	0.49
Kenya	1.35	1.35	1.26	0.76	0.44	0.48	0.86	0.55	1.05
Morocco	1.12	1.13	1.26	1.27	1.13	0.88	1.09	1.08	1.97
Nigeria	1.12	1.38	1.80	1.54	1.27	0.75	0.86	0.97	0.82
Tanzania	0.83	0.93	0.96	0.74	0.44	0.33	0.28	0.37	0.46
Tunisia	1.13	1.11	1.25	1.34	0.94	0.86	1.14	1.14	1.52
India	1.55	1.69	1.43	1.83	1.33	1.45	1.16	1.06	1.11
Japan	2.30	2.43	2.56	3.15	2.25	1.50	1.91	2.26	4.77
Pakistan	0.70	1.12	1.01	0.88	0.78	0.55	0.55	0.73	0.73
South Korea	1.04	0.98	1.08	1.37	0.73	0.58	0.86	1.21	1.56
Syria	1.05	0.78	0.75	0.93	0.97	0.49	0.68	0.76	1.01
Poland	0.28	0.28	0.35	0.45	0.45	0.34	0.22	0.23	0.29
Yugoslavia	1.27	1.09	1.72	2.04	0.78	0.85	0.88	1.20	1.36
Net exporters									
Australia	1.30	1.40	1.51	1.48	2.67	1.18	0.86	0.83	1.04
Argentina	0.73	0.66	0.45	0.31	0.50	0.23	0.12	0.27	0.81
Canada	2.58	3.07	2.94	3.11	3.10	1.48	1.40	1.49	1.95
Uruguay	0.81	na	0.39	0.57	0.74	0.40	0.61	0.68	1.05
USA	2.41	2.55	1.80	2.40	2.56	2.27	1.43	1.37	1.62
France	1.35	1.40	1.27	1.38	1.07	0.92	1.08	1.08	0.98
Greece	1.76	1.63	1.86	1.95	1.18	0.78	0.87	1.37	1.80
Spain	2.27	2.62	1.04	2.51	1.35	0.70	0.55	0.77	1.51
Sweden	1.70	1.65	1.58	1.78	1.30	0.71	1.00	1.12	1.02
South Africa	1.06	1.27	1.27	1.10	0.90	0.85	0.74	0.59	0.87
Turkey	1.26	1.08	0.95	1.38	1.21	0.80	0.77	0.99	1.37
Hungary	1.06	1.11	1.08	0.99	0.71	0.62	0.62	0.58	0.64

Table A3 continued

	1978	1979	1980	1981	1982	1983	1984	1985
Net importers								
Brazil	1.41	1.06	0.73	1.04	0.98	0.75	1.02	1.25
Chile	1.11	0.93	1.00	1.05	0.93	0.86	1.06	1.10
Mexico	1.63	1.42	1.37	1.49	0.69	0.82	1.49	1.94
Italy	1.23	1.22	1.13	1.06	1.08	1.06	1.05	1.05
UK	0.97	1.02	1.01	0.96	1.00	1.03	1.00	1.03
West Germany	1.05	1.38	1.16	0.93	1.31	1.23	1.08	0.87
Algeria	0.73	0.72	0.51	0.35	0.42	0.46	0.42	0.45
Egypt	0.55	0.52	0.56	0.42	0.32	0.48	na	na
Kenya	0.93	0.57	0.74	0.74	0.62	0.67	0.77	0.91
Morocco	1.77	1.64	1.87	1.87	1.32	1.48	1.43	1.62
Nigeria	0.99	1.27	1.26	1.55	1.11	0.37	0.41	0.46
Tanzania	0.67	0.70	0.39	0.39	0.41	0.35	0.31	0.47
Tunisia	1.40	1.11	0.87	1.03	1.16	1.10	1.02	1.28
India	0.74	0.67	0.61	1.08	1.20	1.07	na	na
Japan	5.49	4.42	3.84	3.86	3.93	4.18	4.35	4.48
Pakistan	0.83	0.67	0.64	0.58	0.45	0.55	0.45	0.58
South Korea	1.69	1.33	2.00	1.89	2.16	2.23	2.24	2.34
Syria	1.30	1.24	1.08	0.80	1.48	1.10	0.91	0.67
Poland	0.28	0.27	0.20	0.16	0.16	0.22	0.20	0.25
Yugoslavia	1.17	1.24	1.24	1.43	1.26	1.08	1.24	1.20
Net exporters								
Australia	1.57	1.44	1.21	1.06	1.15	1.07	1.16	1.00
Argentina	1.05	0.94	1.00	0.64	1.15	na	1.04	0.90
Canada	2.20	1.83	1.62	1.45	1.52	1.63	1.57	1.45
Uruguay	0.83	1.05	1.34	1.88	1.30	1.02	0.98	0.51
USA	1.64	1.51	1.38	1.32	1.38	1.44	1.47	1.47
France	0.99	1.06	1.03	0.98	1.04	1.00	0.96	1.02
Greece	1.92	1.94	1.61	1.17	1.46	1.23	1.17	1.12
Spain	1.37	1.25	1.06	1.08	1.30	1.25	1.15	1.21
Sweden	1.00	2.10	0.92	1.04	1.46	1.44	0.90	1.01
South Afrika	0.94	1.16	1.38	1.19	1.29	1.31	1.24	0.99
Turkey	1.16	0.89	0.83	0.62	0.62	0.59	0.66	0.70
Hungary	0.65	0.54	0.61	0.52	0.56	0.53	0.53	0.50
na = not available.								

Source: Own computations with data from Cowitt [1986], IMF [1990], Pick [1978], and Table A2.

