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Price Protection in the Rice Sector*

by

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I. Introduction

In the past a number of studies were conducted in order to measure agricultural protection. The predominating result was that industrial countries strongly protect their domestic producers, whereas developing countries in most cases tend to tax agriculture (Schultz [1978], Peterson [1979], Bale and Lutz [1981]). An opposite outcome was obtained by Byerlee and Sain [1986], who did not detect a systematic discrimination against wheat producers in developing countries. Another branch of the literature was concerned with the identification of factors that might determine the observed protection levels. Anderson, Honma and Hayami [1986] as well as Honma and Hayami [1986] consider the comparative advantage of agriculture, the relative share of agriculture in national economy and the international terms of trade between the agricultural and the industrial sector to be major explanatory variables for agricultural price protection. Herrmann [1989] explains varying protection levels in the wheat market by differences in economic development and import-dependence.

In this paper the variables of these studies are combined in order to elaborate the determinants of protection for another important agricultural product, namely rice[1]. In the first instance, protection coefficients have to be calculated, because appropriate data for regression analysis are not yet available. The objective then is to investigate, whether the econometric performance of the model can be improved by extending the set of explanatory variables to overcome a possible misspecification due to omitted variables. Furthermore, a comparison of the results for rice with those obtained in previous studies is intended. Also information will be given about the sensitivity of estimates in the presence of differently measured protection coefficients.

The analysis is conducted within a pooled cross-country and time series approach. In line with recent studies dummy variables (intercept dummies as well as slope dummies) are introduced in order to account for possible structural differences between

countries and subperiods. As a measure of agricultural price policies serves the Nominal Protection Coefficient (NPC)[2], with three alternatives to be considered: Firstly, the NPC is calculated traditionally as the ratio of domestic to border prices. Secondly, a factor correcting for exchange rate distortions is included to account for indirect effects on agricultural protection resulting from general trade policy (e.g. exchange rate policy). Such indirect effects are significant and may even be stronger than the direct effects (World Bank [1986]), Krueger, Schiff and Valdés [1988]). Thirdly, the existence of concessional imports within food-aid programmes is taken into account (Taylor [1989]).

The paper is organized as follows. Section II presents a survey of the structure of protection levels in different country groups and subperiods. In section III the hypotheses on the determinants of protection are formulated and the data used in the analysis are described. The sample is divided into a group of net-importing and a group of net-exporting countries, 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. Section IV contains the empirical evidence. A pooled cross-section and time series approach is applied for 17 net-importing countries (subsection IV.1.) and 13 net-exporting countries (subsection IV.2.), covering the time period from 1969 to 1980[3]. Finally, the major findings are summarized.

II. Survey of Protection Levels for Different Country Groups and Subperiods

In the first instance, NPCs were calculated as the ratio of domestic to border prices (adjusted for internal transportation costs) for 30 countries and 12 years. After that, these NPCs were corrected for exchange rate distortions and concdessional imports, respectively. A detailed list of the differently calculated NPCs is shown in the Appendices 1 to 3. In order to give an impression of the distribution of NPCs across countries and over

Table 1 - Nominal Protection Coefficients (NPCs) for Rice by Country Groups and Time Periods[a]

Countries/ Subperiods	Measures of Protection[b]		
	NPC_1	NPC_2[c]	NPC_3[d]
Net exporters			
all countries: 1969-1980	0.86	0.77	
1970-1972	1.03	0.89	
1974-1975	0.62	0.56	
other years	0.85	0.78	
developing countries	0.61	0.47	
industrial countries[e] (except Japan)	0.90	0.89	
Japan	2.62	2.62	
Net importers			
all countries: 1969-1980	0.82	0.69	0.81
1970-1972	0.94	0.79	0.92
1974-1975	0.57	0.47	0.54
other years	0.84	0.72	0.84
less developed countries[f]	0.71	0.55	0.66
more developed countries[f]	1.26	1.18	1.28

[a]The net-exporting countries included are: Egypt, Burma, Nepal, Pakistan, Thailand, Argentina, Brazil, Columbia, Japan, USA, Australia, Italy, Spain. The net-importing countries included are: Cameroon, Ivory Coast, Kenya, Madagascar, Nigeria, Senegal, Tanzania, Zambia, Bangladesh, India, Indonesia, Korea (Rep.), Philippines, Malaysia, Sri Lanka, Turkey, Mexico. - [b]All NPCs are unweighted averages. - [c]Adjusted for exchange rate distortions by application of the following formula: NPC_1 * black market exchange rate/official exchange rate (US$ per home currency). - [d]Adjusted for exchange rate distortions and concessional imports. The latter adjustment procedure is described in footnote 7. - [e]USA, Australia, Italy, Spain. - [f]Korea, Malaysia, Turkey, Mexico.

Source: Data are taken from Appendices 1-3.

time, the data on protection levels are summarized in Table 1. Irrespective of the calculation procedure both subsamples show NPCs below unity on average, thus indicating a negative overall protection level for the rice sector. NPCs were above average from 1970 to 1972 and below average during the world food crisis in 1974 and 1975. In developing countries the unadjusted protection coefficients (NPC_1) were substantially higher than those adjusted for exchange rate distortions (NPC_2), because their currencies were overvalued on average. Within the group of developing countries one can observe enormous differences in exchange rate policies. On the one hand, the sample includes countries like Cameroon, Ivory Coast and Senegal, who fixed their currencies to the Franc and thereby avoided major distortions, or like Thailand, Malaysia and Indonesia who also had rather undistorted exchange rates during the period considered here. On the other hand, in some countries (e.g. the socialist countries Tanzania, Zambia and Burma) the official rate partly exceeded the black market rate (both measured in US$ per home currency) by more than 100 per cent thus indicating a strong overvalution.

Most striking among the net exporters is the extraordinarily high protection level in Japan. In contrast, the other industrial countries did not support domestic producers (the average NPC being slightly below unity) and the developing countries apart from Brazil taxed rice exports.

Within the subsample of net importers only the governments of the higher-income countries applied policies in favor of domestic farmers. Furthermore, NPCs adjusted for food aid receipts as well as for exchange rate distortions appeared to be similar to unadjusted NPCs. This might be explained by the fact that countries with overvalued currencies often at the same time depended on concessional imports. Since concessional imports are cheaper than commercial imports, they lower border prices and thereby raise the actual level of protection. Thus, both adjustment procedures tend to offset each other.

III. Hypotheses and Data Base

NPCs of net-importing countries are supposed to be determined by economic development, import-dependence, the relative share of agriculture in total economy and the international terms of trade between food and industrial goods. In detail the causalities can be depicted as follows:

1. The level of protection is assumed to increase with advances in economic development as measured by GDP per capita. Both Balisacan/Roumasset [1987] and Herrmann [1989] confirm this view for a bundle of major grains and for wheat, respectively. Herrmann argues that industrialized countries are more able to separate their domestic agricultural sector from world market conditions in order to reach distributional goals, because they do not face the strong budgetary constraints existing in most developing countries.
   Balisacan and Roumasset explain the relationship between agricultural protection and economic development within a public choice framework, which is based on a model established by Becker [1983]. They divide interest groups into proponents (agricultural producers) and opponents (urban consumers and industrial producers) of agricultural protection. On the one hand, farmer's investment in lobbying activities rise as the economy grows. This is due to falling coalition costs in the presence of improved basic services like transportation and communication facilities combined with the concentration of agricultural production. Lower costs in turn mean higher net benefits of lobbying. On the other hand, investment of consumers and industrialists in opposition to agricultural protection falls as economic development proceeds. Since budget shares for food expenditures decrease as income rises (Engel's law), consumer welfare becomes less sensitive to changes in food prices. Similarly, industrialist's profits become less sensitive to wages (which may be linked to food-crop prices), because wages make up a smaller share of production costs in view of rising capital intensity.

