

TMD DISCUSSION PAPER NO. 18

**EVALUATING THE EFFECTS OF DOMESTIC POLICIES
AND EXTERNAL FACTORS ON THE PRICE
COMPETITIVENESS OF INDONESIAN CROPS:
CASSAVA, SOYBEAN, CORN, AND SUGARCANE**

**Romeo M. Bautista
International Food Policy Research Institute**

**Nu Nu San
Winrock International
International Food Policy Research Institute**

**Dewa Swastika
Sjaiful Bachri
Hermanto
Center for Agro-Socioeconomic Research**

**Trade and Macroeconomics Division
International Food Policy Research Institute
1200 Seventeenth Street, N.W.
Washington, D.C. 20036-3006 U.S.A.**

June 1997

TMD Discussion Papers contain preliminary material and research results, and are circulated prior to a full peer review in order to stimulate discussion and critical comment. It is expected that most Discussion Papers will eventually be published in some other form, and that their content may also be revised. This paper was prepared for the IFPRI-CASER project "Modeling the Future of Indonesian Agriculture."

ABSTRACT

This paper presents a framework for analyzing the contributions of government policies and exogenous (mostly, external) factors to the observed changes in the relative price of a tradable agricultural product. A decomposition analysis is undertaken on the changes in price competitiveness of four major nonrice crops in Indonesia between subperiods during 1970-94, involving the following components: (1) changes in the foreign price; (2) changes in the real exchange rate; and (3) changes in sectoral protection. To isolate the effects of domestic policies, a model of real exchange rate determination is developed in which the main explanatory variables are the external terms of trade, trade policy, current account balance (assumed dependent on macroeconomic policies), and the nominal exchange rate (a short-run influence). The related issue of price bias induced by sectoral and macroeconomic policies is also addressed by examining the nominal protection rates--direct, indirect, and total--for the four crops.

An important conclusion is that, after the attainment of rice self-sufficiency, Indonesian policies have not promoted crop diversification on a "level playing field." The heavy protection accorded to soybean in 1994 reinforces the argument that domestic production has been encouraged beyond what is desirable from a national-interest point of view. The observed price discrimination against cassava may indicate a potentially significant impediment to the expansion of agricultural exports, most importantly of nontraditional export products. The latter is likely to be a key ingredient in agricultural diversification and in the structural transformation of the national economy.

TABLE OF CONTENTS

| | |
|---|----|
| 1. Introduction | 1 |
| 2. Agricultural Trade and Pricing Policies | 6 |
| 3. Observed Changes in Domestic Crop Prices | 8 |
| 4. A Decomposition Analysis | 10 |
| 5. Attributing Real Exchange Rate and Domestic Price Changes to Exogenous and Policy-related Factors | 16 |
| 6. Relative Crop Prices under Alternative Policy Regimes | 24 |
| 7. Summary and Conclusions | 29 |
| References | 33 |
| Appendix | |
| Tables | |
| Figures | |

EVALUATING THE EFFECTS OF DOMESTIC POLICIES AND EXTERNAL FACTORS ON THE PRICE COMPETITIVENESS OF INDONESIAN CROPS: CASSAVA, SOYBEAN, CORN, AND SUGARCANE

1. INTRODUCTION

Agricultural performance is determined, at least in part, by the relative profitability of agricultural production, which in turn is affected by price and nonprice factors. While both output (or product) and input prices are relevant, the present study focuses only on the relative product price facing domestic producers as a measure of the price competitiveness of agricultural crops in Indonesia. That this does not represent a drastic oversimplification is suggested by the typically small proportion (less than 15 percent) of the cost of material inputs to the value of output in crop production.

The domestic relative price of any tradable good in a given period is the outcome of both policy and nonpolicy influences. Included in the latter category would be the international price--more specifically, border price--of the product (in foreign currency), which is exogenously determined under the small-country assumption. Government pricing policies, on the other hand, can be differentiated into sector-specific and economywide, which have direct and indirect effects, respectively, on the product price. A relevant consideration is that the domestic price of a tradable good is influenced by the real exchange rate. The latter can be affected not only by economywide or macroeconomic policies but also by the country's external terms of trade (see below), which is outside the control of policymakers.

It is important, from a policy standpoint, to be able to distinguish between the effects of domestic policies and those of external developments on relative agricultural

prices. Consider, for instance, the case of a sustained deterioration in the international price of an agricultural product. Maintaining the relative domestic price of that product is not likely to be the best policy choice if the promotion of comparative advantage and efficiency of domestic resource use is an important policy objective.¹ It may serve other objectives (promoting national self-sufficiency, income protection for favored producers, etc.), but the cost of such a policy, in terms of national income and consumer welfare, could be high.

The present study examines the comparative effects of government policies and exogenous (mostly, external) factors in the evolution of the domestic prices of four major crops in Indonesia during 1970-94, a period of significant developments in both the country's agricultural sector and macroeconomy. Of the four crops, three--cassava, soybean, and corn--are part of the *palawija* (secondary foodcrops) sector. The fourth crop, sugarcane, is categorized as an estate crop but, as argued in Piggot et al. (1993:96), it "needs to be taken into account when considering rice or *palawija*." These four crops represent interesting and, in some ways, contrasting cases of agricultural crop performance determined partly by the trade orientation of those crops and by the nature of domestic policies affecting them. The economic importance of these crops is not reflected fully in their present contributions to agricultural value added and employment which, relative to rice, are quite small.² In terms of the future

¹ A separate issue concerns the short-run variability of world commodity prices. In many developing countries, government intervention aims to dampen the price fluctuations--but in practice not symmetrically, i.e., governments have tended to reduce the peaks without raising prices in the troughs (Knudsen and Nash 1993).

² Based on the 1990 Input-Output Table, the value of output ranged from Rp 925 million for sugarcane to Rp 1,982 million for cassava, the total for the four crops comprising only about 40 percent of that for rice (Rp 14,081 million).

growth and transformation of Indonesian agriculture, however, these four crops hold considerable significance.

It is generally recognized that, at least during the period from the mid-1970s to the mid-1980s, government policies were heavily biased towards rice, effectively discriminating against *palawija* and other crops. The unprecedented shortages in the world grains markets in 1973-74 accentuated the traditional concern in Indonesia about domestic food security, prompting a strong drive toward self-sufficiency in rice, the primary food crop. Actively promoted by the government through output price support and input subsidies, production of rice increased by about seven percent annually on average from 1975 to 1985. Rice self-sufficiency was attained in the latter year, quite an impressive achievement considering that Indonesia was the world's largest net importer of rice only five years earlier.

The attainment of rice self-sufficiency has drawn policy attention to the need to promote greater economic efficiency in the agricultural sector, and to encourage increased crop diversification. Past policies have contributed to the comparative neglect of nonrice crops, many of which show lower yields compared to those of other Southeast Asian countries, at the same time that rice yield in Indonesia has reached much higher levels.³ Redressing any policy bias against *palawija* crops should also have a favorable distributional impact, since a large number of poor households depend on *palawija* for their livelihood.

Not surprisingly, after 1985, there have been reductions in the real producer

³ As indicated by the following comparative rice yields (kg/ha) in 1985 based on FAO data: Malaysia, 2977; Philippines, 2663; Thailand, 2061; and Indonesia, 3942. On the other hand, soybean yields in the same year were as follows: Malaysia, 1500; Philippines, 1006; Thailand, 1285; and Indonesia, 970.

price of rice and the level of input subsidies. Whether this represented a shift in policy stance and an effective encouragement to *palawija* and other nonrice crops is uncertain. The question also arises on how the structure of price incentives among the various crops has been affected. This issue needs to be addressed in the context of the government's commitment to promote a more diversified agricultural development. Has crop diversification away from rice been promoted efficiently, or have domestic price distortions been introduced in the process?

The period 1975-94 also witnessed some major macroeconomic adjustments in Indonesia. The 1973-74 oil price hike and accompanying dramatic increases in the country's export earnings and public revenue fueled a rapid expansion of the national economy through the early 1980s, at which time earnings from crude oil and petroleum products contributed about two-thirds of total exports, one-fourth of GNP, and 70 percent of government revenue. Since 1982, however, the oil sector has suffered from sharply declining real prices and earnings, reducing its importance as a predominant source of growth for the Indonesian economy. During the adjustment period 1982-85, inevitably one of slower growth,⁴ major reforms in exchange rate management, fiscal and monetary policies, and trade policy were undertaken. The adjustment measures are widely considered to be supportive of agriculture (e.g., World Bank 1986), as is suggested by the 18 percent increase in the agricultural terms of trade⁵ from 1983 to 1989. Beginning 1990 unusually large deficits characterized the

⁴ From 7.5 percent in 1975-81, the average annual GDP growth rate fell to 4.5 percent in 1982-85, before rising to 6.4 percent in 1986-92--based on annual GDP values in 1987 prices (World Bank 1995).

⁵ Based on the implicit price deflators for agriculture and nonagriculture using national-income accounts data.

Indonesian current account, accompanied by an appreciating real exchange rate--the latter representing a reversal of the almost continuous exchange rate depreciation that took place since 1982.

Five subperiods can be usefully distinguished that correspond to the major adjustments in the Indonesian economy indicated above: 1970-74, which immediately precedes the decade-long period of massive government support for rice; 1975-81, the oil-bonanza period; 1982-85, a period of macroeconomic disequilibrium and adjustment, representing as well the final approach to rice self-sufficiency; 1986-89, a growth recovery period and reduced government assistance to rice producers; and 1990-94, a period of large current account deficits and appreciating real exchange rate.

The remainder of this paper is organized as follows. Section 2 describes briefly the nature of agricultural trade and pricing policies in Indonesia, with particular reference to sector-specific policies affecting directly the domestic prices of the four crops. In Section 3 we examine the comparative movements in the domestic prices of the four crops vis-a-vis rice and the consumer price index (CPI) during 1970-94, distinguishing among the various subperiods indicated above. The observed changes in the domestic prices of the four crops relative to the CPI are then decomposed, in Section 4, into the corresponding changes in the following three components: (1) changes in the foreign price; (2) changes in the real exchange rate; and (3) changes in sectoral protection.