Table A4 - Unadjusted NPCs for 29 Rice-Producing Countries, 1969-1985

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Net importers									
Cameroon	0.72	0.45	0.68	0.78	0.52	0.34	0.43	0.65	1.29
Ivory Coast	1.46	1.48	1.86	1.60	0.78	0.88	0.80	1.28	1.38
Kenya	0.48	0.43	0.43	0.63	0.49	0.43	0.38	0.66	0.52
Madagascar	1.25	1.94	2.06	2.15	1.65	0.86	1.14	1.43	0.97
Nigeria	3.03	2.69	1.35	1.45	1.18	1.14	1.20	1.43	1.12
Senegal	1.46	1.62	1.80	1.77	1.48	0.48	0.68	1.71	1.11
Tanzania	0.78	1.03	1.00	0.95	0.83	0.31	0.46	0.62	0.66
Zambia	0.57	0.74	0.86	0.89	0.89	0.72	0.71	0.91	0.88
Bangladesh	0.77	0.92	1.03	1.62	3.48	2.09	0.92	0.68	0.72
India	0.95	1.12	1.08	1.09	0.80	0.83	0.83	0.75	0.58
Indonesia	0.49	0.60	0.38	0.48	0.72	0.46	0.51	0.80	0.86
Malaysia	1.59	1.96	2.40	2.12	1.21	0.48	0.98	1.52	1.51
Philippines	1.31	1.38	1.71	1.98	1.45	0.91	0.71	0.98	1.43
South Korea	1.01	1.19	1.44	1.83	1.22	0.64	0.91	1.78	2.54
Sri Lanka	1.23	1.65	1.60	2.09	1.38	0.82	1.34	1.63	1.46
Turkey	1.51	1.51	1.92	1.72	1.28	1.49	1.62	2.62	3.28
Mexico	1.42	2.49	1.91	1.66	1.25	1.34	0.88	1.05	1.37
Net exporters									
Burma	0.38	0.68	0.69	0.74	0.77	0.38	0.29	0.60	0.57
Egypt	0.74	0.92	0.97	0.94	0.52	0.20	0.28	0.52	0.78
Japan	1.63	3.31	3.45	3.71	3.29	2.85	3.28	3.42	6.71
Nepal	1.35	1.45	1.12	1.11	1.02	0.77	0.75	0.80	0.71
Pakistan	0.85	1.37	0.97	1.38	0.66	0.71	0.65	0.74	0.91
Thailand	0.68	0.74	0.77	0.78	0.57	0.38	0.52	0.68	0.65
Argentina	0.94	1.00	1.20	1.34	0.54	0.77	0.25	0.88	1.03
Colombia	1.25	2.00	1.00	1.48	0.98	0.82	0.85	0.97	1.43
USA	1.60	1.69	1.75	1.85	1.78	1.02	1.02	1.22	1.40
Australia	1.29	1.40	1.31	1.55	1.62	1.23	0.88	0.99	1.15
Italy	1.62	2.37	2.62	2.03	1.35	1.00	1.15	1.38	1.31
Spain	1.34	1.58	1.62	1.68	1.45	1.08	0.97	1.38	1.17

Table A4 continued

	1978	1979	1980	1981	1982	1983	1984	1985
Net importers								
Cameroon	1.74	2.02	2.00	1.78	2.00	na	na	na
Ivory Coast	1.58	1.75	1.60	0.94	1.18	1.22	1.43	1.49
Kenya	0.57	0.62	0.78	0.74	0.75	0.57	na	na
Madagascar	0.94	0.94	0.82	0.75	0.94	1.00	0.85	0.69
Nigeria	1.06	1.45	1.66	1.62	1.71	2.14	2.09	1.89
Senegal	0.94	1.74	1.26	1.12	1.29	1.32	1.31	1.85
Tanzania	0.72	0.80	0.68	0.88	1.31	1.03	1.11	1.05
Zambia	0.82	0.82	0.83	0.78	1.08	0.98	0.74	0.32
Bangladesh	1.09	1.17	1.22	1.34	1.05	1.43	1.00	1.08
India	0.57	0.82	0.83	0.75	0.97	0.97	1.00	1.11
Indonesia	0.86	0.89	0.91	0.91	1.00	0.74	0.80	0.97
Malaysia	1.36	1.26	1.47	1.20	1.64	2.34	2.44	2.66
Philippines	1.35	0.78	0.80	0.80	0.75	1.68	1.08	1.37
South Korea	1.86	2.47	2.18	2.23	2.10	3.24	2.70	2.04
Sri Lanka	0.75	0.74	1.06	0.86	1.00	1.03	0.74	1.14
Turkey	2.31	2.82	2.08	1.83	1.91	1.20	1.31	1.40
Mexico	1.18	1.65	1.57	1.48	1.86	2.12	2.15	2.68
Net exporters								
Burma	0.40	0.46	0.37	0.29	0.40	0.45	0.43	0.37
Egypt	0.69	0.60	0.58	0.51	0.60	0.82	na	na
Japan	5.26	6.52	4.89	4.89	5.02	6.37	5.08	4.71
Nepal	0.65	0.66	0.60	na	na	na	na	na
Pakistan	0.78	0.78	0.78	0.78	0.75	0.89	0.82	na
Thailand	0.45	0.80	0.74	0.57	0.80	0.83	0.88	0.85
Argentina	1.02	0.92	0.88	na	na	na	na	na
Colombia	1.09	0.82	1.00	1.03	1.14	1.03	1.38	0.92
USA	0.98	1.29	1.26	0.88	1.00	1.06	1.00	1.00
Australia	1.22	1.12	1.18	1.08	0.82	1.18	0.88	0.94
Italy	1.26	1.32	1.31	1.28	1.28	1.38	1.32	1.25
Spain	1.05	1.25	1.23	1.00	1.05	1.28	1.25	1.25
na = not available.								

Source: Own computations with data from FAO [d] for producer prices, FAO [e] for border prices and IMF [1990] for official exchange rates.

Table A5 - NPCs for Rice-Producing Countries Adjusted for Exchange Rate Distortions, 1969-1985

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Net importers									
Cameroon	0.71	0.45	0.68	0.80	0.52	0.34	0.43	0.65	1.29
Ivory Coast	1.45	1.46	1.88	1.63	0.78	0.88	0.80	1.29	1.38
Kenya	0.35	0.32	0.32	0.48	0.32	0.35	0.32	0.58	0.51
Madagascar	1.00	1.55	1.65	1.72	1.32	0.69	0.91	1.14	0.77
Nigeria	2.40	2.14	0.95	1.15	0.94	0.82	0.83	1.06	0.71
Senegal	1.45	1.60	1.82	1.82	1.46	0.48	0.68	1.72	1.11
Tanzania	0.55	0.74	0.62	0.45	0.40	0.15	0.17	0.23	0.26
Zambia	0.42	0.54	0.58	0.43	0.46	0.40	0.38	0.35	0.31
Bangladesh	0.45	0.54	0.60	0.95	1.98	1.08	0.54	0.48	0.46
India	0.57	0.68	0.63	0.78	0.68	0.72	0.72	0.65	0.52
Indonesia	0.48	0.58	0.38	0.46	0.71	0.45	0.48	0.78	0.85
Malaysia	1.59	1.96	2.40	2.12	1.21	0.48	0.98	1.52	1.51
Philippines	1.26	1.34	1.57	1.88	1.35	0.86	0.65	0.92	1.35
South Korea	0.84	0.99	1.21	1.72	1.16	0.51	0.87	1.74	2.41
Sri Lanka	0.55	0.74	0.57	0.85	0.75	0.51	0.66	0.97	0.94
Turkey	1.17	1.17	1.83	1.68	1.28	1.45	1.48	2.38	2.78
Mexico	1.42	2.49	1.91	1.66	1.25	1.34	0.88	1.02	1.34
Net exporters									
Burma	0.11	0.18	0.18	0.25	0.23	0.12	0.09	0.18	0.12
Egypt	0.35	0.45	0.51	0.51	0.31	0.12	0.15	0.28	0.43
Japan	1.62	3.26	3.40	3.69	3.28	2.85	3.28	3.42	6.71
Nepal	0.80	0.85	0.66	0.80	0.98	0.82	0.63	0.74	0.65
Pakistan	0.38	0.62	0.38	0.98	0.52	0.60	0.57	0.68	0.71
Thailand	0.68	0.74	0.77	0.78	0.58	0.38	0.51	0.65	0.63
Argentina	0.92	0.97	0.88	0.92	0.45	0.40	0.12	0.48	0.98
Colombia	1.05	1.68	0.88	1.38	0.94	0.72	0.78	0.91	1.42
USA	1.60	1.69	1.75	1.85	1.78	1.02	1.02	1.22	1.40
Australia	1.29	1.40	1.31	1.55	1.62	1.23	0.88	0.98	1.15
Italy	1.57	2.31	2.60	1.98	1.25	0.91	1.09	1.28	1.29
Spain	1.29	1.54	1.55	1.66	1.45	1.06	0.95	1.35	1.12