The same analytical framework can be applied to explain the relationship between agricultural protection and agriculture's share in the economy: As the number of farmers decreases, it becomes easier for them to organize lobbying activities. Concurrently, a growing non-agricultural sector lowers the burden of agricultural protection per capita of the non-agricultural population, thereby reducing their resistence against protective measures.
Although GDP per capita and agriculture's share in the economy are likely to be (negatively) correlated, it is left to the empirical analysis, whether one or the other variable should be omitted because of multicollinearity problems.

2. Most of the rice importers tried to reduce their import-dependence during the 1970s and 1980s. The striving for self-sufficiency has been a major political goal above all in Asia, where rice is the basic food-crop (World Bank [1986])[4]. It seems reasonable to assume that major objectives of governments in developing countries concerning rice policies are to offer cheap rice to the politically influential urban consumers and at the same time to raise the share of domestically produced rice. This would force governments (or, more precisely, the marketing boards that are engaged in the distribution of rice) to buy rice at high prices from domestic farmers in order to create production incentives and to sell it at low prices to consumers. Such a combination of producer price supports and consumer subsidies leads to high budgetary costs. The ability of government authorities to protect domestic farmers thus depends on the expenditures needed to guarantee a given (low) level of consumer prices. This costs in turn are the higher the more rice is produced domestically, i.e. protection levels are supposed to be positively (negatively) related to import shares (the degree of self-sufficiency).

3. Finally, one would expect that the international terms of trade between agricultural and industrial products are inversely related to the protection level. An illustrative ex-

ample supporting this view is the strong increase in agricultural prices relative to industrial prices during the world food crisis in 1974 and 1975, which corresponded with falling NPCs. This phenomenon can be explained by a general tendency of policy makers to stabilize producer prices (or real farm income, respectively) in the presence of unstable world market prices[5].

Since rice prices are more likely moving parallel to other food-crop prices than to agricultural prices as a whole, in this study the international terms of trade between food (instead of total agricultural products) and manufactured goods are introduced as a potential explanatory variable for price protection in the rice sector.

With one exception the above hypotheses are also put forward in the case of net-exporting countries. Only the foreign trade position is now depicted by export shares instead of import-dependence. For this variable the argument is as follows:

4. Firstly, a large agricultural sector, which is typical for developing countries, is the main source of government revenues. Consequently, one would expect decreasing NPCs (i.e. more and more taxation of exports due to budget considerations) as export shares rise. Secondly, developing countries, that hold high world market shares, tax exports trusting in their putative monopoly power in world trade (World Bank [1986]). This adds to the assumption of a negative correlation between agricultural protection and export shares. On the other side, industrial countries do not strongly depend on tax revenues from agriculture (especially in the case of rice) and therefore are in a position to defend their high export shares (except Japan, where domestic demand for rice makes up a high proportion of production) through application of export promoting measures. Altogether, the sign of the partial derivative is not determined a priori.

Formally, the foregoing considerations can be summarized within the following implicit functions:

(1) $NPC_I = f(GDP, IMPDEP, AGRSH, TOT)$

$$\text{with } \frac{NPC_I}{GDP} > 0, \quad \frac{NPC_I}{IMPDEP} > 0, \quad \frac{NPC_I}{AGRSH} < 0, \quad \frac{NPC_I}{TOT} < 0$$

(2) $NPC_E = f(GDP, EXPSH, AGRSH, TOT)$

$$\text{with } \frac{NPC_E}{GDP} > 0, \quad \frac{NPC_E}{EXPSH} \lessgtr 0, \quad \frac{NPC_E}{AGRSH} < 0, \quad \frac{NPC_E}{TOT} < 0$$

NPC stands for the nominal protection coefficient of rice, the subscripts I and E characterize net-importing and net-exporting countries, respectively, GDP is GDP per capita based on purchasing power parities, IMPDEP import-dependence in rice, AGRSH agriculture's share in total economy, TOT the international terms of trade between food and manufactured goods and finally, EXPSH indicates the export share of rice.

NPCs are measured as the ratio between domestic rice prices and border prices, the latter being regarded as the opportunity costs facing domestic producers. The data used are prices received by farmers (FAO [1982]), which are converted into US Dollars at official exchange rates, and per unit prices for exports and imports calculated from FAO Trade Statistics. Import prices include cost, insurance and ocean freight (c.i.f. prices) to the local port, whereas export prices are free on board (f.o.b. prices) at the local port. Since producer prices and border prices should be brought to a single marketing point in order to be comparable (Westlake [1987]), one has to carry out an adjustment for internal transportation costs[6]. Data are taken from Taylor [1989] and for the industrial countries of the sample, which are not included in the Taylor-study, information about major production regions is obtained from The World Atlas of Agriculture [1973]. NPCs adjusted for exchange rate distortions are calculated by multiplying the protection coefficient by the ratio of the published black market rate (Cowitt [1985], Pick [1978]) to the official exchange rate (IMF [1981]). Additionally, for net-importing countries NPCs are computed by adjusting c.i.f. import prices for concessional imports as reported in FAO [1984]. Data on real GDP per capita based on purchasing power parities are

taken from the International Comparison Project (Summers and Heston [1988]).

Import-dependence is defined as rice imports divided by the sum of rice imports and rice production. The export share is the ratio between exported and produced rice quantities. Both variables are introduced one-year lagged to avoid a simultaneity bias in the estimation, which would occur otherwise, because imports and exports as well as production are definitely influenced by varying protection levels. Data on these quantities are available from FAO Trade and Production Yearbooks. Since rice production is reported in paddy units, it is transformed into rice units by applying the standard conversion factor 0.65 (1 paddy unit $\triangleq$ 0.65 rice units). The share of agriculture in the national economy is measured by agriculture's share in total economically active population as reported in the FAO Production Yearbook. Alternatively, one could use agriculture's share in gross domestic product. Since time series data on this variable are not completely available, it is not applied here. Finally, the international terms of trade between food and manufactured goods are specified as the ratio of the index of world export unit value of food (FAO Trade Yearbook) and the world export unit value index for manufactured goods in market economies (UN Statistical Yearbook) with the 1970 value set equal to 100.

IV. Empirical Results

In this section, estimates referring to the above equations are reported separately for net-importing and net-exporting countries. The model was specified linearly, because the linear model outperformed a loglinear version in most cases. The results were obtained within a multiple regression analysis by application of the ordinary least squares (OLS) method to the pooled time series and cross-section data. Alternatively, the equations were estimated (i) without introducing dummy variables, (ii) making solely use of intercept dummies and (iii) including both, intercept and slope dummies.