Because the real exchange rate is itself determined causally by domestic (macroeconomic) policies and other factors, an estimating equation is developed in Section 5 to provide an additional basis for isolating the effects of government policies

on domestic crop prices. Section 6 examines the extent to which the four crops had been protected (or disprotected) by government policies, directly and indirectly, from world-market prices. The paper ends with a brief summary of findings and some concluding remarks.

2. AGRICULTURAL TRADE AND PRICING POLICIES

Much of Indonesia's agricultural trade has been heavily regulated, and until recently, agriculture was relatively unaffected by the trade policy reforms that began in 1985 (World Bank 1992:84). The major policy instruments that restricted the international trade of agricultural products and influenced their domestic prices consist of tariffs, import licensing, export taxes and bans, and informal export quotas. The markets for a number of food products have also been regulated through administered prices, ostensibly aimed at providing low food prices for consumers, protecting farm incomes, and counteracting what is perceived by the government as excessive world price instability.

Another objective of government pricing policy in Indonesia, as in many other developing countries, has been the encouragement of domestic processing industries. For export products, the tendency has been to levy a higher tax on the primary commodity. On the other hand, import restrictions on processed agricultural products have resulted in artificially higher domestic prices of those products.

The 1985 reform package reduced the number of tariff rates, lowered the ceiling on many tariff rates, and raised the number of import items with very low tariff rates. Even after such effort at rationalizing the tariff structure, however, a large number of products continued to be subject to import licensing requirements. Agricultural

commodities on the "Restricted Goods List," most of which can be imported only by BULOG or by one of two state trading companies, represented 54 percent of domestic production in 1986. The 1991 trade policy reforms, which focused on agriculture, effectively reduced to 30 percent the share of agricultural production that continued to be subject to import licensing restrictions.

Of the three import-competing crops included in the present study, corn was the first to be deregulated. In 1989 BULOG's monopoly in corn importation was withdrawn. The setting of floor prices for corn (introduced in 1978) was also discontinued in 1990; it proved redundant as the producer price was consistently higher than the floor price. Nominal protection for corn has been estimated to be moderately negative in the mid-1980s and moderately positive in recent years (see below).

Import restrictions have continued to apply to soybean and sugar, which serve to protect their domestic prices from the international market. Moreover, BULOG plays a major role in the domestic marketing of the two commodities. Nominal protection rates have been estimated for soybean and sugar to be very high during 1985-87 (Gonzales et al. 1993), which apparently have been much lower in recent years (Condon and Kane 1995).

In the past various types of export controls were extensively used in Indonesia. Except for export bans that now affect mainly non-food products (e.g., rattan, logs, some semi-processed wood products, raw hides and skins), the trade reforms implemented during the 1990s have significantly reduced the number of products subject to export regulation.

In the case of cassava, government intervention took the form of export taxes

(5 percent on *gaplek* chips until 1982) and licensing, which artificially lowered the producer price. Most notably, the ban on *gaplek* exports in 1973 pushed down sharply the domestic cassava price and discouraged investments in export facilities (Falcon et al. 1984: 175). Indonesia exports *gaplek* mainly to the European market. The primary link of the domestic cassava price is with the EC import price of *gaplek*, which is determined by its value as a substitute for high-priced European feed grains (Unnevehr 1984). Beginning 1982 EC import quotas on *gaplek* from Indonesia (and other exporters) were in effect. In some years Indonesian cassava production was not enough to meet domestic needs and the export quota (Gunawan et al. 1992, Suharno 1995). Negative nominal protection for cassava during 1985-87 was obtained in Gonzales et al. (1993).

The *direct* protection arising from sector-specific trade and pricing policies as described above for the four crops under study is only a partial measure of the policy-induced effect on price competitiveness. It will be argued below that the *indirect* protection (more likely, disprotection) for all tradable goods arising from real exchange rate misalignment needs to be taken into account in the assessment of the total effect of government policies on domestic relative prices of the four crops.

3. OBSERVED CHANGES IN DOMESTIC CROP PRICES

Figures 1a - 1d show the annual levels of the wholesale prices of cassava, soybean, corn, and sugar deflated by the wholesale price of rice in Jakarta over the period 1970-94. It is evident that there are significant differences in the time profiles for the four crops. Subperiod averages of the relative crop prices, represented as indexes, are contained in Table 1. Unsurprisingly, during the entire period 1975-85

when rice self-sufficiency was a dominant policy goal, agricultural prices turned more favorable to rice--to the relative detriment of corn, soybean, and cassava, the latter being hurt particularly during the oil-boom period 1975-81. By contrast, the relative price of sugar increased in the later subperiod.

After rice self-sufficiency was achieved, the relative prices of cassava, sugar, and corn declined during 1986-89 but subsequently increased--more significantly in both directions for cassava and sugar than for corn. On the other hand, the soybean-rice price ratio continued to show increasing subperiod averages during the macro-growth recovery and rice self-sufficiency period 1986-94. Thus, in the first half of the 1990s, domestic prices of all four crops relative to rice were higher than in 1982-85--markedly higher for cassava and soybean but only slightly for corn and sugar.

The changes in actual domestic prices of the four crops relative to rice as described above reflect not only the sector-specific trade and pricing policies adopted by the government but also the international prices of all five agricultural products. Thus, the steep decline in world sugar prices during 1982-85 (to almost half of the 1975-81 average level) would have contributed importantly to the observed large reduction in the domestic price of sugar relative to rice for that subperiod.

The ratio of domestic prices of two tradable goods, however, does not provide an adequate measure of price competitiveness in that it does not reflect changes in the relative profitability with respect to nontradable goods production. Comparison of the relative profitability of the four crops under study would be better done on the basis of their relative prices vis-a-vis nontradable goods, assumed to be (imperfectly) substitutable to tradable goods in domestic production.

Using the consumer price index (CPI) as a proxy for the average price of

nontradable goods, the annual levels of our measure of price competitiveness (index of the wholesale price deflated by CPI) for the four crops are shown in Figures 2a - 2d. They differ from the corresponding profiles in Figures 1a - 1d to the extent that the wholesale price index of rice differs from the CPI for the various years. Table 2 contains the subperiod averages of the crop price-CPI ratio for each crop.

A striking observation from Table 2 is that the least price-competitive period for the four crops was 1975-81. This is presumably related to the massive appreciation of the real exchange rate that was induced by the oil boom, which effectively penalized all non-oil tradable goods. It is also worth noting that after the attainment of rice self-sufficiency, the relative product price increased during 1986-89 for sugar and quite significantly for soybean, but decreased slightly for cassava and sugar. Subsequently, during 1990-94, the price competitiveness of all four crops shows a general improvement over the 1982-85 levels, cassava and soybean having the larger relative price gains. This was despite the appreciation of the real exchange rate that would have exerted a negative effect on the domestic prices of tradable goods.

To what extent have government policies been responsible for the differential changes observed above in the price competitiveness of the four crops? To be able to address systematically this question, we need an analytical framework that can decompose the observed changes in domestic crop prices into those attributable to factors determined by domestic policies and those due to factors outside the control of policymakers, the latter including world market developments.

4. A DECOMPOSITION ANALYSIS

Denote by P_t the domestic price,⁶ in Indonesian rupiah (Rp), of the commodity (cassava, soybean, corn, or sugar) in year t , and by P_t^* the corresponding foreign (border) price in U.S. dollars--in which currency most international transactions in primary products are denominated (Bautista and Riedel 1982). By definition,

$$P_t = P_t^* E_t T_t (1 + m_t) \quad (1)$$

where

- E = nominal exchange rate (in Rp/dollar),
- T = nominal protection coefficient; equal to $1-t_x$ for cassava (t_x is the implicit export tax rate), or $1+t_m$ for soybean, corn, and sugar (t_m is the implicit tariff rate), and
- m = the "marketing margin" (including transport cost and normal profits) that makes P and P^* comparable.

It is of course not the nominal price but the relative price of the product that affects producer behavior. We consider here the evolution of the producer prices of the four crops relative to the consumer price index, i.e., $p_t = P_t/CPI_t$. Equation (1) can be written

$$p_t = p_t^* RER_t T_t (1 + m_t) \quad (2)$$

⁶ Instead of farmgate prices, on which data are not available, we make use below of the "wholesale prices of farm crops in Jakarta" to represent the producer prices of the four crops.

where p_t^* is P_t^* deflated by the general level of foreign prices, proxied here by the U.S. wholesale price index (WPI_{us}), and $RER_t (= E_t WPI_{ust}/CPI_t)$ is the real exchange rate in year t . This empirical measure of the real exchange rate is a rough approximation of that used in theoretical discussions representing the foreign price of tradable goods, expressed in domestic currency, relative to the price of nontradable goods. Noting that an RER increase (decrease) represents a real depreciation (appreciation), it is remarkable that the Indonesian government was able to sustain a depreciating RER that more than doubled from 1975-77 to 1989-90 (see Figure 3).

Taking natural logarithms on both sides of equation (2) and then taking first differences, we have

$$\Delta \ln p_t = \Delta \ln p_t^* + \Delta \ln RER_t + \Delta \ln T_t + \Delta \ln (1 + m_t) \quad (3)$$

where Δ is the first difference operator. Equation (3) shows that any observed change in the relative domestic price over a given period can be decomposed into four components: (1) the change in its border price; (2) the change in real exchange rate; (3) the change in (direct) nominal protection; and (4) the change in marketing margin.