Table A5 continued

	1978	1979	1980	1981	1982	1983	1984	1985
Net importers								
Cameroon	1.82	1.98	2.02	1.66	1.86	na	na	na
Ivory Coast	1.66	1.72	1.62	0.88	1.11	1.03	1.28	1.75
Kenya	0.52	0.54	0.71	0.52	0.49	0.46	na	na
Madagascar	0.75	0.75	0.65	0.52	0.46	0.48	0.55	0.66
Nigeria	0.58	0.83	1.00	0.97	1.03	1.28	1.26	1.14
Senegal	0.98	1.71	1.29	1.05	1.20	1.08	1.17	2.17
Tanzania	0.43	0.55	0.29	0.29	0.42	0.23	0.23	0.31
Zambia	0.31	0.45	0.49	0.55	0.74	0.65	0.31	0.11
Bangladesh	0.49	0.49	0.57	0.78	0.62	0.95	0.66	0.34
India	0.48	0.68	0.58	0.66	0.85	0.72	0.78	0.98
Indonesia	0.82	0.88	0.89	0.86	0.91	0.66	0.75	0.89
Malaysia	1.36	1.26	1.47	1.20	1.64	2.34	2.44	2.66
Philippines	1.28	0.72	0.75	0.72	0.66	0.86	0.88	1.52
South Korea	1.72	2.15	1.98	2.15	1.98	2.93	2.89	2.23
Sri Lanka	0.57	0.52	0.80	0.65	0.75	0.77	0.55	0.86
Turkey	1.77	1.82	1.88	1.28	1.45	0.86	1.06	1.23
Mexico	1.17	1.63	1.52	1.32	1.12	1.46	1.54	1.42
Net exporters								
Burma	0.09	0.08	0.06	0.09	0.12	0.14	0.12	0.11
Egypt	0.38	0.55	0.54	0.35	0.40	0.49	na	na
Japan	5.26	6.52	4.89	4.89	5.02	6.37	5.08	4.71
Nepal	0.57	0.58	0.58	na	na	na	na	na
Pakistan	0.58	0.60	0.62	0.55	0.49	0.65	0.65	na
Thailand	0.45	0.80	0.77	0.54	0.85	0.82	0.80	0.89
Argentina	1.00	0.91	0.86	na	na	na	na	na
Colombia	1.08	0.80	0.98	0.94	1.03	0.75	1.02	0.69
USA	0.98	1.29	1.26	0.88	1.00	1.06	1.00	1.00
Australia	1.22	1.12	1.18	1.08	0.82	1.18	0.88	0.94
Italy	1.25	1.32	1.29	1.28	1.28	1.38	1.32	1.25
Spain	1.00	1.20	1.20	1.00	1.05	1.28	1.25	1.25
na = not available.								

Source: Own computations with data from Cowitt [1986], IMF [1990], Pick [1978], and Table A4.

Table A6 - Unadjusted NPCs for 22 Coffee-Producing Countries, 1969-1985

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Cameroon	0.82	0.59	0.60	0.69	0.61	0.55	0.72	0.57	0.36
Ivory Coast	0.59	0.47	0.50	0.58	0.56	0.54	0.65	0.39	0.23
Kenya	1.03	0.96	0.99	1.05	1.02	0.96	1.08	1.08	0.94
Madagascar	0.70	0.71	0.73	0.73	0.78	0.77	0.87	0.48	0.25
Rwanda	1.08	0.62	0.77	0.79	0.83	0.86	1.00	0.57	0.29
Tanzania	0.81	0.97	1.10	1.18	1.22	0.86	2.02	0.81	0.45
Uganda	0.84	0.81	0.73	0.82	0.66	0.55	0.69	0.36	0.16
Zaire	0.65	0.85	0.87	0.64	0.59	0.73	0.36	0.11	0.08
Brazil	0.62	0.50	0.70	0.75	0.69	1.19	2.86	0.71	0.28
Colombia	0.73	0.65	0.70	0.70	0.63	0.68	0.58	0.52	0.33
Costa Rica	0.86	0.81	0.82	0.83	0.78	0.75	0.78	0.72	0.69
Dominican Republic	0.66	0.50	0.58	0.55	0.89	0.91	0.99	0.95	0.93
Ecuador	0.76	0.54	0.53	0.58	0.78	0.47	0.88	0.46	0.37
El Salvador	0.91	0.91	0.89	0.93	0.90	0.81	0.62	1.03	0.92
Guatemala	0.78	0.68	0.74	0.83	0.63	0.70	0.89	0.83	0.80
Honduras	0.83	0.81	0.68	0.62	0.71	0.67	0.80	0.48	0.23
Mexico	0.85	0.73	0.78	0.74	0.72	0.69	0.84	1.29	0.46
Peru	0.61	0.50	0.51	0.55	0.51	0.46	0.57	0.22	0.34
Venezuela	0.88	1.05	1.10	0.78	0.81	0.33	0.41	0.39	0.30
Indonesia	0.97	0.60	0.46	0.45	0.84	0.74	1.16	0.54	0.30
Philippines	na	1.24	0.82	0.92	0.96	0.69	0.87	0.91	1.00
Sri Lanka	na	na	na	na	1.03	1.16	0.85	1.07	1.11
	1978	1979	1980	1981	1982	1983	1984	1985	
Cameroon	0.37	0.47	0.47	0.60	0.52	0.50	0.40	0.41	
Ivory Coast	0.45	0.40	0.48	0.59	0.55	0.44	0.38	0.32	
Kenya	0.99	1.03	1.00	0.85	0.99	1.01	0.93	0.92	
Madagascar	0.30	0.34	0.36	0.53	0.47	0.32	0.25	0.29	
Rwanda	0.36	0.60	0.80	0.74	0.65	0.76	0.76	0.76	
Tanzania	0.33	0.32	0.36	0.41	0.56	0.62	0.61	0.85	
Uganda	0.20	0.38	0.36	0.45	0.34	0.14	0.11	0.12	
Zaire	na	0.53	0.71	0.93	1.51	1.01	0.55	na	
Brazil	0.61	0.49	0.48	0.67	0.38	0.27	0.25	0.53	
Colombia	0.42	0.47	0.44	0.56	0.50	0.31	0.45	0.40	
Costa Rica	0.71	0.71	0.75	0.60	0.70	0.77	0.73	0.72	
Dominican Republic	0.98	na	0.85	1.07	0.81	0.80	na	0.35	
Ecuador	0.49	0.43	0.74	na	na	na	na	na	
El Salvador	0.80	na	na	na	0.54	0.60	0.66	0.61	
Guatemala	0.71	0.83	0.67	0.73	0.68	0.64	0.65	0.93	
Honduras	0.78	1.13	0.65	0.67	0.63	0.62	0.60	0.56	
Mexico	0.61	0.62	0.60	0.80	0.48	0.45	0.41	0.99	
Peru	0.45	0.42	0.43	0.41	0.31	0.31	0.47	na	
Venezuela	0.71	0.81	0.68	0.87	0.88	1.10	0.40	0.64	
Indonesia	0.93	0.60	0.70	1.09	1.10	1.02	0.94	1.00	
Philippines	0.88	0.82	0.86	0.83	0.69	0.75	0.77	0.59	
Sri Lanka	0.77	0.67	0.71	0.79	0.71	0.65	0.62	0.72	

na = not available.