IV.1. Determinants of Protection in Net-importing Countries

The sample consists of 17 developing countries (see Table 1) and covers a period of 12 years, thus amounting to 204 observations. In order to account for structural differences between various countries and subperiods, dummy variables were constructed according to the following observable peculiarities:

i) Developing countries with higher income (Korea, Malaysia, Turkey, Mexico) protect domestic farmers more than less developed countries. This argument is much in line with the empirical findings for the Asian newly industrialized countries by Herrmann [1989] and Anderson, Hayami and Honma [1986].

ii) Low world market prices for rice in the years 1970 to 1972 imply a low denominator of the NPC. If governments tend to stabilize producer prices, as was assumed in chapter III, this leads to NPCs which are above average.

iii) Finally, a similar argument holds true for the period of the world food crisis, which caused extremely high world market prices for agricultural commodities, especially in 1974 and 1975. Therefore, NPCs should be below average in this years.

Econometric estimates based on differently calculated NPCs and different compositions of structural and qualitative explanatory variables are summarized in the Tables 2, 3 and 4.

Table 2 contains the results obtained by regressing the conventional NPC, which only reflects direct agricultural price policies, on the exogenous variables of the model. The first column of the table reveals that economic development as measured by GDP per capita significantly accounted for variations in NPC, the t-value of 6.8 indicating a coefficient different from zero even at the 0.1 significance level. However, the coefficient is quite low. The result for the influence of import-dependence on protec-

Table 2 - Determinants of Rice Price Protection with Unadjusted NPCs; 17 Net-importing Countries, 1969-1980[a]

Explanatory Variables	Regression (1)	(2)	(3)	(4)
Intercept	0.58298** (10.42)	1.9131** (5.37)	1.0071 (1.60)	0.5710** (14.04)
GDP per capita	0.00229** (6.80)	0.00213** (4.52)	-0.00019 (-0.30)	0.00156** (4.52)
Import-dependence	-0.6294 (-0.60)	-0.5408 (-0.54)	0.2237 (0.23)	
Agriculture's share		-0.0131 (-0.50)	-0.0149 (-0.60)	
Terms of trade		-1.261** (-4.37)	-0.1627 (-0.29)	
D1[b]			0.5595** (4.94)	
D2[b]			0.1139* (1.68)	
D3[b]			-0.24078* (-1.67)	
D2*GDP per capita				0.00133** (2.91)
D3*GDP per capita				-0.00215** (-2.56)
D1*Import-dependence				2.48** (2.46)
$\bar{R}^2$	0.19	0.25	0.35	0.37
F	24.91	18.36	16.70	32.95
DF	201	199	196	199

[a]NPC is defined as the ratio of domestic and border prices corrected for internal transportation costs. Value in parantheses are t-values. $\bar{R}^2$ is the adjusted coefficient of determination, F is the F-value and DF indicates the degrees of freedom. - [b]D1 to D3 are defined in the text.
* (**) statistically different from zero at the 10% (1%) significance level.

Source: Own computations based on data given in the Appendix.

tion entirely contradicts the theoretical considerations. No significant causal connection could be detected and the sign was even negative as opposed to the postulate of a positive relationship.

These results confirm those for the wheat sector obtained by Herrmann [1989], if one is only looking at the unquestionably positive relationship between economic development and protection levels. Referring to import-dependence, there is no consistency between both commodities. This might originate from the different composition of the samples in both studies. Whereas in the case of wheat industrialized as well as developing countries were included, the net rice importers considerd here are exclusively developing countries. Industrialized countries are more likely applying foreign trade measures (e.g. import tarifffs or quantity restrictions) in order to raise the degree of self-sufficiency, because they do not give priority to low consumer prices. Policy makers in developing countries in turn have to provide cheap food and therefore are supposed to prefer domestic measures like consumer subsidies and price supports for farmers. However, the latter measure was not observable on average (see Table 1). Since some countries with low producer prices (India, Indonesia, Philippines) nevertheless were successful in their striving for self-sufficiency, this must be due to other incentives than price supports, which cannot be covered by the NPC (e.g. fertilizer subsidies). Other countries probably gave priority to the provision of cheap food and could not at the same time pursue the self-sufficiency goal, because budget constraints were too severe.

Apart from the insignificant coefficient of import-dependence the $\bar{R}^2$ value was unsatisfactory low in regression (1). Since this might be due to omitted variables, agriculture's share in total economy and the international terms of trade between food and manufactured goods were introduced as additional explanatory variables. As regression (2) reports, the $\bar{R}^2$ value was slightly raised from 0.19 to 0.25. The results for both variables confirm

the theoretical hypotheses, but the coefficient of the former was not significant[8], whereas the coefficient of the latter was statistically different from zero at the 0.1 significance level[9].

The consideration of intercept dummies in regression (3) raised the $\bar{R}^2$ to 0.35, a size, which is in line with the results obtained by other authors for samples consisting of developing countries. The surprising outcome then was that all structural explanatory variables did not account for variations in NPCs, whereas the qualitative variables were significant at least at the 10% level. The coefficient of the intercept dummy D1, representing the higher-income countries within the sample (Korea, Malaysia, Turkey, Mexico), suggests that rice protection in these countries exceeded the level in the other countries by more than 50 percentage points. D1 was highly correlated with GDP per capita (the correlation coefficient being 0.86); therefore one can conclude that the positive coefficient of GDP per capita in regression (2) is mainly due to the weight of the higher income countries, which is underlined by the insignificant coefficient of that variable in regression (3). D2, which characterizes the low world market prices for rice in the years 1970 to 1972, reveals that in this subperiod the protection level of rice exceeded the one in the other years significantly. The dummy D3, which stands for the commodity price boom during the world food crisis, indicates NPCs being significantly lower in 1974 and 1975 than in the other years. D3 was highly correlated with the international terms of trade between food and industrial goods (the correlation coefficient being 0.84), that is to say, the significance of the latter in regression (2) was mainly caused by its particularly high values in 1974 and 1975, which corresponded to low NPCs.

Summarizing the information of regression (3), rice price protection levels were above average in higher-income developing countries as well as from 1970 to 1972 and below average during the world food crisis. Apart from this structural peculiarities the econometric analysis does not provide any explanatory power so far. The additional consideration of slope-dummies (Regression 4)

did not improve the estimates substantially. Since this was the case in all regressions, the respective results are not reported for the remainder of the paper.

Table 3 summarizes the regression results with differently calculated NPCs serving as left-hand variables. In all three cases the model specification including intercept dummies was chosen as the best alternative. The second column of Table 3 presents the estimate, which was obtained, when the NPC adjusted for exchange rate distortions was used as a dependent variable. In this case the corrected coefficient of determination was substantially raised, the $\bar{R}^2$ value being 0.48. This improvement is caused by a closer relationship between GDP per capita and the protection coefficient (the t-value was 1.32 as compared to -0.30 in the case of the unadjusted NPC). The rise in significance of the income-variable in turn can be explained by the fact that particularly lower developed countries are known to have strongly distorted exchange rates, which was for example true for Tanzania and Zambia, whose adjusted NPCs were much lower than the unadjusted ones during the sample period.

On the other hand, one can conclude from Table 3 that the consideration of the effects of overvalued exchange rates on protection levels did not change the structure of the econometric results. As in the case of unadjusted NPCs the qualitative variables D1 to D3 explained variations in protection at the expense of the structural variables. Even the coefficient of GDP per capita was not significant.

Finally, the third column of Table 3 comprises the estimates, which were obtained, when NPCs adjusted for exchange rate distortions as well as concessional imports were regressed on the usual explanatory variables. The $\bar{R}^2$ values was similar to the value reported in column 1 and lower than that in column 2. This can be explained as follows: concessional imports are much cheaper than commercial imports, thereby raising the actual protection level in the food-aid receiving countries via falling border prices, whereas corrections for overvalued exchange rates lower the NPC.