Changes in government policies are usually associated with components (2) and (3). The latter is completely determined by shifts in sectoral trade and pricing policies, while the former is jointly determined by changes in macroeconomic or economywide policies and in such exogenous factors as the external terms of trade (see below). Moreover, component (4) is at least partly determined by government policies, since transport cost between the farmgate or wholesale market and the port (border) is a function of public infrastructure expenditures and fuel subsidies/taxes. Finally,

component (1) cannot be considered to be policy determined since Indonesia has had little or no monopoly power in the international trade of any of the four crops under study.

The annual values of $T_t(1 + m_t)$ in equation (2) can be calculated from time series data on wholesale and border prices when expressed in the same currency. It is not possible, given existing data, to separate out for each period the changes in nominal protection and in marketing margin. Considering that the latter, conceptually, should reflect the normal (competitive) profits rather than actual profits, we can follow the assumption commonly used in the analysis of the evolution of agricultural prices (e.g., Quiroz and Valdés 1993) that the marketing margin m_t remains constant over time. Alternatively, the nominal protection variable T_t can be interpreted to include the effects on the producer price arising from government policies that determine transport cost and other transaction costs incurred in moving the tradable product from the farmgate or wholesale market to the port, in which case it is reasonable to still associate the third term in the right-hand side of equation (3) with changes in direct (sector-specific) government interventions. In either case, the last term (pertaining to the marketing margin) is set equal to zero.

Changes in the real exchange rate, as a component in the decomposition of the changes in relative domestic price, can be associated with the shifts in macroeconomic policies that represent indirect price interventions of the government. Whether the real exchange rate in Indonesia has also been subject to the influence of the external terms of trade and other exogenous factors will be addressed below.

Calculated changes in the relative producer prices of cassava and soybean from one subperiod to the next, and their decomposition into the three main components as

identified above, are presented in Table 3.

1970-74 to 1975-81: The oil boom was accompanied by a decline in the foreign price of each crop and a substantial appreciation of the real exchange rate. Sectoral policies "leaned against the wind," increasing the nominal protection for cassava, soybean, and corn--despite which the domestic prices of these three crops decreased. A much larger price decline is observed for the export crop--cassava, for which the improvement in sectoral protection was not as substantial as that for soybean and corn, both import-competing goods.

1975-81 to 1982-85: There was an even more severe deterioration of the foreign prices of the four crops during the subperiod of macroeconomic disequilibrium and adjustment. However, the real exchange rate depreciated significantly and sectoral protection for each crop continued to increase. The net effect on price competitiveness was a substantial increase for cassava and sugar accompanied by a slight increase for soybean and corn.

1982-85 to 1986-89: During the growth recovery subperiod the foreign price of soybean and corn continued to decline while that of cassava and sugar increased. There was again a substantial real exchange rate depreciation. An accompanying sharp reduction in sectoral protection effectively nullified the favorable price effects of the real exchange rate depreciation and foreign price improvements for cassava and sugar. Despite a decline in sectoral protection, the domestic price of corn increased, albeit modestly. On the other hand, sectoral policies continued to raise the protection for soybeans, leading to a marked increase in its domestic price.

1986-89 to 1990-94: Increasing sectoral protection was the most important influence on the changes in price competitiveness of the four crops during the first half

of the 1990s. The real exchange rate appreciated and foreign prices declined but only slightly, so that the leaning-against-the-wind policy benefitted domestic producers of cassava, soybean, and sugar (but not corn producers) in the form of higher product prices.

In general, sectoral policies are observed to be countervailing, i.e., they tend to offset--in some cases, more than offset--the actual changes in foreign prices of the four crops. The net effect is stabilizing, in the sense that the product price changes by less than the component changes in either the foreign price or sectoral protection. Direct government intervention in the rice market is well known to have targeted, and successfully achieved, the same outcome with respect to price stabilization for domestic producers (Timmer 1989).

Focusing on the period after self-sufficiency in rice was attained, it is evident that sectoral pricing policies did not immediately become more highly favorable for nonrice crops. Sectoral protection during 1986-89 increased slightly for soybean but declined for the other three crops, substantially for cassava and sugar. Moreover, the subsequent improvement in sectoral protection for the three crops during 1990-94 did not fully compensate for the negative changes in the preceding subperiod. Thus, in so far as sectoral pricing policies are concerned, there was no evidence of a strong push toward crop diversification after the objective of rice self-sufficiency was fulfilled.

Except for the last subperiod, changes in the real exchange rate were a major influence in the observed changes in the price competitiveness of the four crops. As pointed out above, the real exchange rate is a function of both policy and nonpolicy factors. Macroeconomic policies add to the influence of sector-specific policies on the domestic relative prices of tradable goods. Also, since the foreign terms of trade is a

determinant of the real exchange rate, the contribution of external developments to the observed changes in domestic prices of cassava, soybean, corn, and sugar goes beyond the changes in their foreign prices.

In the following section, we investigate quantitatively the exogenous and policy-related determinants of the real exchange rate. The separate effects of these two sets of variables determining the real exchange rate, which can be reinforcing or offsetting, are then incorporated into the decomposition of the changes in the relative domestic price of each crop to derive the net contributions of external shocks and of changes in government policies between specific subperiods during 1970-94.

5. ATTRIBUTING REAL EXCHANGE RATE AND DOMESTIC PRICE CHANGES TO EXOGENOUS AND POLICY-RELATED FACTORS

The real exchange rate plays an intermediary role in transmitting the price incentive effects of trade and macroeconomic policies to tradable goods production. It is of course the real exchange rate, rather than the nominal exchange rate (which the government can control directly), that is relevant in the assessment of the relative profitability of tradable goods.

In an accounting sense, movements of the real exchange rate are due to movements of the nominal exchange rate, foreign prices (exogenous to the small country), and the general level of domestic prices. Because domestic prices are affected by nominal exchange rate changes (to an extent determined by the accompanying fiscal and monetary policies), there is no one-to-one correspondence between the nominal and real exchange rates.

Behaviorally, changes in the real exchange rate are explained in the theoretical

literature (see, for example, Edwards 1989) in terms of at least four variables. These are: the country's external terms of trade, trade policies, the current account balance, and the nominal exchange rate. The nature of their separate influences on the real exchange rate can be described as follows.

The terms of trade

If export prices fall relative to nontradable goods while import prices remain constant--hence, the terms of trade deteriorates, the supply of nontradables will increase. At the same time the demand for nontradables will decrease due to both reduced income and the substitution towards exportables. Therefore, the price of nontradables will decline and the real exchange rate will depreciate (based on the above measure, increase) to eliminate the excess supply and restore equilibrium in the nontradable goods market. If the deterioration in the terms of trade arises from an increase in import prices, supply of nontradables will decrease as resources are drawn towards the production of importables. Moreover, the induced income and substitution effects on demand will be in opposite directions. If the (positive) substitution effect is stronger, the real exchange rate will appreciate (Dornbusch 1980). The greater is the influence of import prices on the terms of trade change and the lower the substitutability between nontradables and importables in consumption, the more likely will an appreciation of the real exchange rate result from a deterioration in the terms of trade (Bautista 1987).

Trade policies

An import quota or tariff (export subsidy) raises the domestic price of importables (exportables), which encourages their domestic production and induces lower consumption, leading to a decrease in imports (an increase in exports). Resources are

reallocated toward the tradable goods sector away from nontradable goods production. The reduced supply of and increased demand for nontradables result in an increase in their price and hence in a decrease in the real exchange rate. It is well known, for example, that the adoption of import-protection policies to promote industrialization has helped sustain an overvalued exchange rate in many developing countries. In contrast to the terms-of-trade variable, this determinant of the real exchange rate is within the control of policymakers.

The current account

The expected relationship between the current account balance and the real exchange rate is positive. A deficit in the current account implies an excess demand for foreign exchange, and its accommodation through reserve drawdowns or capital inflows serves to defend an artificially low (overvalued) real exchange rate. For many developing countries in which the domestic capital market is underdeveloped and not integrated to the world financial system (in part due to government restrictions on private capital movements), the current account balance can be considered a policy variable, determined largely by macroeconomic policies (including foreign borrowing policy).

The nominal exchange rate

There is wide agreement in the literature that while changes in the nominal exchange rate can affect the short-run behavior of the real exchange rate, they will not have a long-run effect (Edwards 1989). The real exchange rate being a relative price variable, its long-run level is not likely to be influenced by nominal variables.⁷

⁷ Some authors (e.g., Turnovsky 1987) have argued that a systematic relationship between the nominal and real exchange rates is possible if there is

However, in the short run, a change in the nominal exchange rate may facilitate the adjustment of the real exchange rate to the changes in real variables. Without accompanying measures addressing the "fundamentals" (e.g., liberalizing the trade regime, reducing the gap between national income and expenditure), a nominal devaluation will not lead to a sustained real devaluation; it may only raise the general price level without changing relative prices in the economy.

Based on the foregoing considerations, the following specification of the real exchange rate equation for Indonesia is adopted:

$$\ln RER = f(\ln TOT, CA, \ln TRP, \Delta \ln E, YEAR) \quad (4)$$

where TOT is the external terms of trade index, CA is the current account balance as a ratio of GDP (expressed in percent), TRP is the trade policy variable represented by $(1 + t_m^o / 1 - t_x^o)$, t_m^o is the implicit tariff rate for all imports, t_x^o is the implicit tax rate for all exports, and the other variables (E and RER) are as defined earlier. The trend variable (YEAR) has been added to take account of such influences as shifting consumption and investment expenditures between tradable and nontradable goods over time.

Note that the nominal exchange rate is entered as a first difference, which is meant to reflect the short-run character of its influence on the real exchange rate. TRP is calculated as an index (1987 = 1.00) from the implicit tax rates t_m^o and t_x^o based on:

wage indexation.

goods and non-factor services--at current and constant prices; and (2) unit-value indexes of imports and exports for Indonesia. Concerning the CA variable, relatively large amounts of "official transfers" appear in the Indonesian current account for some years. The measure used for CA in our empirical analysis is the "current account balance before official transfers" (based on World Bank data), assumed to be the more sustainable component of the current account.