Source: Own computations with data from FAO [d] for domestic prices, FAO [e] for border prices and World Atlas Agricultural Committee [1973] for internal transportation costs.

Table A7 -NPCs for Coffee-Producing Countries Adjusted for Exchange Rate Distortions, 1969-1985

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Cameroon	0.80	0.59	0.60	0.70	0.61	0.55	0.72	0.57	0.36
Ivory Coast	0.58	0.47	0.50	0.59	0.56	0.54	0.65	0.39	0.23
Kenya	0.76	0.72	0.74	0.80	0.67	0.79	0.91	0.95	0.91
Madagascar	0.56	0.57	0.58	0.58	0.63	0.62	0.70	0.38	0.20
Rwanda	na	na	na	na	na	na	na	0.27	0.27
Tanzania	0.57	0.69	0.68	0.55	0.59	0.43	0.74	0.30	0.18
Uganda	0.59	0.57	0.48	0.45	0.22	0.14	0.09	0.04	0.02
Zaire	0.66	0.68	0.60	0.41	0.37	0.43	0.18	0.04	0.03
Brazil	0.55	0.45	0.61	0.66	0.62	1.04	2.30	0.54	0.23
Colombia	0.61	0.54	0.62	0.65	0.60	0.60	0.54	0.48	0.33
Costa Rica	0.72	0.80	0.67	0.48	0.50	0.65	0.72	0.63	0.63
Dominican Republic	0.53	0.41	0.46	0.45	0.73	0.75	0.78	0.70	0.69
Ecuador	0.62	0.45	0.48	0.53	0.76	0.47	0.86	0.42	0.34
El Salvador	0.77	0.77	0.76	0.79	0.76	0.69	0.52	0.85	0.69
Guatemala	0.63	0.54	0.59	0.67	0.50	0.56	0.71	0.68	0.64
Honduras	0.83	0.81	0.68	0.62	0.71	0.67	0.80	0.48	0.23
Mexico	0.85	0.73	0.78	0.74	0.72	0.69	0.84	1.25	0.45
Peru	0.54	0.36	0.33	0.33	0.30	0.30	0.34	0.16	0.30
Venezuela	0.87	1.04	1.09	0.78	0.81	0.33	0.41	0.42	0.30
Indonesia	0.94	0.58	0.46	0.44	0.82	0.71	1.09	0.53	0.30
Philippines	na	1.20	0.76	0.87	0.89	0.66	0.80	0.85	0.94
Sri Lanka	na	na	na	na	0.56	0.72	0.42	0.64	0.71
	1978	1979	1980	1981	1982	1983	1984	1985	
Cameroon	0.39	0.46	0.47	0.57	0.48	0.44	0.35	0.43	
Ivory Coast	0.47	0.39	0.49	0.55	0.52	0.39	0.33	0.33	
Kenya	0.91	0.91	0.90	0.69	0.68	0.75	0.74	0.83	
Madagascar	0.24	0.27	0.28	0.40	0.28	0.16	0.14	0.24	
Rwanda	0.30	0.50	0.67	0.62	0.42	0.50	0.45	0.54	
Tanzania	0.20	0.22	0.15	0.13	0.19	0.17	0.13	0.22	
Uganda	0.02	0.04	0.03	0.11	0.13	0.06	0.08	0.08	
Zaire	na	0.18	0.31	0.33	0.48	0.28	0.30	na	
Brazil	0.49	0.41	0.43	0.60	0.27	0.17	0.20	0.40	
Colombia	0.41	0.46	0.36	0.52	0.46	0.42	0.33	0.30	
Costa Rica	0.68	0.65	0.59	0.47	0.45	0.54	0.58	0.58	
Dominican Republic	0.71	na	0.62	0.79	0.54	0.45	na	0.22	
Ecuador	0.47	0.38	0.66	na	na	na	na	na	
El Salvador	0.66	na	na	na	0.28	0.30	0.33	0.21	
Guatemala	0.52	0.56	0.42	0.60	0.55	0.44	0.37	0.36	
Honduras	0.78	1.13	0.65	0.67	0.63	0.62	0.60	0.56	
Mexico	0.60	0.61	0.59	0.74	0.29	0.22	0.29	0.62	
Peru	0.43	0.37	0.37	0.34	0.24	0.21	0.28	na	
Venezuela	0.71	0.81	0.68	0.87	0.85	0.69	0.17	0.30	
Indonesia	0.88	0.59	0.69	1.06	1.02	0.91	0.86	0.93	
Philippines	0.83	0.76	0.81	0.77	0.62	0.52	0.51	0.57	
Sri Lanka	0.58	0.47	0.54	0.71	0.63	0.51	0.45	0.63	

na = not available.

Source: Own computations with data from Cowitt [1986], IMF [1990], Pick [1978], and Table A6.

Table A8 - Average Exchange Rate Distortion Factors, 1969-1985 (a)

Algeria	0.4813	Malaysia	1.0000
Argentina	0.7241	Mexico	0.8968
Australia	0.9983	Morocco	0.9460
Bangladesh	0.5591	Nepal	0.8260
Brazil	0.8236	Nigeria	0.6187
Burma	0.2734	Pakistan	0.7209
Cameroon	0.9822	Peru	0.7423
Canada	0.9992	Philippines	0.9046
Chile	0.6992	Poland	0.2980
Colombia	0.8882	Rwanda	0.7355
Costa Rica	0.8124	Senegal	0.9824
Dominican Republic	0.7466	South Africa	0.8876
Ecuador	0.9143	Spain	0.9751
Egypt	0.6254	Sri Lanka	0.7140
El Salvador	0.7276	Sweden	0.9813
France	0.9778	Syria	0.8085
Greece	0.9452	Tanzania	0.4551
Guatemala	0.7366	Thailand	0.9933
Honduras	1.0000	Tunisia	0.9087
Hungary	1.1107	Uganda	0.3746
India	0.7866	UK	0.9986
Indonesia	0.9591	USA	1.0000
Italy	0.9711	Venezuela	0.9134
Ivory Coast	0.9836	West Germany	1.0000
Japan	0.9711	Yugoslavia	0.9237
Kenya	0.8113	Zaire	0.5101
Madagascar	0.7530	Zambia	0.6355

(a) The distortion factor was computed by dividing black market exchange rates by official exchange rates. The more the factor differs from unity, the stronger exchange rate distortions are. Factors below unity indicate exchange rate overvaluations.

Source: Own computations with data from Cowitt [1986], IMF [1990] and Pick [1978].