Table 3 - Sensitivity Analysis of the Estimates in the Presence of Differently Measured NPCs; 17 Net-importing Countries, 1969-1980[a]

Explanatory Variables	Dependent Variable NPC_1	NPC_2	NPC_3
Intercept	1.0071 (1.60)	0.5425 (0.93)	1.3601* (2.01)
GDP per capita	-0.00019 (-0.30)	0.00079 (1.32)	-0.00063 (-0.89)
Import-dependence	0.2237 (0.23)	-0.06227 (-0.71)	-0.0598 (-0.58)
Agriculture's share	-0.0149 (-0.60)	-0.0124 (-0.54)	-0.021 (-0.78)
Terms of trade	-0.1627 (-0.29)	-0.10223 (-0.26)	-0.0429 (-0.71)
D1	0.5595** (4.94)	0.53066** (5.05)	0.6735** (5.49)
D2	0.1139* (1.68)	0.1022* (1.65)	0.0570 (1.53)
D3	-0.2408* (-1.67)	-0.2171* (1.66)	-0.2075* (1.65)
$\bar{R}^2$	0.35	0.48	0.36
F	16.70	22.71	17.29
DF	196	196	196

[a] $\bar{R}^2$, F and DF are defined in Table 2.

* (**) statistically different from zero at the 10% (1%) significance level.

Source: Own computations based on data given in the Appendix.

Under the assumption that both concessional imports and exchange rate distortions coincide in many less developed countries, these two adjustment procedures should tend to offset each other.

Again, the estimates revealed no structural differences compared with the cases analyzed before, that is to say, the estimates for net rice importing countries are robust in the presence of differently measured NPCs. In all three cases variations in protection levels can only be explained by structural peculiarities.

IV.2. Determinants of Protection in Net-exporting Countries

The present sample contains 13 countries, splitting up into 8 developing and 5 developed countries. With a time series length of 12 years the sample includes 156 observations. Analogously to the preceding subsection a couple of dummy variables have to be specified in order to account for structural differences across countries and over time:

i) As in the case of net-importing countries time-variations in parameters were likely to prevail in the years 1970 to 1972 and during the world food crisis. The corresponding dummies are called D4 and D5, respectively.

ii) It is often mentioned in the literature and shown in Table 1 that Japan protects its domestic farmers more strongly than most other countries. The dummy D6 is constructed to take into account this peculiarity.

iii) An additional dummy D7, which represents the industrial countries except Japan (USA, Australia, Italy, Spain), reflects the fact that developed countries generally tend to protect their agricultural sectors, whereas developing countries tax particularly export-crops in order to raise revenues (see e.g. World Bank [1986]).

Estimates based on different combinations of structural and qualitative explanatory variables are presented in Tables 4 and 5.

Table 4 contains the results, which were obtained by making use of unadjusted NPCs as dependent variables. The model specification without dummy variables provides an $\bar{R}^2$-value of 0.46, which is acceptable given the standards of a cross-section analysis. The coefficient of GDP per capita was positive and strongly significant as theory suggests. Export-shares, the coefficients of which were not determined a priori, were negatively related to protection levels. The inverse relationship results from the following peculiarities: Firstly, developing countries with high export shares (like Thailand) tax rice exports substantially (see e.g. World Bank [1985]). Secondly, Japan has low export shares, which correspond to extremely high protection levels. And thirdly, the industrial countries with high export shares (USA, Australia, Italy) do not systematically promote rice exports to defend world market shares. As in the case of net-importing countries agriculture's share in total economy did not significantly account for variations in protection. A possible reason is multicollinearity: the correlation coefficient between agriculture's share in economy and GDP per capita was 0.85[10]. Thus, the variable is eliminated from the analysis for the remainder of this chapter. According to theory, the coefficient of the international terms of trade between food and industrial goods was negative and different from zero at the 1 per cent significance level.

Regression (2) reports the estimates which were obtained after the omission of agriculture's share in economy. The $\bar{R}^2$-value remained unchanged and the coefficients only marginally differ from those in regression (1), but the F-value rose noticeably.

The introduction of intercept-dummies caused an enormous increase in the corrected coefficient of determination from 0.46 to 0.73. Such a high explanatory power is very satisfactory in the presence of cross-section data. The coefficients of GDP per capita and export shares were still significant at the 1 per cent level, although the t-values were somewhat lower than before. As in the

Table 4 - Determinants of Rice Price Protection Unadjusted NPCs, 13 Net-exporting Countries, 1969-1980[a]

Explanatory Variables	Regression (1)	(2)	(3)
Intercept	2.4697** (5.52)	2.3104** (5.63)	0.90745 (1.39)
GDP per capita	0.00156** (6.23)	0.00174** (11.06)	0.000727** (3.71)
Export share	-1.6761** (-8.62)	-1.6734** (-8.62)	-0.5343** (3.06)
Agriculture's share	-0.02416 (-0.91)		
Terms of trade	-1.5320** (-4.12)	-1.5306** (-4.12)	-0.3303 (-0.54)
D4[b]			0.21303** (2.9027)
D5[b]			-0.16622 (-1.06)
D6[b]			1.5787** (10.46)
D7[b]			0.08148 (0.68)
$\bar{R}^2$	0.46	0.46	0.73
F	34.03	45.16	59.41
DF	151	152	148

[a] $\bar{R}^2$, F and DF are defined in Table 2. - [b]D4-D7 are defined in the text.

* (**) statistically different from zero at the 10% (1%) significance level.

Source: Own computations based on data given in the Appendix.

foregoing subsection the international terms of trade between food and manufactured goods were highly correlated with the corresponding intercept-dummy D5 (the correlation coefficient being 0.88) and therefore became insignificant. Two of the qualitative variables were different from zero at the 1 per cent level. D4 indicates that protection levels were higher in the years 1970 to 1972 than in the other years. Moreover, from the Japan dummy D6, which mainly contributed to the increasing $\bar{R}^2$-value, can be derived that Japan's nominal protection coefficient was very much higher than in the other countries, by more than 150 percentage points. Herrmann [1989] obtained nearly the same result for the wheat sector. The insignificance of D7 is due to the fact that none of the industrial countries (except Japan) applied price policies in favor of domestic rice producers during the 1970s.

Turning to the case of NPCs adjusted for exchange rate distortions, one again (as in the previous subsection) does not observe any fundamental changes. As regression (1) in Table 5 documents, all coefficients were significant and had the same sign as in the presence of unadjusted NPCs. The $\bar{R}^2$- and F-value were slightly increased due to a closer relationship between GDP per capita and protection levels, which can in turn be explained by the fact that only developing countries (here particularly Burma and Egypt) had strongly overvalued exchange rates during the sample period. The same reason was responsible for the dummy D7 to be significant in regression (2). The adjusted NPCs (as opposed to the unadjusted ones) were significantly higher in industrial than in developing countries.

Altogether, the empirical performance of the model for net rice exporting countries is much better than that for net-importing countries, which might partly be due to the fact that the sample includes industrial as well as developing countries. As in the case of net-importing countries the structure of the econometric results was not changed by differently measured NPCs. The adjustment for exchange rate overvaluations only slightly improved the estimates in terms of the $\bar{R}^2$- and F-value.