Annual data for the observation period 1970-92 are used in estimating equation (4) by OLS. To deal with possible simultaneity bias, the "instrumental variable technique" is applied, replacing the observed values of CA by predicted values based on a regression on the other variables appearing in the right-hand side of equation (4) together with money supply and fiscal deficit (divided by GDP). The Cochran-Orcutt iteration procedure is used to correct for first-order autocorrelation. The "best" estimated equation is:⁸

$$\begin{aligned} \ln RER = & -41.4 - 0.382 \ln TOT + 0.029 CA - 0.644 \ln TRP & (5) \\ & (0.090) & (0.014) & (0.226) \\ & & + 0.499 \Delta \ln E + 0.016 YEAR \\ & & (0.211) & (0.005) \end{aligned}$$

$$R^2 = 0.789 \quad \text{Rho} = 0.245$$

where the numbers in parentheses are the standard errors of the coefficient estimates, R^2 is the adjusted coefficient of determination, and Rho is the autoregressive coefficient.

⁸ Other regression results (including those with a lagged RER adjustment à la Koyck-Nerlove) proved less satisfactory, considering standard statistical criteria and the economic implications of the magnitude and signs of the coefficient estimates.

All the estimated coefficients are significant (at the 5 percent level), and have the expected signs. Notice the negative coefficient for the terms-of-trade variable--presumably related to the volatility of the world price of oil, Indonesia's most important export product, which dominated the changes in the external terms of trade during the observation period. That the coefficient of $\Delta \ln E$ proved to be highly significant supports the hypothesis of a short-run influence of the nominal exchange rate on the RER: About 50 percent of say, a nominal devaluation is translated into real devaluation within one year. The latter can be sustained beyond the first year by any one or a combination of the following: (1) the external terms of trade declines; (2) trade restrictions are reduced; and (3) macroeconomic policies promote an improvement of the current account. The first is outside the purview of domestic policy. With respect to the second, a 10 percent decline in TRP will lead to a 6.4 percent increase in RER. Thirdly, a one percentage point rise in CA (reduction in the current-account deficit) will yield an RER depreciation of 2.9 percent.

The estimated coefficients in the RER equation (5) can be used to distinguish the effects of government (macroeconomic and trade) policies (influencing CA, TRP, and E) from those of the other determinants of the real exchange rate. The calculated contributions of "policy-related" and "exogenous" factors to the observed RER changes from one subperiod to the next during 1970-94 are shown in the top part of Table 4. It is notable that the relative contributions of domestic policies and exogenous factors varied substantially over the study period. Unsurprisingly, the large RER appreciation (decline) during 1975-81 was induced solely by exogenous factors (more specifically, the oil boom). It was reversed in the subsequent macroeconomic adjustment as government policies overwhelmed the opposing exogenous effects, resulting in a 30

percent RER depreciation (increase).⁹ The real exchange rate depreciated by another 30 percent in 1986-89 relative to the preceding subperiod, with exogenous and policy factors being almost equally influential. Subsequently, both components of RER changes tended to stabilize and there was a slight appreciation (decrease) in the real exchange rate during 1990-94.

The top part of Table 4 provides the additional information necessary to derive an alternative decomposition of the changes in relative domestic prices of cassava, soybean, corn, and sugar that differentiates between the changes due to policy and nonpolicy (exogenous) factors. Such decomposition is given in the lower part of Table 4, which in effect substituted out the "changes in real exchange rate" in Table 3 with their policy-related and exogenous determinants as shown in the upper portion of Table 4. While only the price effects of sectoral policies can be isolated in Table 3, both macroeconomic and sectoral policies are taken into account in the "policy factors" component of the relative price changes contained in Table 4.

The observed changes in the relative domestic price of cassava are seen to have resulted from the offsetting effects of exogenous and policy-related factors. The substantial price decline from 1970-74 to 1975-81 was caused chiefly by exogenous influences, mitigated by domestic policies to only a small extent. In the next subperiod there was a further negative effect of exogenous factors on the cassava price which however was more than compensated for by more favorable government policies,

⁹This is consistent with the assessment in Thorbecke (1992:23) that "Indonesia responded (to the drastic decline in oil revenues) quickly and relatively forcefully with measures that included devaluations, significant reductions in government expenditures, and policies that liberalized both internal markets and external trade."

resulting in a significant price rise. During 1986-89 the relatively small decrease in the domestic price of cassava from the preceding subperiod was the outcome of a marked improvement in exogenous factors but which was completely negated by government price interventions. Subsequently, however, favorable policy factors were responsible for the substantial increase in the domestic price of cassava.

In the case of soybeans, improvement of the price competitiveness for domestic producers was evidently being promoted by government policies during each subperiod regardless of the concurrent exogenous influences. However, it was only during 1986-89 that soybean producers enjoyed a significantly large price increase, in view of the relatively deep price cuts induced by unfavorable nonpolicy developments during the other subperiods.

The domestic relative price of corn had also been positively affected by government policies throughout the study period. Moreover, the price changes from one subperiod to the next were generally smaller compared to the three other crops. The large price declines induced by exogenous factors in 1975-81 and 1982-85 were effectively offset by favorable domestic policies. Both exogenous and policy components of the observed changes in the domestic price of corn were relatively small during the last two subperiods.

With respect to sugar, government policies during 1982-85 more than compensated for the sharp price reduction due to exogenous factors. In the following subperiod, the exogenous price change became positive; it was however accompanied by unfavorable policy developments, leading to a lower relative sugar price. During 1990-94 the price competitiveness of sugar producers visibly increased as a result of favorable government policies.

The relative contribution of macroeconomic policies, through their effects on the real exchange rate, to the improvement of price incentives for nonrice crop producers in Indonesia can be discerned from Table 4. The macroeconomic policy environment is seen to have contributed significantly to the price competitiveness of tradable goods in the 1980s. During 1982-85 there were accompanying improvements in sectoral policies affecting directly the domestic prices of cassava, soybean, corn, and sugar; in total the positive policy effects more than compensated for the unfavorable exogenous developments, resulting in a net increase in the domestic price of each crop (significantly larger for cassava and sugar). However, in the second half of the decade, large negative changes in sectoral protection for cassava and sugar swamped the positive contributions of macroeconomic policies and led to a decline in their domestic prices--despite the concurrent improvement in exogenous factors. For soybean and corn, we find that the changes in sectoral protection as well as the exogenous price effects were insignificant, so that their improved price competitiveness can be attributed primarily to favorable macroeconomic policies.

Our final observation is that, in contrast to what happened during the second half of the 1980s, sectoral pricing policies in Indonesia during the first half of the 1990s served as a more important instrument than macroeconomic policies in promoting nonrice crop production and hence in supporting the objective of a more diversified production structure in agriculture.

6. RELATIVE CROP PRICES UNDER ALTERNATIVE POLICY REGIMES

The foregoing analysis has focused on the factors that determined how the relative domestic prices of the four crops changed during 1970-94, making an

assessment of the separate contributions of government policies and exogenous factors. It examines what had actually happened, not what might have happened under a different set of government policies. In this section we address the question of how the relative product prices would have adjusted to the removal of incentive biases arising from sector-specific and economywide (or macroeconomic) policies.

It is useful to distinguish between government interventions that affect relative agricultural prices (1) directly, i.e., policies aimed specifically at the agricultural sector, and (2) indirectly, i.e., those aimed at other production sectors (in particular, manufacturing) and macroeconomic policies that influence agricultural prices through the real exchange rate. They are referred to here simply as *direct* and *indirect* interventions. For any given year, the "actual" policy regime can then be compared with two counterfactual policy regimes: (1) "sectoral free trade", in which there is an absence of direct interventions; and (2) "economywide free trade", in which there is an absence of total (direct and indirect) interventions.

The relative domestic price of a tradable good under the actual and sectoral free-trade regimes can be represented, respectively, by $P_1 = P_a/CPI$ and $P_2 = P_b/CPI$ where P_a is the actual nominal price, P_b is the border-price equivalent at the official exchange rate (E), and CPI is the consumer price index. By definition, the "direct protection rate" is the proportionate excess of the actual producer price from the border-price equivalent evaluated at the official exchange rate, that is,

$$DPR = \frac{P_1 - P_2}{P_2}, \quad (6)$$

where a negative DPR indicates that P_2 is greater than P_1 , in which case there is direct

price "disprotection" or taxation.

Domestic relative prices of tradable agricultural products are influenced not only by sector-specific policies but also by trade and economywide policies that affect the real exchange rate. Thus, import restrictions to protect domestic industry and expansionary macroeconomic management have caused significant real exchange rate overvaluation in many developing countries, indirectly penalizing agricultural tradable goods production. The relative price under the policy regime of economywide free trade can be represented by $P_3 = P_b^*/CPI^*$, where P_b^* is the border price evaluated at the "equilibrium" exchange rate (E^*), and CPI^* is the consumer price index with the tradable goods component calculated at border prices using the equilibrium exchange rate.

The equilibrium exchange rate is defined here as the exchange rate that would have prevailed under conditions of current account balance and unrestricted foreign trade. It follows closely the Krueger et al. (1988) definition, and associates the equilibrium exchange rate with the economywide free-trade regime. To estimate the equilibrium real exchange rate RER^* , we make use of the estimated equation (5), imposing the required conditions that the current account is in balance and that there are no trade restrictions ($t_m^o, t_x^o = 0$)--i.e., setting the policy variables CA and ln TPR equal to zero. The divergence of the actual RER for each year from the corresponding RER^* so estimated is the rate of exchange rate distortion,

$$RERD = \frac{RER - RER^*}{RER^*}, \quad (7)$$

where, by definition, $RER^* = E^*WPI_{us}/CPI^*$.