Table A9 - Variance Decomposition of Gross NPCs for Wheat-Producing Countries (a), 1969-1985

	Percentage standard deviation from loglinear trend(b)			Contribution of components to Var(NPC) (percent)(c)		
	NPC	P_i^S	P_w	CP_i^S	CP_w	$CP_i^S P_w$
Importers						
Italy	10.95--	16.12++	22.58++	211.64	421.39	533.03
Japan	26.46++	22.58++	27.93++	72.90	111.56	84.46
UK	16.12	20.25++	28.28++	158.14	308.83	366.97
West Germany	14.49	18.71+	21.68+	170.27	226.73	297.00
Algeria	30.17	10.95++	31.30++	13.60	107.61	21.21
Brazil	25.50-	17.89++	26.65++	49.12	108.42	57.54
Chile	36.47+	27.93++	27.02++	58.87	54.77	13.64
Egypt	23.24-	15.49++	25.69++	43.87	121.77	65.64
India	24.08--	6.32++	24.90++	5.95	107.19	13.14
Kenya	30.33	15.81++	31.78++	27.11	109.64	36.75
Mexico	34.35	18.17++	38.99+	28.03	128.00	56.03
Morocco	18.97+	28.11++	27.57++	217.53	206.97	324.50
Nigeria	27.75	11.83++	25.10++	18.61	82.87	1.48
Pakistan	29.66--	16.12++	25.69++	29.25	75.14	4.39
Poland	21.68	12.25++	16.43++	31.86	57.70	-10.44
South Korea	24.49++	20.00++	29.33++	67.21	142.60	109.81
Syria	27.57++	11.40++	25.69++	16.63	87.80	4.43
Tanzania	25.10	9.49++	25.50++	14.11	102.95	17.06
Tunisia	15.81	12.25++	23.66++	60.66	225.14	185.80
Yugoslavia	25.10	18.97++	29.83+	57.02	141.96	98.98
Exporters						
Australia	24.08	23.24++	28.28++	93.41	137.34	130.75
Canada	20.25--	13.42++	26.65++	42.90	174.26	117.16
France	9.49--	17.89++	23.24++	358.11	599.12	857.23
Greece	26.27	17.32++	32.09++	42.56	149.05	91.62
Spain	42.19	16.43++	46.15+	14.92	119.32	34.24
Sweden	20.49	14.83++	28.64++	51.41	195.56	146.97
USA	21.21--	14.14++	27.39++	44.81	168.11	112.92
Argentina	43.37++	33.40++	30.48++	59.30	49.41	8.71
Hungary	20.74	10.95++	27.93++	28.65	182.09	110.74
South Africa	18.17	21.45++	23.02++	138.50	161.61	200.11
Turkey	21.45-	25.69+	32.25++	145.79	228.05	273.84
Uruguay	28.11	29.50++	29.33++	110.60	108.69	119.29

(a) The method of decomposing variances is defined in Section C.II. Var stands for the trend-corrected variance, P_i^S and P_w are domestic and border prices in US\$, respectively. -

(b) Defined as standard deviation from the loglinear trend multiplied by 100. The indices +, - indicate the 95 percent level and ++, -- the 99 percent level of significance of the estimated loglinear trend. Moreover, they show whether the estimated coefficients carry a positive or negative sign. - (c) CP_i^S , CP_w and $CP_i^S P_w$ are defined in Section C.II.

Source: Own computations with data from FAO [d; e], IMF [1990] and Table A2.

Table A10 - Variance Decomposition of Net NPC's for Wheat-Producing Countries (a), 1969-1985

	Percentage standard deviation from loglinear trend(b)			Contribution of components to Var(NPC) (percent)(c)		
	NPC	P_i^S	P_w	CP_i^S	CP_w	$CP_{iP_w}^S$
Importers						
Italy	13.04-	15.49++	22.58++	135.88	293.85	329.73
Japan	26.46++	22.80++	27.93++	74.56	112.21	86.77
UK	16.12	20.25++	28.28++	156.78	303.80	360.58
West Germany	14.14	18.97+	21.68+	181.01	231.56	312.57
Algeria	25.30--	16.73	31.30++	42.90	152.99	95.89
Brazil	23.66--	17.03+	26.65++	52.18	124.95	77.13
Chile	78.55+	85.09++	27.02++	117.40	11.84	29.24
Egypt	20.74	14.14++	25.69++	46.20	151.88	98.08
India	23.02--	14.14++	24.90++	37.62	117.69	55.31
Kenya	31.30	23.02++	31.78++	54.17	103.56	57.73
Mexico(d)	39.87	30.00	46.69	56.71	137.22	93.93
Morocco	18.44+	27.75++	27.57++	226.25	222.38	348.63
Nigeria	35.64--	27.93	25.10++	61.29	49.87	11.16
Pakistan	17.32--	18.17++	25.69++	111.24	219.57	230.81
Poland	21.91--	17.03	16.43++	59.81	56.50	16.31
South Korea	24.49++	17.89++	29.33++	52.81	142.17	94.98
Syria	26.08	25.69++	25.69++	97.00	97.00	94.00
Tanzania	31.62-	23.02+	25.50++	52.82	65.47	18.29
Tunisia	15.17	16.43++	23.66++	120.81	246.36	267.17
Yugoslavia	22.80	17.89++	29.83+	61.69	171.20	132.89
Exporters						
Australia	24.29	23.24++	28.28++	91.34	135.47	126.81
Canada	20.25--	13.42++	26.65++	43.40	175.00	118.40
France	8.94--	17.61++	23.24++	407.85	696.17	1004.02
Greece	26.65	17.61++	32.09++	43.77	146.17	89.94
Spain	41.95	16.73++	46.15+	16.15	121.14	37.29
Sweden	20.49	14.14++	28.64++	47.11	196.93	144.04
USA	21.21--	14.14++	27.39++	44.82	168.11	112.93
Argentina	55.62	45.03++	30.48++	65.54	30.03	-4.43
Hungary	12.65--	18.17	27.93++	203.58	481.61	585.19
South Africa	21.91	22.36++	23.02++	103.75	110.12	113.87
Turkey	18.97--	26.46	32.25++	195.96	289.08	385.04
Uruguay	36.74+	36.61++	29.33++	99.39	63.41	62.80

(a) The method of decomposing variances is defined in Section C.II. Var stands for the trend-corrected variance in most cases (for exceptions see annotation (d)), P_i^S and P_w are domestic and border prices in US\$, respectively. - (b) Defined as standard deviation from the log-linear trend multiplied by 100. The indices +, - indicate the 95 percent level and ++, -- the 99 percent level of significance of the estimated loglinear trend. Besides they show whether the estimated coefficients carry a positive or negative sign. - (c) CP_i^S , CP_w and $CP_{iP_w}^S$ are defined in Section C.II. - (d) Variance decomposition with uncorrected variances, as two out of three components showed no significant trend.

Source: Own computations with data from FAO [d; e], IMF [1990] and Table A3.