Table 5 - Determinants of Rice Price Protection with NPCs Adjusted for Exchange Rate Distortions, 13 Net-exporting Countries, 1969-1980[a]

Explanatory Variables	Regression (1)	(2)
Intercept	- 2.085**	0.89713
	(4.63)	(1.36)
GDP per capita	0.00184**	0.000897**
	(7.27)	(4.16)
Export share	-1.6936**	-0.5346**
	(-8.64)	(-3.05)
Terms of trade	-1.3844**	-0.446**
	(-3.69)	(-0.72)
D4		0.14228*
		(1.92)
D5		-0.1219
		(-0.77)
D6		1.6567**
		(10.89)
D7		0.1465*
		(1.81)
$\bar{R}^2$	0.50	0.75
F	39.29	65.54
DF	151	148

[a] $\bar{R}^2$, F and DF are defined in Table 2.

* (**) statistically different from zero at the 10% (1%) significance level.

Source: Own computations based on data given in the Appendix.

V. Summary and Major Findings

The main objectives of this study were

- to quantify the extent of agricultural price differentials for one important food crop, rice, for a cross-section of countries, and

- to identify economic (budgetary) as well as political factors underlying agricultural protectionism in net-exporting and net-importing countries, respectively.

Nominal protection coefficients for rice for 30 countries covering the period 1969-80 were calculated first. Subsequently, free or black market exchange rates were used to adjust nominal protection coefficients in order to reflect the indirect effects of price distortions resulting from macroeconomic policies. For the 17 net-importing countries an additional set of NPCs was produced by including the price effects brought about by concessional imports.

The major findings of this part of the study are:

1. On average, domestic producer prices were below border price equivalents, thus indicating a discrimination of domestic farmers.
2. If exchange rate overvaluations are taken into account, price discrimination is, on average, higher in net-exporting than in net-importing countries. However, indirect price discrimination is partly offset by concessional imports in net-importing countries. As a result, exporters are ultimately discriminated more heavily than importers.

The calculated NPCs were then used in the econometric analysis of the determinants of rice price protection. Summarizing the estimates for net-importing countries, one can put forward the following statement:

In contrast to the recent studies for wheat and a bundle of major grains, respectively, variations in protection levels here are explained by qualitative variables (indicating structural peculiarities) at the expense of the structural variables.

1. NPCs appeared to be above average in the years 1970 to 1972 (when world market prices were very low) and below average during the world food crisis (which caused a commodity price boom). These findings support the view that policy makers in developing countries tend to stabilize producer prices in the presence of volatile world market prices.
2. Protection levels are higher in more developed countries (Korea, Malaysia, Turkey, Mexico) than in less developed countries, i.e. the former are more able to give price incentives to domestic farmers.
3. The degree of self-sufficiency does not account for variations in NPCs. This might be explained by the fact that governments in developing countries focus on the provision of cheap food to urban consumers and cannot at the same time afford to support producer prices because of budgetary constraints. For some countries (India, Indonesia, Philippines) the evidence suggests that their striving for self-sufficiency is promoted by other measures than price supports (e.g. fertilizer subsidies).

For net-exporting countries the main results are:

1. Low export shares correspond to high protection levels. The following facts contribute to this outcome: Firstly, Japan protects domestic farmers strongly and at the same time has low export shares. Secondly, developing countries with high export shares (e.g. Thailand) tax rice exports substantially in order to raise revenues. And thirdly, the industrial countries with high export shares (USA, Spain, Australia, Italy) do not systematically promote exports to defend world market shares.

2. Rice price protection rises with an increasing level of economic development, a result being consistent with a priori theorizing and recent empirical evidence.

3. The explanatory power of the model is enormously improved, if one accounts for Japan's large deviations from average protection levels. This exceptional position is similar for wheat and rice, respectively, although Japan is a net importer of wheat and a net exporter of rice, which would suggest different policies in both cases.

Altogether, this study has confirmed the view that it is necessary to focus the analysis on individual agricultural goods, because there may be differences in the structure of protection between commodities, which are obscured in an aggregate approach for total agriculture. This is underlined by the inconsistencies between the wheat and rice sector referring to the effect of import-dependence on protection levels.

Notes

1. The comparative advantage of the agricultural sector can be proxied by the ratio of labor productivity in agriculture to labor productivity in industry (productivity ratio) or by the ratio of agricultural land area per farm worker to average capital endowment per worker (factor ratio). Since time series data on this subjects are not completely available, the variable is omitted here. Honma and Hayami [1986] obtained a significant negative relationship between this variable and agricultural protection within a cross-section analysis for 10 industrial countries.

2. Generally, Effective Protection Coefficients (EPCs) should be used to measure protection on the production side. However, NPCs for rice are very close to EPCs, since secondary inputs are not important in rice production (Gotsch and Brown [1980], Scandizzo and Bruce [1980]). Insofar, it does not matter, whether one takes NPCs or EPCs as a measure of protection.

3. Some socialist countries, which are important rice producers (China, P.R., Laos, Kampuchea, Democratic Republic of Korea, Vietnam), are missing in the sample due to a lack of data.

4. The efforts to become self-sufficient have been quite successful in Asia. The Philippines almost reached self-sufficiency at the end of the 1970s, India became a net exporter of rice in 1979 and other nations like Indonesia, Korea and Sri Lanka reduced their rice imports substantially during the 1970s. Indonesia, the main rice importer of the 1970s, reached self-sufficiency in 1984 (USDA [1986]).

5. The stabilization of domestic prices is usually accomplished by placing monopoly control over imports and exports in the hand of a logistics agency (Timmer [1988]).

6. The calculation of internal transportation costs is described in detail in Taylor [1989, p. 32].

7. The adjustment procedure applied here is in line with Taylor [1989, p. 30]: Food aid quantities as reported by the FAO were multiplied by c.i.f. market prices to obtain the market value of concessional imports. This value was subtracted from the import value reported in the FAO Trade Statistics, the difference being the value of commercial imports. The per unit price of concessional imports as well as commercial imports was then obtained by dividing the value of commercial imports by the sum of both import quantities. In cases, where concessional imports exceeded the imports reported in FAO Trade Statistics, the per unit price was calculated as the value of the reported FAO import value divided by the sum of FAO import and concessional import quantities. This is done under the assumption that concessional imports were not included in the FAO Trade Statistics.

8. The insignificant coefficient of agriculture's share in total economy is partly due to a substantial correlation with GDP per capita (the correlation coefficient being 0.73).

9. The coefficient obtained in this study is 1.26. Honma and Hayami [1986] estimated lower coefficients lying between 0.40 and 0.69 for an average of agricultural commodities in 10 industrial countries.

10. Another problem with agriculture's share in economy is that it possibly changes with varying NPCs, thereby causing a simultaneity bias in the OLS-regression.