The "total protection rate" is the proportionate excess of the actual domestic price from the border-price equivalent evaluated at the equilibrium exchange rate, that is,

$$\text{TPR} = \frac{P_1 - P_3}{P_3}. \quad (8)$$

A measure of the differential between total and direct protection is given by the "indirect protection rate," represented here by

$$\begin{aligned} \text{IPR} &= \text{TPR} - \text{DPR}(P_2/P_3) \\ &= \frac{P_2 - P_3}{P_3}, \end{aligned} \quad (9)$$

which indicates also the difference between the border-price equivalents evaluated at the official and equilibrium exchange rates. It is readily seen that IPR is equal to the rate of exchange rate distortion RERD in equation (7), since $P_2/P_3 = \text{RER}/\text{RER}^*$.

We make use of the DPR estimates derived in Gonzales et al. (1993:63) for cassava, soybean, corn, and sugar at the Jakarta wholesale market for the years 1985, 1986, and 1987, based on 1986 data on marketing and handling costs between the wholesale market and major port. As shown in Table 5, cassava was subject to negative direct protection in all three years, markedly so in 1986 and 1987. By contrast, direct government interventions in the soybean and sugar markets had a consistently large positive bias. In the case of corn, the slight negative bias in 1985 and 1986 changed to a substantial positive bias in 1987. It is worth noting that the declining direct protection for cassava and sugar during 1985-87 is consistent with the negative changes in sectoral protection during 1986-89 observed above (Table 3).

Under a regime of sectoral free trade, cassava producers would have benefitted from a higher price of their export product during 1985-87, especially in 1986 (by 35 percent) and in 1987 (by 40 percent). On the other hand, producers of the three other crops, which are import-competing, would have faced, at least in 1987, significantly lower product prices.

The negative indirect protection rate shown in each year indicates the extent of policy-induced real exchange rate overvaluation, ranging from 20 to 25 percent,¹⁰ which acted as a uniform tax on the four crops (and other tradable goods). As long as the current account is in deficit and trade restrictions exist, the overvalued real exchange rate will impose an indirect penalty to domestic producers of all tradable goods.

Finally, the bottom part of Table 5 shows that the total protection rate was negative for cassava but positive for soybean and sugar in each of the three years. Real exchange rate overvaluation (negative indirect protection) served to reinforce the negative direct protection for cassava in each year and for corn in 1985 and 1986, but did not completely offset the large positive direct protection for corn in 1987 and for soybean and sugar in the three years.

Under an economywide free-trade regime, the domestic price of cassava would have been higher than the actual price by 42 percent on average during 1985-87 and by 52 percent in 1987. These represent severe price penalties to Indonesian cassava

¹⁰The indirect protection rate of -16 percent is used in Gonzales et al. (1993:63) for each year during 1985-87 based on an estimated RER overvaluation for 1986. The latter takes account of the effect of trade restrictions but not of the current-account deficit (which ranged from 2.2 to 5.1 percent of GDP during 1985-87).

producers that even exceed the average 40 percent total disprotection estimated for the principal export crops in 16 developing countries during 1980-84 (Krueger, Schiff, and Valdes 1988:262). On the other hand, for the three import-competing crops, economywide free trade in 1987 would have lowered their domestic prices--by 9 percent for corn, 29 percent for soybean, and 30 percent for sugar. These positive total protection rates are in sharp contrast to the average -6 percent obtained for the principal import-competing food products in 16 developing countries during 1980-84 (Krueger, Schiff, and Valdes 1988:263).

Referring back to the changes in domestic crop prices induced by policy factors during 1990-94 (Table 4), it appears that total disprotection for cassava subsequently would have been reduced significantly. This is supported by the finding in Condon and Kane (1995) that there was zero nominal protection for cassava in 1994. Moreover, our estimate of the indirect disprotection (RER overvaluation) for 1994 is lower (than for 1985-87) at -18 percent (see Appendix below).

Condon and Kane (1995) have also provided the following estimates of the (direct) nominal protection rate for 1994: 25 percent for soybean and 10 percent for both corn and sugarcane. Viewed jointly with our low estimated RER overvaluation in 1994, they do not seem inconsistent with the changes in price competitiveness due to "policy factors" for the three import-competing crops given for 1990-94 in Table 4 above.

7. SUMMARY AND CONCLUSIONS

This paper has presented a framework for analyzing the contributions of government policies and exogenous (mostly, external) factors to the observed changes

in the domestic relative price of a tradable agricultural product. A decomposition analysis was undertaken on the actual changes in the domestic prices of four major nonrice crops on Indonesia between subperiods during 1970-94, involving the following components: (1) changes in the foreign price; (2) changes in the real exchange rate; and (3) changes in sectoral protection. To be able to isolate the effects of domestic policies, we developed a model of real exchange rate determination in which the main explanatory variables are the external terms of trade, trade policy, current account balance (assumed dependent on macroeconomic policies), and the nominal exchange rate (a short-run influence). The related issue of price bias induced by sectoral and macroeconomic policies was also addressed by examining the nominal protection rates--direct, indirect, and total--for the four crops in 1985-87.

The following findings of the study are worth emphasizing:

- o Changes in relative crop prices during 1975-85 clearly favored rice over cassava, soybean, and corn but not sugar. However, price competitiveness (represented by the ratio of domestic product price to the CPI) of the three crops was not severely impaired and indeed even improved toward the end of the period. Subsequently, there were further increases in the domestic relative prices of the four crops, more significantly during 1986-89 for soybean and corn and during 1990-94 for cassava and sugar.

- o The improving prices of soybean and corn during 1986-89 can be primarily attributed to the concurrent substantial depreciation of the real exchange rate. The latter was completely negated, for cassava and sugar, by sharp reductions in sectoral protection. During 1990-94 increased sectoral protection was responsible for the much improved price competitiveness of cassava and sugar.

o With the exception of the 1990-94 subperiod, the real exchange rate had a significant, if not a predominant, influence on the changes in domestic prices of the four crops.¹¹ In particular, the marked depreciation of the real exchange rate following the end of the oil boom contributed heavily to the reversal of the declining price competitiveness of cassava, soybean, and corn during 1982-85.

o Using an estimated equation for the real exchange rate, we found that exogenous factors (principally, the oil boom) had an overwhelming effect on the observed large appreciation of the exchange rate during 1975-81. The latter gave way to an even larger depreciation resulting from the macroeconomic policy adjustments during 1982-85.

o Government policies were generally the more important contributor to the observed changes in domestic crop prices (than the exogenous influences) from the early 1980s. Throughout the study period policy factors tended to compensate for the price effects of exogenous developments, which serve to reduce the variability of domestic crop prices.

o In 1986 and 1987 the magnitude of the price bias arising from economywide policies (equivalently, from real exchange rate overvaluation) for the four crops (except for corn in 1986) was much less than that from sector-specific policies. This differs from the more dominant effect of indirect interventions generally found in developing countries. The situation has changed somewhat by 1994, given the estimated direct

¹¹ In this sense, it is a valid statement that the agricultural price environment in Indonesia "is defined to a large extent by macro price policies and not just by commodity and sectoral policies" (Timmer 1989:60). In terms of the relative contribution to the price bias (i.e., the disparity between domestic and foreign prices), however, macroeconomic policies were a less important source, at least during 1986-87 (see below).

and indirect protection rates for 1994 as reported above.

o The observed pattern of protection during 1985-87 by trade orientation conforms to the general finding that agricultural pricing policy in developing countries favors import-competing relative to export products. Based on the 1994 estimates of direct protection reported above, such pattern has persisted in Indonesia, at least with respect to the four crops studied here.

An important conclusion is that, after the attainment of rice self-sufficiency, Indonesian policies have not promoted crop diversification on a "level playing field." The heavy protection accorded to soybean in 1994 reinforces the argument that domestic production has been encouraged beyond what is desirable from a national-interest point of view (Napitupulu and Rasahan 1992). The observed price discrimination against cassava (in relative terms) may indicate a potentially significant impediment to the expansion of agricultural exports, most importantly of nontraditional export products. The latter is likely to be a key ingredient in agricultural diversification and in the structural transformation of the national economy.

We believe that the decomposition framework and the three nominal protection measures employed in the present study are useful aids to policy analysis and formulation in Indonesia. Our *ex post* analysis of the past behavior of relative domestic prices of cassava, soybean, corn, and sugar represents a significant application in evaluating the comparative importance of the policy and nonpolicy components of the observed changes in price competitiveness of those four crops during different subperiods of significant adjustments in Indonesia's agricultural sector and macroeconomy.

In an *ex ante* sense, policymakers seeking to promote efficient crop

diversification and agricultural transformation (among other objectives) need information on how crop prices facing domestic producers are being affected by external developments (such as world commodity price changes) on the one hand and by sectoral and macroeconomic policies on the other. Such information can provide guidance on how current policies (and the associated protection structure) might be modified in response to changing international prices and other exogenous developments. At a minimum, policymakers (or their advisers) need to know the unintended consequences of existing policies on relative crop prices and to remain alert to the likely direct and indirect price effects of proposed policy changes.