Table A11 - Variance Decomposition of Gross NPCs for Rice-Producing Countries (a), 1969-1985

	Percentage standard deviation from loglinear trend(a)			Contribution of components to Var(NPC) (percent)(a)		
	NPC	P ₁	P _w	CP ₁	CP _w	CP ₁ ^S P _w
Importers						
Bangladesh(b)	38.86	36.05	33.62+	85.69	74.87	60.56
Cameroon	39.12++	27.20++	29.66+	48.04	57.22	5.25
India	19.75	13.78++	25.69++	48.73	169.78	118.51
Indonesia	18.44++	24.70++	19.49++	179.20	110.59	189.79
Ivory Coast	26.27	39.62+	51.12+	227.50	379.75	507.25
Kenya	16.12++	22.80++	26.27++	202.44	268.52	370.95
Madagascar	21.11--	20.49	33.32++	92.34	243.47	235.81
Malaysia(b)	42.54	23.45++	32.71	30.15	58.75	-11.10
Mexico(b)	29.33	20.00++	37.68	46.99	165.93	112.92
Nigeria	29.83	13.78++	37.42++	21.42	157.59	79.00
Philippines	30.00	21.45++	41.35+	50.73	189.17	139.89
Senegal	35.50	20.25++	37.94+	32.82	153.68	86.50
South Korea	29.66++	27.02++	33.02+	82.79	123.44	106.23
Sri Lanka	24.90--	23.87	32.86++	93.12	175.56	168.68
Tanzania	32.71	13.78++	28.28++	18.16	74.39	-7.45
Turkey	28.11	32.56++	24.70++	133.17	76.44	109.61
Zambia	25.69	24.70+	25.30++	92.03	96.97	89.00
Exporters						
Argentina	42.54	25.50++	40.25++	36.02	89.76	25.78
Australia	14.14--	19.49++	22.80++	193.32	263.66	356.88
Burma	25.88-	25.88	41.83+	99.53	260.97	260.50
Colombia	22.36	15.17++	24.90++	47.19	124.18	71.37
Egypt	42.31	13.04++	44.50++	9.66	110.96	20.62
Italy	20.00-	16.12++	30.98++	63.42	237.68	200.68
Japan	23.45++	28.63++	29.33+	149.74	156.71	206.45
Nepal	7.75--	8.94	14.83++	130.66	350.26	380.92
Pakistan	19.75	13.78++	26.83++	49.79	183.96	133.75
Spain	26.27-	21.68++	28.81++	68.12	120.29	88.41
Thailand	21.68	21.90++	37.82++	101.39	303.82	305.20
USA	16.73--	19.24+	24.29++	133.11	209.98	243.08
(a) All notes of Table A9 are again valid. - (b) Variance decomposition with uncorrected variances, as two out of three components showed no significant trend.						

Source: Own computations with data from FAO [d; e], IMF [1990] and Table A4.

Table A12 - Variance Decomposition of Net NPC's for Rice-Producing Countries (a), 1969-1985

	Percentage standard deviation from loglinear trend(a)			Contribution of components to Var(NPC) (percent)(a)		
	NPC	P _i	P _w	CP _i	CP _w	CP _{i w} ^{\$}
Importers						
Bangladesh(b)	40.99	35.36	33.62+	74.55	67.35	41.90
Cameroon	39.24++	27.93++	29.66++	50.71	56.72	7.42
India	15.81+	20.25++	25.69++	163.98	266.89	330.86
Indonesia	19.24++	25.69++	19.49++	175.63	101.22	176.85
Ivory Coast	28.46	40.50+	51.12+	204.58	325.54	430.12
Kenya	17.89++	29.49++	26.27++	271.42	214.96	386.38
Madagascar	22.36--	27.02	33.32++	145.72	220.80	266.52
Malaysia(b)	42.54	23.45++	32.71	30.15	58.75	-11.10
Mexico(b)	23.23	22.14	37.68	91.29	261.83	253.12
Nigeria	32.56	15.17++	37.42++	21.32	131.47	52.79
Philippines	29.33-	28.98+	41.35++	96.96	197.57	194.53
Senegal	37.01	22.58++	37.94+	37.09	141.68	78.77
South Korea	30.82++	25.69++	33.02+	69.46	115.05	84.51
Sri Lanka	20.00	27.39++	32.86++	185.69	268.04	353.73
Tanzania	40.12-	24.29++	28.28++	37.00	49.62	-13.37
Turkey	28.28	32.71++	24.70++	133.80	75.94	109.74
Zambia	41.71	39.50+	25.30++	89.34	21.20	10.54
Exporters						
Argentina	59.75	41.23++	40.25++	47.68	45.38	-6.94
Australia	14.14--	19.49++	22.80+	186.68	259.15	345.83
Burma	32.71-	30.33	41.83+	86.17	163.53	149.70
Colombia	21.68-	20.98++	24.90++	94.28	132.67	126.97
Egypt	42.07	13.41++	44.50++	10.10	112.33	22.43
Italy	22.14	16.12++	30.98++	52.71	194.81	147.51
Japan	23.45++	28.63++	29.33+	150.30	156.59	206.89
Nepal	11.83--	19.75+	14.83++	288.36	161.92	350.27
Pakistan	21.21	26.08++	26.83++	151.88	160.78	212.65
Spain	28.14-	22.32++	28.81++	62.91	104.82	67.73
Thailand	22.36	21.91++	37.82++	96.30	286.67	282.94
USA	16.73--	19.23+	24.29++	133.11	209.88	243.08
(a) All notes of Table A9 are again valid. - (b) Variance decomposition with uncorrected variances, as two out of three components showed no significant trend.						

Source: Own computations with data from Cowitt [1986], FAO [e, f], IMF [1990], Pick [1978], and Table A5.

Table A13 - Variance Decomposition of Gross NPCs for Coffee-Producing Countries (a), 1969-1985

	Percentage standard deviation from loglinear trend(a)			Contribution of components to Var(NPC) (percent)(a)		
	NPC	P_i^S	P_w	CP_i^S	CP_w	$CP_i^S P_w$
Cameroon	17.03--	20.25++	29.50++	141.79	301.33	343.12
Ivory Coast	23.24	25.10++	32.71++	115.88	196.16	212.04
Kenya	5.48	35.07++	34.64++	4229.30	4115.60	8244.90
Madagascar	27.57--	18.97+	32.09++	48.07	136.03	84.10
Rwanda	31.62	13.78++	38.47++	18.84	147.76	66.60
Tanzania	43.24-	30.50	37.28++	49.97	74.10	24.07
Uganda	37.01--	34.50	33.91++	87.38	83.84	71.22
Zaire	76.94	41.71++	42.54++	29.37	30.51	-40.12
Brazil(b)	57.88	57.01	57.10	96.96	97.40	94.36
Colombia	15.49--	18.71++	30.66++	147.12	398.57	445.69
Costa Rica	6.32--	33.47++	36.88++	2924.90	3552.90	6377.90
Dominican Republic	30.33	52.06++	31.30++	293.82	105.94	299.75
Ecuador	25.10	17.32++	25.50++	47.46	102.87	50.33
El Salvador	13.04--	44.05+	34.93++	1118.00	704.38	1722.38
Guatemala	11.83	32.25++	31.78++	750.19	723.78	1374.97
Honduras	31.14	36.61++	36.61++	138.14	138.47	176.62
Mexico	26.65	37.68++	33.17++	197.96	153.79	251.76
Peru	22.14-	33.47++	36.33++	229.86	271.39	401.26
Venezuela	41.35	40.00++	20.00++	93.32	23.51	16.83
Indonesia	34.21	26.83++	39.12++	61.61	131.35	92.96
Philippines	12.25--	43.01+	36.74++	1208.30	879.88	1988.18
Sri Lanka	12.25--	40.74	38.47+	1136.00	1013.90	2049.90

(a) All notes of Table A9 are again valid. - (b) Variance decomposition with uncorrected variances, as two out of three components showed no significant trend.