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Appendix 1 - Unadjusted NPCs for 30 Rice Producers, 1969-1980

Country \ Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Cameroon	0.47	0.29	0.44	0.51	0.34	0.22	0.28	0.42	0.84	1.13	1.31	1.30
Ivory Coast	0.95	0.96	1.21	1.04	0.51	0.57	0.52	0.83	0.90	1.03	1.14	1.04
Kenya	0.31	0.28	0.28	0.41	0.32	0.28	0.25	0.43	0.34	0.37	0.40	0.51
Madagascar	0.81	1.26	1.34	1.40	1.07	0.56	0.74	0.93	0.63	0.61	0.61	0.53
Nigeria	1.97	1.75	0.88	0.94	0.77	0.74	0.78	0.93	0.73	0.69	0.94	1.08
Senegal	0.95	1.05	1.17	1.15	0.96	0.31	0.44	1.11	0.73	0.61	1.13	0.83
Tanzania	0.51	0.67	0.65	0.62	0.54	0.20	0.30	0.40	0.43	0.47	0.52	0.44
Zambia	0.37	0.48	0.56	0.58	0.58	0.47	0.46	0.59	0.57	0.53	0.53	0.54
Bangladesh[b]	0.50	0.60	0.67	1.05	2.26	1.36	0.60	0.44	0.47	0.71	0.76	0.79
India[b]	0.62	0.73	0.70	0.71	0.52	0.54	0.54	0.49	0.38	0.37	0.53	0.54
Indonesia[b]	0.32	0.39	0.25	0.31	0.47	0.30	0.33	0.52	0.56	0.56	0.58	0.59
Korea,Rep.of[b]	0.81	0.95	1.15	1.46	0.98	0.51	0.73	1.42	2.03	1.49	1.98	1.74
Philippines[b]	0.85	0.90	1.11	1.29	0.94	0.59	0.46	0.64	0.93	0.88	0.51	0.52
Malaysia[b]	1.60	1.97	2.42	2.13	1.23	0.48	0.99	1.52	1.51	1.36	1.26	1.47
Sri Lanka[b]	0.80	1.07	1.04	1.36	0.90	0.53	0.87	1.06	0.95	0.49	0.48	0.69
Turkey	0.98	0.98	1.25	1.12	0.83	0.97	1.05	1.70	2.13	1.50	1.83	1.35
Mexico	0.92	1.62	1.24	1.08	0.81	0.87	0.57	0.68	0.89	0.77	1.07	1.02
Egypt	0.48	0.60	0.63	0.61	0.34	0.13	0.18	0.34	0.51	0.45	0.39	0.38
Burma[b]	0.25	0.44	0.45	0.48	0.50	0.25	0.19	0.39	0.37	0.26	0.30	0.24
Nepal[b]	0.88	0.94	0.73	0.72	0.66	0.50	0.49	0.52	0.46	0.42	0.43	0.39
Pakistan[b]	0.55	0.89	0.63	0.90	0.43	0.46	0.42	0.48	0.59	0.51	0.51	0.51
Thailand[b]	0.44	0.48	0.50	0.51	0.37	0.25	0.34	0.44	0.42	0.29	0.52	0.48
Argentina	0.61	0.65	0.78	0.87	0.35	0.50	0.16	0.57	0.67	0.66	0.60	0.57
Brazil	0.95	1.55	1.45	1.64	1.15	0.63	1.02	1.30	1.05	1.04	1.05	1.12
Columbia	0.81	1.30	0.65	0.96	0.64	0.53	0.55	0.63	0.93	0.71	0.53	0.65
Japan	1.06	2.15	2.24	2.41	2.14	1.85	2.13	2.22	4.36	3.42	4.24	3.18
USA	1.04	1.10	1.14	1.20	1.16	0.66	0.66	0.79	0.91	0.64	0.84	0.82
Australia	0.84	0.91	0.85	1.01	1.05	0.80	0.57	0.64	0.75	0.79	0.73	0.77
Italy	1.05	1.54	1.70	1.32	0.88	0.65	0.75	0.90	0.85	0.82	0.86	0.85
Spain	0.87	1.03	1.05	1.09	0.94	0.70	0.63	0.90	0.76	0.68	0.81	0.80

[a]Countries above the dotted line are net-importers, countries below the line net-exporters. - [b]Producer Prices are taken from IRRI (1988)

Source: Own computations with data from FAO [1982] for domestic prices, FAO[b] for border prices and Taylor [1989] as well as The World Atlas of Agriculture [1973] for internal transportation costs.

Appendix 2 - NPCs Adjusted for Exchange Rate Distortions, 1969-1980

Country \ Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Cameroon	0.46	0.29	0.44	0.52	0.34	0.22	0.28	0.42	0.84	1.18	1.29	1.31
Ivory Coast	0.94	0.95	1.22	1.06	0.51	0.57	0.52	0.84	0.90	1.08	1.12	1.05
Kenya	0.23	0.21	0.21	0.31	0.21	0.23	0.21	0.38	0.33	0.34	0.35	0.46
Madagascar	0.65	1.01	1.07	1.12	0.86	0.45	0.59	0.74	0.50	0.49	0.49	0.42
Nigeria	1.56	1.39	0.62	0.75	0.61	0.53	0.54	0.69	0.46	0.38	0.54	0.65
Senegal	0.94	1.04	1.18	1.18	0.95	0.31	0.44	1.12	0.72	0.64	1.11	0.84
Tanzania	0.36	0.48	0.40	0.29	0.26	0.10	0.11	0.15	0.17	0.28	0.36	0.19
Zambia	0.27	0.35	0.38	0.28	0.30	0.26	0.25	0.23	0.20	0.20	0.29	0.32
Bangladesh	0.29	0.35	0.39	0.62	1.29	0.70	0.35	0.31	0.30	0.32	0.32	0.37
India	0.37	0.44	0.41	0.51	0.44	0.47	0.47	0.42	0.34	0.31	0.44	0.38
Indonesia	0.31	0.38	0.25	0.30	0.46	0.29	0.31	0.51	0.55	0.53	0.57	0.58
Korea,Rep.of	0.67	0.79	0.97	1.38	0.93	0.41	0.70	1.39	1.93	1.38	1.72	1.58
Philippines	0.82	0.87	1.02	1.22	0.88	0.56	0.42	0.60	0.88	0.83	0.47	0.49
Malaysia	1.59	1.96	2.40	2.12	1.21	0.48	0.98	1.52	1.51	1.36	1.26	1.47
Sri Lanka	0.36	0.48	0.37	0.55	0.49	0.33	0.43	0.63	0.61	0.37	0.34	0.52
Turkey	0.76	0.76	1.19	1.09	0.83	0.94	0.96	1.55	1.81	1.15	1.18	1.22
Mexico	0.92	1.62	1.24	1.08	0.81	0.87	0.57	0.66	0.87	0.76	1.06	0.99
Egypt	0.23	0.29	0.33	0.33	0.20	0.08	0.10	0.18	0.28	0.25	0.36	0.35
Burma	0.07	0.12	0.12	0.16	0.15	0.08	0.06	0.12	0.08	0.06	0.05	0.04
Nepal	0.52	0.55	0.43	0.52	0.64	0.53	0.41	0.48	0.42	0.37	0.38	0.38
Pakistan	0.25	0.40	0.25	0.64	0.34	0.39	0.37	0.44	0.46	0.38	0.39	0.40
Thailand	0.44	0.48	0.50	0.51	0.38	0.25	0.33	0.42	0.41	0.29	0.52	0.40
Argentina	0.60	0.63	0.57	0.60	0.29	0.26	0.08	0.31	0.64	0.65	0.59	0.56
Brazil	0.85	1.39	1.27	1.44	1.04	0.55	0.82	0.99	0.84	0.84	0.87	1.00
Columbia	0.68	1.09	0.57	0.90	0.61	0.47	0.51	0.59	0.92	0.70	0.52	0.54
Japan	1.05	2.12	2.21	2.40	2.13	1.85	2.13	2.22	4.36	3.42	4.24	3.18
USA	1.04	1.10	1.14	1.20	1.16	0.66	0.66	0.79	0.91	0.64	0.84	0.82
Australia	0.84	0.91	0.85	1.01	1.05	0.79	0.57	0.63	0.75	0.79	0.73	0.77
Italy	1.02	1.50	1.69	1.29	0.81	0.59	0.71	0.83	0.84	0.81	0.86	0.84
Spain	0.84	1.00	1.01	1.08	0.94	0.69	0.62	0.88	0.73	0.65	0.78	0.78

Source: Own computations with data from Appendix 1, Cowitt [1985], Pick [1978] and IMF [1981].