REFERENCES

- Bautista, R. M. 1987. *Production incentives in Philippine agriculture: Effects of trade and exchange rate policies*. Research Report 59. Washington, D.C.: International Food Policy Research Institute.
- _____ and J. Riedel. 1982. Major currency realignments and the terms of trade in developing countries. *Journal of Development Economics* 10: 227-243.
- _____ and A. Valdés. 1993. *The bias against agriculture: Trade and macroeconomic policies in developing countries*. San Francisco: ICS Press for the International Center for Economic Growth and the International Food Policy Research Institute.
- Condon, T. and G. Fane. 1995. Measuring trade deregulation in Indonesia. Paper presented at the Conference on Building Success: Maximizing the Gains from Deregulation, April, Jakarta.
- Dornbusch, R. 1980. *Open economy macroeconomics*. New York: Basic Books Inc.
- Edwards, S. 1989. *Real exchange rates, devaluation and adjustment in less developed countries*. Cambridge, Mass.: MIT Press.
- Falcon, W. P., W. O. Jones, and S. R. Pearson. 1984. *The cassava economy of Java*. Stanford: Stanford University Press.
- Gonzales, L. A., F. Kasryno, N. D. Perez, and M. W. Rosengrant. 1993. *Economic incentives and comparative advantage in Indonesian food crop production*. Research Report 93. Washington, D.C.: International Food Policy Research Institute.
- Gunawan *et al.* 1992. Economic review of cassava in Indonesia. In Pakpahan *et al.*, *Cassava marketing in Indonesia*. Monograph Series No. 2. Bogor: Center for Agro-Socioeconomic Research.
- Knudsen, O. and J. Nash. 1993. Agricultural price stabilization and risk reduction in developing countries. In R.M. Bautista and A. Valdes (ed.), *The bias against agriculture: Trade and macroeconomic policies in developing countries*.

- Krueger, A. O., M. Schiff, and A. Valdés. 1988. Agricultural incentives in developing countries: Measuring the effect of sectoral and economy-wide policies. *World Bank Economic Review* 2: 255-271.
- Napitupulu, T. A., and C. A. Rasahan. 1992. The effects of trade and price policies on agricultural diversification in Indonesia. Paper presented at the IFPRI seminar on Southeast Asian Agriculture in Transition: Implications for Food Policy, September, Jakarta.
- Piggot, R. R., K. A. Parton, E. M. Treadgold, and B. Hutabarat. 1993. *Food price policy in Indonesia*. Canberra: Australian Centre for International Agricultural Research.
- Schiff, M., and A. Valdés. 1992. *A synthesis of the economics in developing countries*. The political economy of agricultural pricing policy, vol. 4. Baltimore: Johns Hopkins University Press for the World Bank.
- Suharno, P. 1995. *The dynamic structure of demand for cassava in Indonesia and its implications for policy*. Unpublished Ph.D. dissertation. University of the Philippines at Los Banos.
- Thorbecke, E. 1992. *Adjustment and equity in Indonesia*. Paris: Organization for Economic Co-operation and Development.
- Timmer, C. P. 1989. Indonesia: Transition from food importer to exporter. In *Food price policy in Asia: A comparative study*, ed. T. Sicular. Ithaca: Cornell University Press.
- Turnovsky, S. 1987. Optimal monetary policy and wage indexation under alternative disturbances and information structures. *Journal of Money, Credit and Banking* 19: 157-180.
- Unnevehr, L. 1984. *Transport costs, tariffs and the influence of world markets on Indonesian cassava prices*. Agricultural Economics Department Paper No. 84-30. Los Banos: International Rice Research Institute.
- World Bank. 1986. *World development report, 1986*. Washington, D.C.
- _____. 1992. *Indonesia. Agricultural transformation: Challenges and opportunities*. Washington, D.C.

APPENDIX: Calculating the rate of exchange rate distortion, 1985-87 and 1994

| | 1985 | 1986 | 1987 | 1994 |
|----------------------------------|--------|--------|--------|--------|
| (1) TRP | 1.321 | 1.238 | 1.243 | 1.214 |
| (2) lnTRP | 0.278 | 0.213 | 0.218 | 0.194 |
| (3) -0.644 lnTRP | -0.179 | -0.137 | -0.140 | -0.125 |
| (4) CA | -2.23 | -5.12 | -2.99 | -2.62 |
| (5) .029CA | -0.065 | -0.148 | -0.087 | -0.076 |
| (6) ln (RER/RER*) = (3) + (5) | -0.244 | -0.285 | -0.227 | -0.201 |
| (7) RER/RER* | 0.783 | 0.752 | 0.797 | 0.818 |
| (8) RERD = [(7) - 1.00] * 100 | -21.7 | -24.8 | -20.3 | -18.2 |

Source: Based on the estimated equation (5) and observed values of TRP and CA.

Note: The rate of exchange rate distortion (RERD) is in percent.

Table 1. Indexes of average domestic prices of cassava, soybean, corn, and sugar relative to rice, 1970-74 to 1990-94

| | Cassava | Soybean | Corn | Sugar |
|---------|---------|---------|-------|-------|
| 1970-74 | 103.1 | 105.4 | 111.0 | n.a. |
| 1975-81 | 83.1 | 103.2 | 106.1 | 92.4 |
| 1982-85 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1986-89 | 90.7 | 118.8 | 98.3 | 86.0 |
| 1990-94 | 115.7 | 127.1 | 102.0 | 104.2 |

Source: Authors' calculations based on wholesale prices of farm crops in Jakarta reported in Statistical Yearbook of Indonesia (various years).

Table 2. Indexes of average domestic prices of cassava, soybean, corn, and sugar relative to CPI, 1970-74 to 1990-94

| | Cassava | Soybean | Corn | Sugar |
|---------|---------|---------|-------|-------|
| 1970-74 | 95.5 | 96.8 | 101.9 | n.a. |
| 1975-81 | 74.3 | 93.8 | 96.1 | 85.0 |
| 1982-85 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1986-89 | 99.1 | 130.8 | 108.2 | 94.6 |
| 1990-94 | 121.8 | 134.2 | 107.7 | 110.0 |

Source: Authors' calculation based on wholesale prices of farm crops and CPI in Jakarta.

Table 3. Decomposition of changes in average domestic prices, 1970-74 to 1990-94

| | 1970-74 to 1975-81 | 1975-81 to 1982-85 | 1982-85 to 1986-89 | 1986-89 to 1990-94 |
|------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Cassava | | | | |
| Changes in relative domestic price | -25.1 | 29.7 | -0.9 | 20.6 |
| Changes in relative foreign price | -7.7 | -23.7 | 13.1 | -1.9 |
| Changes in real exchange rate | -26.9 | 29.8 | 29.5 | -0.7 |
| Changes in sectoral protection | 9.4 | 23.6 | -43.5 | 23.2 |
| Soybean | | | | |
| Changes in relative domestic price | -3.2 | 6.4 | 26.9 | 2.5 |
| Changes in relative foreign price | -12.2 | -37.2 | -6.8 | -10.4 |
| Changes in real exchange rate | -26.9 | 29.8 | 29.5 | -0.7 |
| Changes in sectoral protection | 35.9 | 13.8 | 4.2 | 13.7 |
| Corn | | | | |
| Changes in relative domestic price | -5.9 | 4.0 | 7.8 | -0.4 |
| Changes in relative foreign price | -35.4 | -38.1 | -15.4 | -0.9 |
| Changes in real exchange rate | -26.9 | 29.8 | 29.5 | -0.7 |
| Changes in sectoral protection | 56.4 | 12.3 | -6.3 | 1.2 |
| Sugar | | | | |
| Changes in relative domestic price | n.a. | 16.2 | -5.6 | 15.1 |
| Changes in relative foreign price | -13.4 | -83.8 | 9.7 | -1.9 |
| Changes in real exchange rate | -26.9 | 29.8 | 29.5 | -0.7 |
| Changes in sectoral protection | n.a. | 70.2 | -44.8 | 17.8 |

Source: Authors' calculations.

Note: The entries are 100 times the calculated changes in natural logarithms of the variables, which therefore approximate the percentage changes from one subperiod to the next.

Table 4. Decomposition of changes in the real exchange rate and in relative domestic prices into exogenous and policy-related factors, 1970-74 to 1990-94

| | 1970-74 to 1975-81 | 1975-81 to 1982-85 | 1982-85 to 1986-89 | 1986-89 to 1990-94 |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Real exchange rate | -26.9 | 29.8 | 29.5 | -0.7 |
| Exogenous factors | -27.1 | -7.3 | 14.5 | -0.5 |
| Policy factors | 0.2 | 37.1 | 15.0 | -0.2 |
| ===== | | | | |
| Relative cassava price | -25.1 | 29.7 | -0.9 | 20.6 |
| Exogenous factors | -34.8 | -30.9 | 27.6 | 7.2 |
| Policy factors | 9.7 | 60.6 | -28.5 | 13.4 |
| Relative soybean price | -3.2 | 6.4 | 26.9 | 2.5 |
| Exogenous factors | 7.7 | -11.4 | 11.6 | -2.5 |
| Policy factors | -10.9 | 17.8 | 15.3 | 5.0 |
| Relative corn price | -5.9 | 4.0 | 7.8 | -0.4 |
| Exogenous factors | 8.0 | 0.2 | -11.0 | 10.1 |
| Policy factors | -13.9 | 3.8 | 18.8 | -10.5 |
| Relative sugar price | -- | 15.9 | -5.5 | 15.1 |
| Exogenous factors | -- | -70.3 | 24.1 | 18.7 |
| Policy factors | -- | 86.2 | -29.6 | -3.6 |

Source: Authors' calculations.

Note: The entries are 100 times the calculated changes in natural logarithms of the variables, which therefore approximate the percentage changes over the indicated subperiods.

Table 5. Direct, indirect, and total protection rates for cassava and soybeans, 1985-87

| | 1985 | 1986 | 1987 |
|--------------------------------|------|------|------|
| Direct protection rate (DPR) | | | |
| Cassava | -1 | -35 | -40 |
| Soybean | 44 | 31 | 61 |
| Corn | -10 | -6 | 36 |
| Sugar | 173 | 81 | 62 |
| Indirect protection rate (IPR) | | | |
| Cassava | -22 | -25 | -20 |
| Soybean | -22 | -25 | -20 |
| Corn | -22 | -25 | -20 |
| Sugar | -22 | -25 | -20 |
| Total protection rate (TPR) | | | |
| Cassava | -23 | -51 | -52 |
| Soybean | 12 | 2 | 29 |
| Corn | -30 | -29 | 9 |
| Sugar | 112 | 36 | 30 |

Source: Gonzales et al. (1993:63) for DPR estimates. Authors' calculations for others.