Source: Own computations with data from Cowitt [1986], FAO [d; e], IMF [1990], Pick [1978], and Table A6.

Table A14 - Variance Decomposition of Net NPCs for Coffee-Producers (a), 1969-1985

	Percentage standard deviation from loglinear trend(a)			Contribution of components to Var(NPC) (percent)(a)		
	NPC	$P_i^{\$}$	P_w	$CP_i^{\$}$	CP_w	$CP_i^{\$} P_w$
Cameroon	15.81--	22.14++	29.50++	194.85	347.73	442.58
Ivory Coast	22.80-	27.02++	32.71++	141.68	206.89	248.57
Kenya	11.40	42.54++	34.64++	1399.50	952.84	2225.34
Madagascar	28.98--	26.83	32.09++	85.00	121.82	106.82
Rwanda(b)	33.17	30.33	30.33	83.67	83.32	66.99
Tanzania	30.82--	25.50	37.28++	68.15	145.93	114.08
Uganda	84.32--	54.41	33.91++	41.64	16.13	-42.23
Zaire(b)	92.52	53.94	61.73	34.00	44.52	-21.48
Brazil	50.89-	54.86	38.34++	116.01	56.73	72.74
Colombia	14.49--	25.10++	30.66++	295.92	440.68	636.60
Costa Rica	14.14	42.66+	36.88++	915.68	686.94	1502.62
Dominican Republic	32.40	53.85+	31.30++	274.44	92.66	267.10
Ecuador	26.27	14.83++	25.50++	31.77	94.04	25.81
El Salvador	20.98--	51.96	34.93++	613.52	278.02	791.55
Guatemala	15.17--	38.21+	31.78++	642.06	444.23	986.29
Honduras	31.14	36.61++	36.61++	138.14	138.47	176.61
Mexico	33.17--	48.27	33.17++	211.34	99.81	211.15
Peru	24.90	45.39+	36.33++	331.03	212.26	443.29
Venezuela	46.26	47.96+	20.00++	107.27	18.80	26.07
Indonesia	32.56	27.39++	39.12++	70.95	144.20	115.15
Philippines	14.14--	46.04+	36.74++	1039.54	661.23	1600.77
Sri Lanka(b)	17.89	51.58	49.30	827.18	754.15	1481.33

(a) All notes of Table A9 are again valid. - (b) Variance decomposition with uncorrected variances, as two out of three components showed no significant trend.

Source: Own computations with data from Cowitt [1986], FAO [d; e], IMF [1990], Pick [1978], and Table A7.

Table A15 - Variance Decomposition of Producer Prices for Wheat in US\$ (a), 1969-1985

	Percentage standard deviation from loglinear trend(b)			Contribution of components to Var(P_i^S) (percent) (c)		
	P_i^S	P_i	E	CP_i	CE	$CP_i E$
Importers						
Italy	19.57++	10.38++	17.75--	28.14	82.28	-10.42
Japan	22.59++	15.85++	14.11++	49.21	38.98	11.81
UK	21.81++	14.92++	11.43--	46.81	27.45	25.74
West Germany	21.86++	5.56++	18.17+	6.46	69.06	24.48
Algeria	12.05++	10.82++	9.65	80.51	64.11	-44.62
Brazil	22.92++	78.64++	84.84--	1177.50	1370.80	-2448.30
Chile	38.86++	149.52++	126.82--	1480.20	1064.80	-2445.00
Egypt	15.41++	10.11++	17.52--	43.09	129.32	-72.41
India	9.98++	12.14++	5.09--	148.11	26.04	-74.15
Kenya	20.31++	12.63++	15.17--	38.69	55.83	5.48
Mexico	18.09++	37.76++	47.76--	435.53	696.69	-1032.22
Morocco	28.18++	11.24++	21.90-	15.90	60.39	23.71
Nigeria	11.94++	11.19++	10.59	87.85	78.72	-66.57
Pakistan	18.98++	11.09++	17.34--	34.16	83.46	-17.62
Poland	12.26++	31.90++	29.91--	676.92	595.10	-1172.02
South Korea	20.44++	20.30++	16.09--	98.67	61.99	-60.66
Syria	11.21++	11.31++	1.29--	101.83	1.32	-3.15
Tanzania	12.01++	19.22++	15.50--	256.14	166.48	-322.62
Tunisia	13.85++	7.88++	19.24-	32.43	193.09	-125.52
Yugoslavia	25.30++	26.01++	44.56--	105.69	310.28	-315.97
Exporters						
Australia	27.89++	16.80++	12.54--	36.26	20.23	43.51
Canada	32.67++	29.63++	5.18--	82.23	2.51	15.26
France	20.24++	4.72++	19.32-	5.44	91.21	3.35
Greece	19.76++	11.00++	23.06--	30.95	136.11	-67.07
Spain	19.24++	7.35++	21.08--	14.58	120.00	-34.58
Sweden	14.71++	7.90++	18.62-	28.85	160.18	-89.04
USA	29.91++	29.91++	0.00	100.00	0.00	0.00
Argentina	33.40++	94.35++	99.29--	798.24	883.89	-1582.13
Hungary	12.41++	3.75++	14.69++	9.13	140.17	-49.30
South Africa	21.39++	10.10++	17.67--	22.29	68.26	9.45
Turkey	25.78+	31.75++	47.91--	151.69	345.40	-397.09
Uruguay	33.37++	35.53++	25.52--	113.38	58.46	-71.84

(a) The method of decomposing variances is defined in Section C.II. Var stands for the trend-corrected variance. P_i^S and P_i are producer prices in US\$ and local currency, respectively. E indicates the exchange rate between US\$ and the local currency. - (b) Defined as standard deviation from the loglinear trend multiplied by 100. The indices +, - indicate the 95 percent level and ++, -- the 99 percent level of significance of the estimated log-linear trend. Moreover, they show whether the estimated coefficients carry a positive or negative sign. - (c) CP_i^S , CP_W and $CP_i^S P_W$ are defined in Section C.II.

Source: Own computations with data from FAO [d] and IMF [1990].