Appendix 3 - NPCs Adjusted for Exchange Rate Distortions and Food-aid Receipts, 1969-1980

Country \ Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Cameroon	0.46	0.29	0.44	0.52	0.34	0.22	0.28	0.42	0.84	1.39	1.31	1.57
Ivory Coast	0.94	0.95	1.22	1.08	0.51	0.57	0.52	0.84	0.90	1.08	1.14	1.05
Kenya	0.23	0.21	0.21	0.31	0.21	0.23	0.25	0.38	0.33	0.34	0.99	0.87
Madagascar	0.65	1.01	1.07	1.22	1.58	0.47	0.59	0.76	0.50	0.52	0.49	0.83
Nigeria	1.56	1.39	0.62	0.75	0.61	0.53	0.54	0.69	0.46	0.38	0.54	0.65
Senegal	0.94	1.04	1.18	1.18	0.98	0.32	0.44	1.12	0.75	0.70	1.16	1.09
Tanzania	0.36	0.48	0.40	0.29	0.26	0.16	0.13	0.46	0.22	0.64	1.04	0.28
Zambia	0.27	0.35	0.38	0.28	0.30	0.26	0.25	0.23	0.20	0.27	0.49	0.66
Bangladesh	0.29	0.35	0.93	0.97	1.45	0.88	0.87	0.47	0.54	0.48	1.57	0.49
India	0.37	0.44	0.84	0.92	0.44	0.47	0.56	0.60	0.37	0.38	0.44	0.38
Indonesia	0.54	0.56	0.55	0.50	0.49	0.37	0.34	0.95	1.09	0.86	0.95	0.79
Korea,Rep.of	1.28	1.35	1.28	1.79	1.17	0.57	1.18	2.33	1.93	1.38	1.72	2.38
Philippines	0.82	0.87	1.67	2.15	1.32	0.82	0.49	0.60	1.23	0.83	0.47	0.86
Malaysia	1.59	1.96	2.40	2.12	1.21	0.48	0.98	1.52	1.51	1.36	1.26	1.47
Sri Lanka	0.36	0.48	0.37	0.56	0.49	0.43	0.43	0.74	0.62	0.37	0.34	0.52
Turkey	0.76	0.76	1.19	1.09	0.83	0.94	1.05	1.55	2.06	1.15	1.31	1.22
Mexico	0.92	1.62	1.24	1.08	0.81	0.87	0.57	0.66	0.87	0.76	1.06	0.99

Source: Own computations with data from Appendix 1, Cowitt [1985], Pick [1978] and FAO [1984].

Appendix 4 - GDP Per Capita Based on Purchasing Power Parities, 1969-1980

Country \ Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Cameroon	705	703	707	739	804	769	756	718	777	820	862	875
Ivory Coast	975	1028	1034	1061	1036	1030	1050	1113	1047	1093	1088	1110
Kenya	535	552	570	589	588	604	603	600	632	662	664	662
Madagascar	653	673	676	670	629	620	593	573	583	580	606	589
Nigeria	522	630	700	717	733	788	705	771	822	761	840	824
Senegal	724	760	745	757	710	725	758	811	777	733	774	744
Tanzania	290	283	279	296	313	309	318	338	346	339	354	353
Zambia	703	789	754	825	843	841	883	918	800	817	666	716
Bangladesh	497	458	393	394	452	453	501	492	516	527	515	540
India	559	576	583	565	571	554	592	579	610	630	587	614
Indonesia	521	559	591	635	706	756	784	830	879	931	986	1063
Korea,Rep.of	1112	1189	1314	1366	1553	17322	1829	2013	2170	2411	2566	2369
Philippines	1081	1094	1114	1147	1209	1271	1321	1380	1416	1468	1496	1551
Malaysia	1450	1525	1837	1950	2146	2336	2239	2430	2594	2717	2929	13111
Sri Lanka	1024	1018	999	1014	973	999	953	1004	1023	1176	1165	1199
Turkey	1678	1702	1810	1885	1887	2084	2250	2455	2506	2421	2341	2319
Mexico	2954	3063	3086	3239	3403	3509	3586	3624	3768	3822	4080	4333
Egypt	653	671	681	700	718	735	780	820	853	897	936	995
Burma	385	398	397	398	389	388	397	413	429	444	459	483
Nepal	504	506	493	493	474	489	494	493	505	516	510	490
Pakistan	812	797	779	795	818	821	836	846	890	896	958	989
Thailand	1033	1063	1096	1143	1226	1260	1307	1384	1515	1590	1662	1694
Argentina	3858	4002	4116	4140	4157	4306	4214	4125	4364	4099	4308	4342
Brazil	1685	1782	1951	2111	2338	2504	2589	2805	2924	3030	3190	3356
Columbia	1616	1711	1821	1891	2010	2094	2113	2191	2256	2403	2474	2552
Japan	5060	5494	5690	6139	6640	6434	6518	6816	7119	7439	7765	8117
USA	9594	9459	9645	10071	10555	10382	10197	10598	11065	11470	11602	11404
Australia	7096	7344	7458	7581	7794	7646	7739	7895	7864	8122	8152	8349
Italy	4872	5028	5112	5276	5663	5907	5685	6068	6220	6431	6808	7164
Spain	4217	4379	4546	4853	5179	5466	5478	5568	5660	5682	5642	6131

Source: Summers and Heston [1988].

Appendix 5 - Import Dependence of Net Importers of Rice[a], 1968-1979

Country \ Year	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Cameroon	0.464	0.461	0.468	0.779	0.742	0.822	0.651	0.687	0.362	0.639	0.594	0.808
Ivory Coast	0.165	0.221	0.278	0.279	0.270	0.405	0.217	0.006	0.007	0.267	0.278	0.376
Kenya	0.195	0.028	0.056	0.339	0.093	0.008	0.004	0.019	0.278	0.011	0.035	0.012
Madagascar	0.000	0.035	0.016	0.047	0.038	0.053	0.070	0.043	0.070	0.054	0.091	0.116
Nigeria	0.001	0.005	0.009	0.004	0.020	0.003	0.014	0.020	0.205	0.617	0.628	0.334
Senegal	0.831	0.579	0.668	0.728	0.840	0.822	0.703	0.520	0.733	0.860	0.742	0.804
Tanzania	0.145	0.082	0.055	0.074	0.051	0.061	0.324	0.256	0.036	0.179	0.157	0.085
Zambia	0.871	0.860	0.885	0.915	0.902	0.822	0.902	0.860	0.860	0.874	0.804	0.843
Bangladesh	0.043	0.020	0.045	0.035	0.065	0.033	0.005	0.021	0.033	0.015	0.023	0.005
India	0.011	0.010	0.014	0.013	0.008	0.006	0.003	0.006	0.010	0.002	0.002	0.003
Indonesia	0.068	0.049	0.071	0.038	0.055	0.118	0.072	0.046	0.079	0.115	0.099	0.101
Korea,Rep.of	0.079	0.146	0.178	0.218	0.174	0.081	0.082	0.103	0.037	0.012	0.000	0.045
Philippines	0.091	0.030	0.074	0.097	0.132	0.081	0.041	0.031	0.012	0.007	0.000	0.000
Malaysia	0.236	0.234	0.251	0.175	0.091	0.194	0.206	0.113	0.153	0.187	0.296	0.149
Sri Lanka	0.295	0.257	0.342	0.272	0.238	0.287	0.222	0.383	0.317	0.331	0.132	0.145
Turkey	0.009	0.087	0.075	0.010	0.015	0.268	0.063	0.322	0.105	0.144	0.152	0.086
Mexico	0.001	0.004	0.019	0.070	0.004	0.003	0.106	0.132	0.003	0.003	0.004	0.101

[a]Import-dependence is defined as Imports/(Imports + Production * 0.65). The variable is introduced one-year lagged

Source: Own computations with data taken from FAO, Trade and Production Yearbooks, various years.