Note: IPR is equal to the rate of real exchange rate distortion (RERD) as derived in the Appendix.

Figure 1a -- Index of domestic price of cassava relative to rice, 1970-94

Index (1987=100)

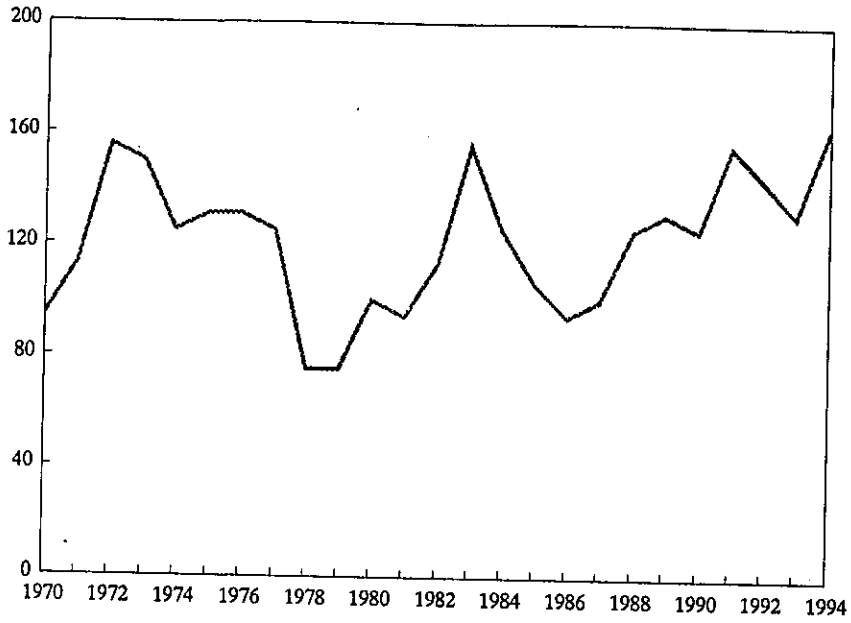


Figure 1b -- Index of domestic price of soybean relative to rice, 1970-94

Index (1987=100)

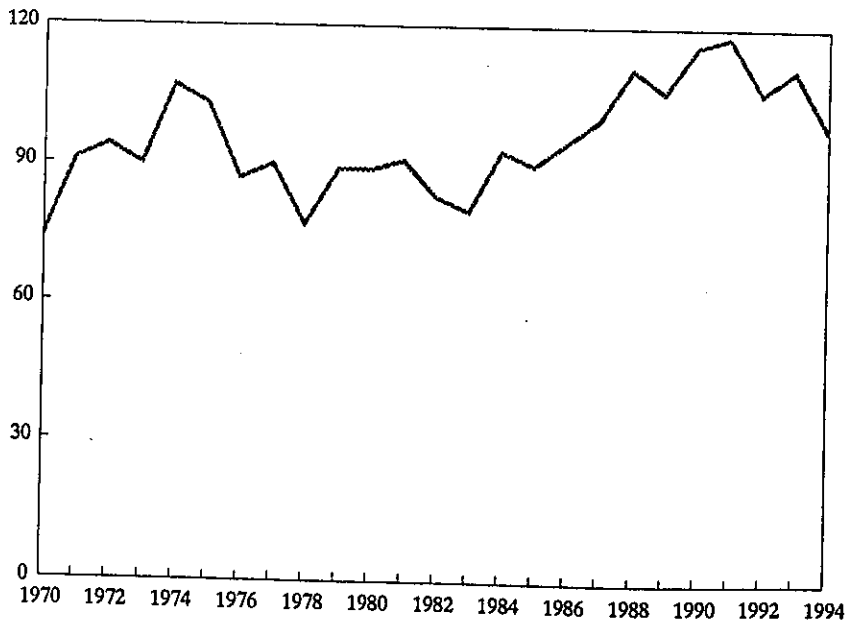


Figure 1c -- Index of domestic price of corn relative to rice, 1970-94

Index (1987=100)

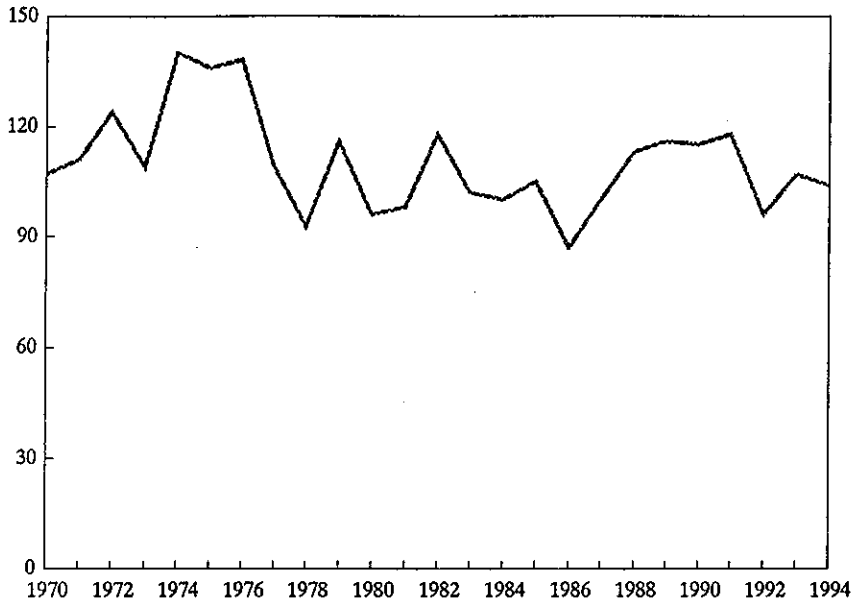


Figure 1d -- Index of domestic price of sugar relative to rice, 1970-94

Index (1987=100)

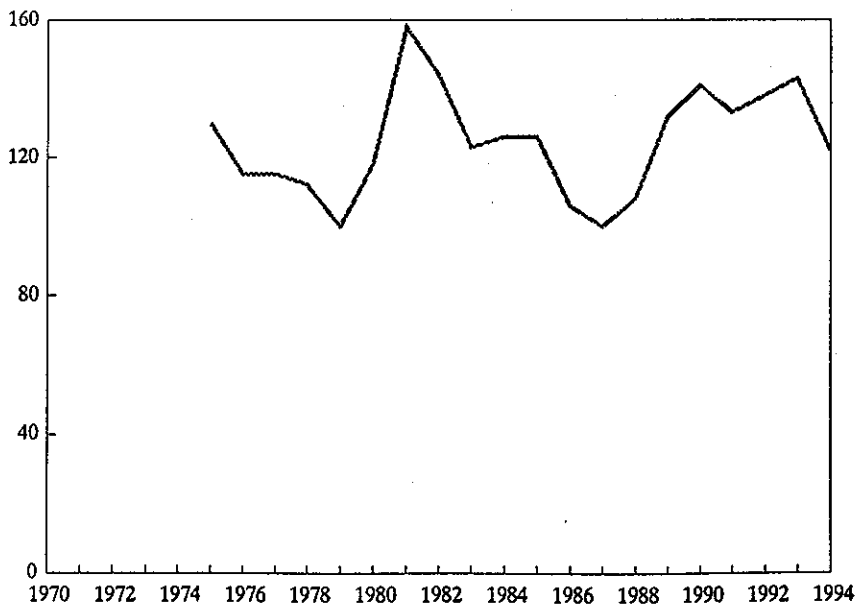


Figure 2a -- Index of domestic price of cassava deflated by CPI, 1970-94

Index (1987=100)

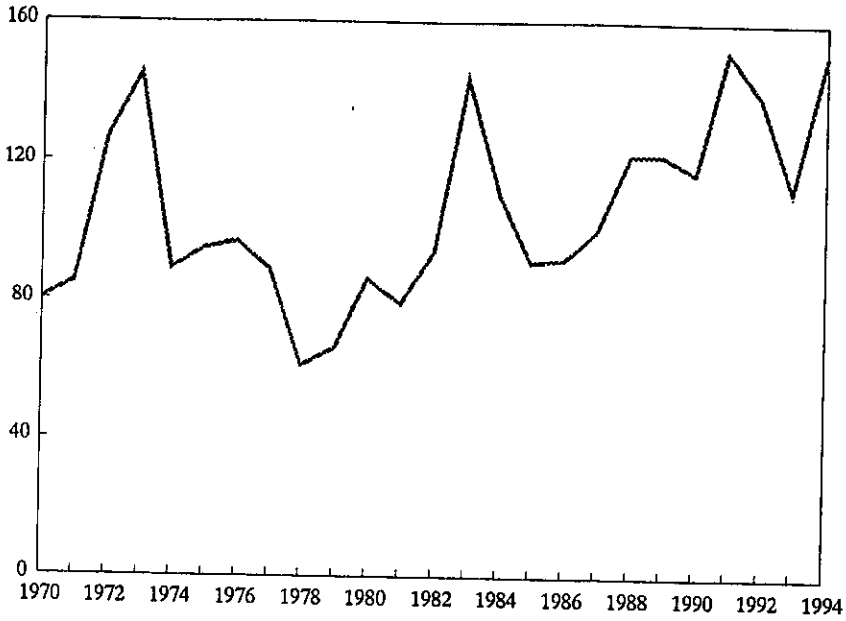


Figure 2b -- Index of domestic price of soybean deflated by CPI, 1970-94

Index (1987=100)