Table A16 - Variance Decomposition of Producer Prices for Rice in US\$
(a), 1969-1985

	Percentage standard deviation from loglinear trend			Contribution of components to $\text{Var}(P_i^{\$})$ (percent)		
	$P_i^{\$}$	P_i	E	CP_i	CE	$CP_i E$
Importers						
Bangladesh	38.86+	31.14++	11.83--	63.96	9.13	26.91
Cameroon	28.10++	21.14++	19.23-	73.32	59.13	-32.45
India	15.17++	12.25++	7.75--	64.34	25.78	9.88
Indonesia	25.14++	13.04++	13.41--	34.22	37.24	28.53
Ivory Coast	41.99++	28.10++	19.23-	21.96	47.63	30.41
Kenya	23.45++	16.73++	15.20--	56.63	50.23	-0.86
Madagascar	30.17++	14.83++	26.26--	23.55	75.37	1.09
Malaysia	23.45++	11.83++	7.07--	25.45	9.09	65.46
Mexico	24.29++	38.86++	47.85--	255.06	386.77	-541.83
Nigeria	31.94++	10.49++	10.48	110.24	105.11	-113.35
Philippines	17.61++	18.17++	18.44--	111.59	106.70	-118.29
Senegal	21.91++	12.65++	19.23-	32.90	75.98	-8.87
South Korea	27.03++	14.83++	16.10--	30.10	35.48	34.42
Sri Lanka	28.11++	18.71++	14.83--	44.26	27.07	28.67
Tanzania	16.12++	26.46++	15.17--	271.82	91.07	-262.89
Turkey	34.64+	24.08++	48.27--	48.07	194.17	-142.24
Zambia	31.14++	12.25++	24.29++	15.32	61.95	22.73
Exporters						
Argentina	32.56++	92.16++	99.35--	801.27	931.17	-1732.44
Australia	21.91++	16.12++	12.65--	54.14	33.34	12.52
Burma	23.88+	23.45++	8.37--	96.93	12.66	-9.58
Colombia	16.43++	11.83++	12.25--	53.53	55.44	-8.97
Egypt	15.81++	10.00++	17.60--	39.09	124.17	-63.76
Italy	17.61++	11.83++	17.70--	45.60	101.06	-46.66
Japan	28.63++	14.49++	14.10++	25.61	24.25	50.14
Nepal	10.49	7.75++	4.47--	61.37	14.52	24.11
Pakistan	14.83++	21.91++	17.89--	214.02	141.81	-255.83
Spain	22.49++	10.95++	20.73--	23.71	84.96	-8.67
Thailand	28.11++	24.29++	17.61--	73.37	3.93	22.70
USA	24.49+	24.49+	0.00	100.00	0.00	0.00
(a) All notes of Table A15 are valid again.						

Source: Own computations with data from FAO [d] and IMF [1990].

Table A17 - Variance Decomposition of Producer Prices for Coffee in US\$
(a), 1969-1985

	Percentage standard deviation from loglinear trend			Contribution of components to $\text{Var}(P_i^{\$})$ (percent)		
	$P_i^{\$}$	P_i	E	CP_i	CE	$CP_i E$
Cameroon	20.75++	8.47++	19.30-	16.67	86.50	-3.17
Ivory Coast	25.89++	10.40++	19.30-	16.14	55.56	28.30
Kenya	36.21++	29.48++	15.10--	66.25	17.40	16.35
Madagascar	21.58+	8.14++	26.51--	14.23	150.84	-65.07
Rwanda	16.69++	15.16++	4.57	82.49	7.49	10.02
Tanzania	32.52	35.95++	15.31--	122.25	22.18	-44.43
Uganda	45.23	59.91++	91.36--	175.41	408.01	-483.42
Zaire	57.06++	87.78++	56.25--	236.70	97.18	-233.88
Brazil	56.48	58.92++	84.76--	108.82	225.20	-234.02
Colombia	20.69++	14.33++	12.46--	47.96	36.26	15.78
Costa Rica	35.27++	24.00++	37.29--	46.28	111.77	-58.05
Dominican Republic	52.82++	41.02++	24.91	60.33	22.23	17.44
Ecuador	17.65++	12.62++	7.69-	51.17	19.00	29.83
El Salvador	45.06+	45.06+	0.00	100.00	0.00	0.00
Guatemala	33.34++	28.72++	8.77	74.20	6.91	18.89
Honduras	37.09++	31.73++	8.77	73.20	5.59	21.21
Mexico	38.02++	40.87++	47.81--	115.54	158.10	-173.64
Peru	34.95++	53.53++	56.07--	234.53	257.37	-391.90
Venezuela	39.97++	37.62++	15.56-	88.59	15.17	-3.76
Indonesia	27.44++	20.87++	13.32--	57.87	23.58	18.55
Philippines	42.03++	36.05++	18.52--	73.59	19.42	6.99
Sri Lanka	41.01	41.30++	11.39--	101.44	7.72	-9.16

(a) All notes of Table A15 are again valid.

Source: Own computations with data from FAO [d] and IMF [1990].

Table A18 - Production of Main Agricultural Commodities, 1970-1988 (1000 tons)

	Malaysia				Peru							Zimbabwe						
	rubber	palm oil	cocoa	paddy	sugar	cotton	coffee	potatoes	rice	wheat	maize	maize	wheat	cotton	tobacco	soya-beans	ground-nuts	sorghum
1970	1263	431	2	1679	8050	248	65	1929	587	125	615	980	56	86	55	9	36	na
1971	1318	580	4	1817	8758	233	71	1968	615	122	616	1809	88	139	65	9	29	na
1972	1304	719	5	1837	8612	225	70	1713	482	120	628	2267	82	165	67	10	35	na
1973	1542	812	9	1980	8772	236	70	1713	484	123	600	968	86	130	69	9	34	na
1974	1524	1045	10	2095	9184	257	70	1722	494	127	606	2125	90	190	75	22	206	161
1975	1459	1258	13	2013	8958	227	65	1639	537	126	635	1747	130	170	86	32	127	109
1976	1612	1391	15	1995	8792	165	65	1667	570	128	726	1787	147	142	109	45	192	135
1977	1588	1612	17	1898	8816	173	65	1615	587	115	734	1655	175	144	84	50	141	51
1978	1582	1785	18	1590	7970	199	88	1695	468	104	590	1619	204	166	83	79	114	73
1979	1570	2188	27	2095	7034	244	106	1695	560	102	631	1149	162	145	108	87	108	49
1980	1529	2575	37	2171	5598	256	95	1380	420	77	453	2813	191	158	120	97	78	82
1981	1510	2824	45	2177	5129	286	95	1705	712	119	587	2729	201	171	69	73	119	125
1982	1494	3514	66	1832	6509	256	90	1799	776	101	631	1785	213	135	89	92	111	67
1983	1563	3018	69	1818	6381	105	91	1200	798	76	585	844	124	147	94	81	33	52
1984	1530	3715	88	1755	6988	203	91	1463	1156	84	776	1283	99	222	117	99	26	54
1985	1469	4133	103	1895	7329	291	91	1557	878	92	702	2952	210	274	108	87	67	127
1986	1541	4543	131	1948	5273	304	96	1658	726	121	876	2486	232	247	na	72	73	131
1987	1581	4533	191	1623	6099	202	98	1709	1169	133	914	958	198	237	na	95	76	49
1988	1660	5030	230	1796	5948	275	99	2108	1129	153	908	2034	242	279	na	120	139	169

na = not available.

Source: Rahman [1990b]; Rukovo et al. [1991]; Thiele [1991b].

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