Appendix 6 - Export Shares of Net Exporters of Rice[a], 1968-1979

Country \ Year	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Egypt	0.338	0.464	0.386	0.313	0.280	0.202	0.093	0.066	0.141	0.151	0.095	0.058
Burma	0.067	0.119	0.121	0.153	0.107	0.026	0.037	0.048	0.104	0.109	0.051	0.087
Nepal	0.017	0.178	0.165	0.150	0.100	0.145	0.037	0.059	0.117	0.071	0.056	0.075
Pakistan	0.040	0.134	0.225	0.083	0.087	0.330	0.265	0.187	0.293	0.334	0.244	0.324
Thailand	0.132	0.117	0.118	0.178	0.262	0.088	0.120	0.096	0.197	0.324	0.142	0.273
Argentina	0.304	0.334	0.374	0.491	0.120	0.207	0.190	0.316	0.433	0.942	0.640	0.488
Brazil	0.037	0.017	0.019	0.035	0.000	0.007	0.013	0.001	0.012	0.070	0.038	0.000
Columbia	0.001	0.034	0.011	0.002	0.005	0.027	0.001	0.069	0.077	0.092	0.076	0.024
Japan	0.000	0.031	0.056	0.099	0.018	0.053	0.030	0.001	0.000	0.002	0.008	0.062
USA	0.618	0.709	0.705	0.585	0.809	0.596	0.521	0.565	0.618	0.782	0.580	0.591
Australia	0.710	0.670	0.803	0.523	0.738	0.782	0.512	0.690	0.804	0.740	0.870	0.536
Italy	0.443	0.312	0.648	0.752	0.744	0.361	0.675	0.681	0.676	0.684	0.713	0.730
Spain	0.425	0.187	0.282	0.175	0.249	0.191	0.193	0.199	0.034	0.333	0.188	0.198

[a]The variable is introduced one-year lagged. Export shares are defined as Exports/Production*0.65.

Source: FAO, Trade and Production Yearbook, various issues.

Appendix 7 - International Terms of Trade Between Food and Manufactured Goods, 1969-1980

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
	1.05	1.00	1.00	1.03	1.15	1.31	1.27	1.14	1.07	1.00	1.00	1.03

Source: FAO, Trade Yearbook and UN, Statistical Yearbook, various issues.

Appendix 8 - Agriculture's Share in Labor Force[a], 1969-1980

Country \ Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Cameroon	84.7	84.6	84.3	83.9	83.5	83.1	82.7	82.3	81.9	81.5	81.1	80.7
Ivory Coast	84.9	84.5	84.1	83.7	83.2	82.7	82.1	81.5	81.0	80.5	79.9	79.3
Kenya	82.5	82.1	81.7	81.3	80.9	80.4	79.9	79.5	79.0	78.5	78.1	77.6
Madagascar	89.9	89.4	88.9	88.4	87.8	87.2	86.6	86.0	85.3	84.7	84.0	83.3
Nigeria	62.9	62.1	61.3	60.4	59.4	58.6	57.7	56.8	56.0	55.1	54.2	53.3
Senegal	80.2	79.7	79.2	78.6	78.1	77.6	77.1	76.6	76.0	75.5	74.9	74.4
Tanzania	86.4	86.0	85.6	85.2	84.7	84.2	83.7	83.1	82.6	82.1	81.6	81.0
Zambia	73.4	72.8	72.2	71.6	71.0	70.4	69.8	69.2	68.6	67.9	67.3	66.6
Bangladesh	86.0	85.9	85.8	85.7	85.5	85.3	85.1	84.9	84.6	84.4	84.1	83.8
India	69.8	69.3	68.8	68.3	67.8	67.2	66.6	66.0	65.3	64.6	64.0	63.2
Indonesia	66.8	66.3	65.8	65.3	63.8	63.2	62.6	61.9	61.2	60.4	59.7	58.9
Korea,Rep.of	52.3	51.0	49.7	48.4	47.1	45.9	44.7	43.5	42.3	41.1	39.9	38.6
Philippines	54.0	53.2	52.4	51.7	51.0	50.3	49.6	48.9	48.2	47.5	46.8	46.0
Malaysia	56.2	55.5	54.8	54.1	53.3	52.5	51.7	50.9	50.1	49.3	48.6	47.8
Sri Lanka	55.3	55.1	55.0	54.9	54.7	54.5	54.3	54.1	53.9	53.7	53.5	53.2
Turkey	68.9	67.7	66.5	65.2	63.9	62.6	61.3	59.9	58.6	57.2	55.8	54.4
Mexico	46.2	45.2	44.2	43.2	42.3	41.4	40.5	39.6	38.7	37.8	36.9	36.0
Egypt	54.8	54.4	54.0	53.6	53.2	52.8	52.4	52.0	51.6	51.2	50.8	50.4
Burma	60.4	59.6	58.7	57.9	57.1	56.3	55.5	54.8	54.0	53.3	52.5	51.8
Nepal	94.0	93.9	93.7	93.6	93.5	93.4	93.3	93.1	93.0	92.8	92.7	92.6
Pakistan	59.4	58.9	58.4	57.9	57.4	56.8	56.2	55.6	55.0	54.5	53.9	53.5
Thailand	80.3	79.9	79.5	79.1	78.7	78.2	77.8	77.2	76.8	76.3	75.8	75.4
Argentina	16.8	16.4	16.0	15.7	15.4	15.0	14.6	14.2	13.9	13.6	13.3	13.0
Brazil	46.3	45.6	44.9	44.2	43.5	42.8	42.0	41.2	40.5	39.7	38.9	38.2
Columbia	39.0	37.9	36.7	35.6	34.4	33.3	32.2	31.2	30.2	29.2	28.3	27.4
Japan	20.8	19.7	18.6	17.5	16.5	15.6	14.8	14.0	13.2	12.5	11.8	11.0
USA	3.9	3.7	3.5	3.3	3.1	3.0	2.8	2.6	2.5	2.4	2.3	2.3
Australia	8.4	8.1	7.8	7.5	7.2	7.0	6.8	6.6	6.4	6.2	6.0	5.8
Italy	26.8	26.0	25.2	24.4	23.7	23.0	21.3	20.5	19.7	18.9	18.2	17.2
Spain												

[a]Due to a lack of data shares for the years 1971 to 1974 are estimated assuming a linearly decreasing agricultural sector for each country, which seems to be an acceptable approximation in view of the actual time series observations for the other years.

Source: FAO, Production Yearbook, various issues.