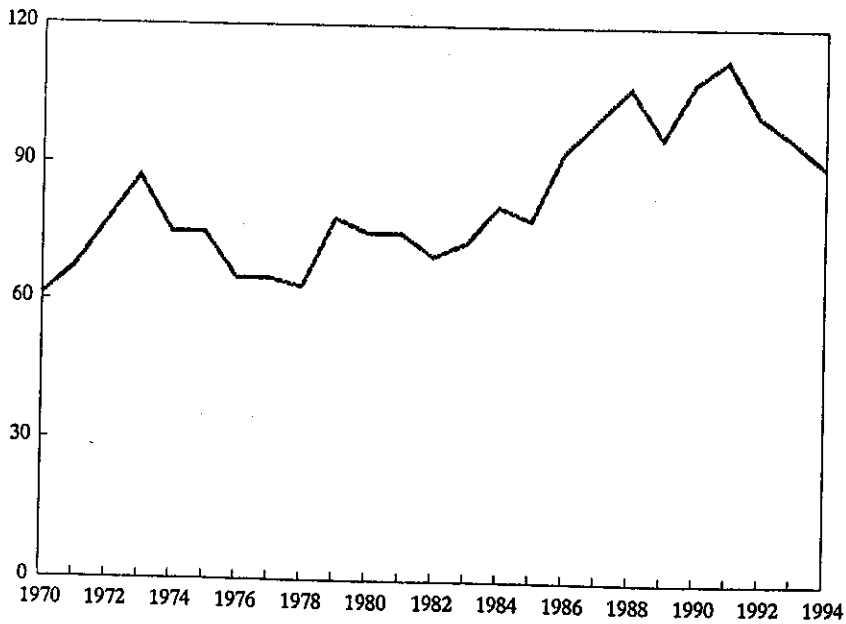


Figure 2c -- Index of domestic price of corn deflated by CPI, 1970-94

Index (1987=100)

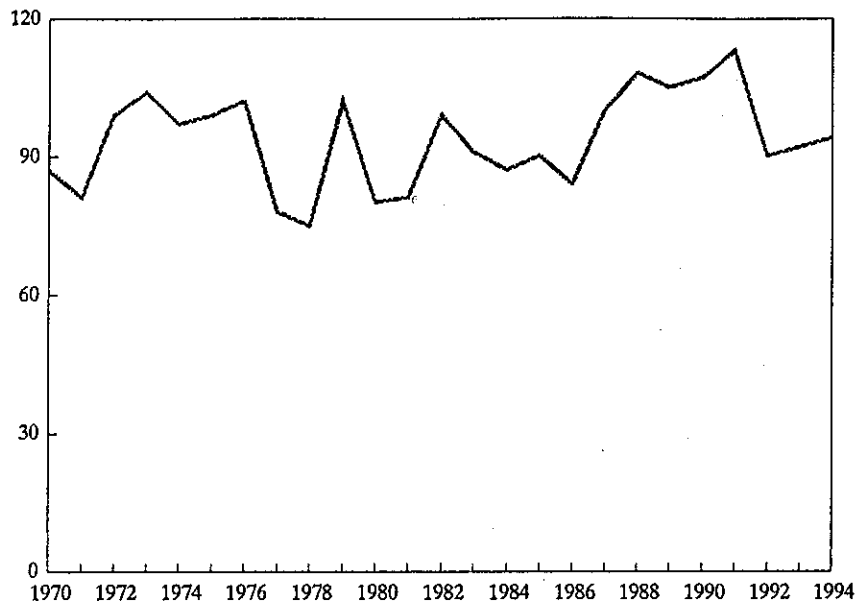


Figure 2d -- Index of domestic price of sugar deflated by CPI, 1970-94

Index (1987=100)

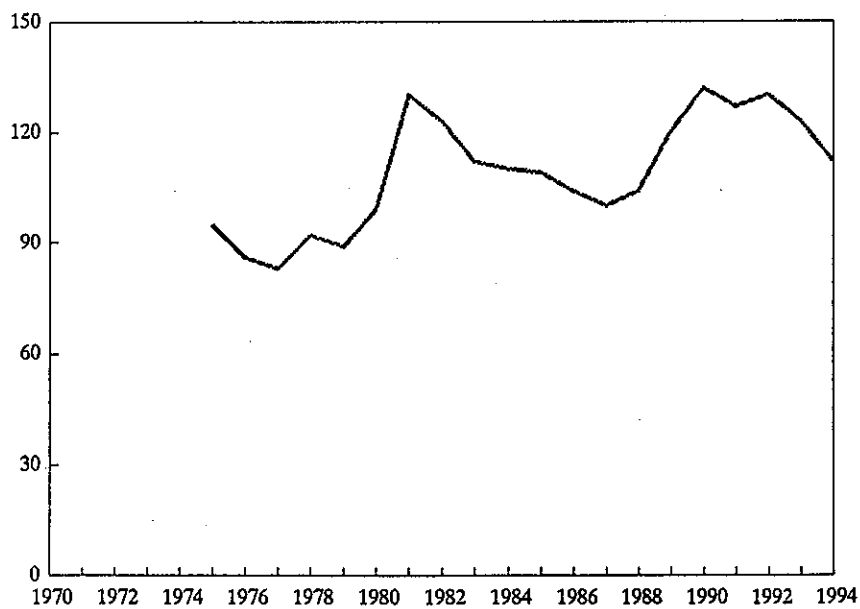
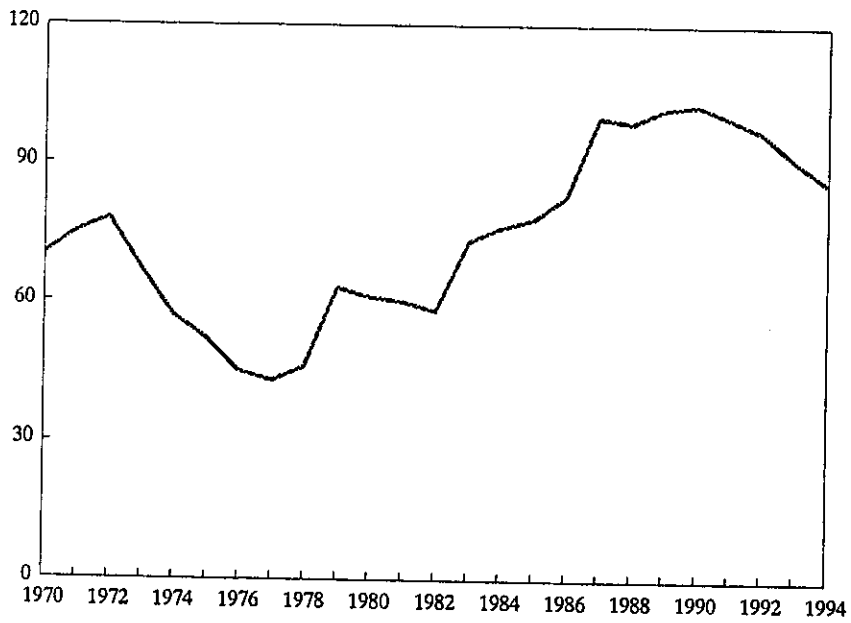


Figure 3 -- Real exchange rate index, 1970-94

Index (1987=100)



LIST OF TMD DISCUSSION PAPERS

- No. 1 - "Land, Water, and Agriculture in Egypt: The Economywide Impact of Policy Reform" by Sherman Robinson and Clemen Gehlhar (January 1995)
- No. 2 - "Price Competitiveness and Variability in Egyptian Cotton: Effects of Sectoral and Economywide Policies" by Romeo M. Bautista and Clemen Gehlhar (January 1995)
- No. 3 - "International Trade, Regional Integration and Food Security in the Middle East" by Dean A. DeRosa (January 1995)
- No. 4 - "The Green Revolution in a Macroeconomic Perspective: The Philippine Case" by Romeo M. Bautista (May 1995)
- No. 5 - "Macro and Micro Effects of Subsidy Cuts: A Short-Run CGE Analysis for Egypt" by Hans Löfgren (May 1995)
- No. 6 - "On the Production Economics of Cattle" by Yair Mundlak, He Huang and Edgardo Favaro (May 1995)
- No. 7 - "The Cost of Managing with Less: Cutting Water Subsidies and Supplies in Egypt's Agriculture" by Hans Löfgren (July 1995, Revised April 1996)
- No. 8 - "The Impact of the Mexican Crisis on Trade, Agriculture and Migration" by Sherman Robinson, Mary Burfisher and Karen Thierfelder (September 1995)
- No. 9 - "The Trade-Wage Debate in a Model with Nontraded Goods: Making Room for Labor Economists in Trade Theory" by Sherman Robinson and Karen Thierfelder (Revised March 1996)
- No. 10 - "Macroeconomic Adjustment and Agricultural Performance in Southern Africa: A Quantitative Overview" by Romeo M. Bautista (February 1996)
- No. 11 - "Tiger or Turtle? Exploring Alternative Futures for Egypt to 2020" by Hans Löfgren, Sherman Robinson and David Nygaard (August 1996)
- No. 12 - "Water and Land in South Africa: Economywide Impacts of Reform - A Case Study for the Olifants River" by Natasha Mukherjee (July 1996)

- No. 13 - "Agriculture and the New Industrial Revolution in Asia" by Romeo M. Bautista and Dean A. DeRosa (September 1996)
- No. 14 - "Income and Equity Effects of Crop Productivity Growth Under Alternative Foreign Trade Regimes: A CGE Analysis for the Philippines" by Romeo M. Bautista and Sherman Robinson (September 1996)
- No. 15 - "Southern Africa: Economic Structure, Trade, and Regional Integration" by Natasha Mukherjee and Sherman Robinson (October 1996)
- No. 16 - "The 1990's Global Grain Situation and its Impact on the Food Security of Selected Developing Countries" by Mark Friedberg and Marcelle Thomas (February 1997)
- No. 17 - "Rural Development in Morocco: Alternative Scenarios to the Year 2000" by Hans Löfgren, Rachid Doukkali, Hassan Serghini and Sherman Robinson (February 1997)
- No. 18 - "Evaluating the Effects of Domestic Policies and External Factors on the Price Competitiveness of Indonesian Crops: Cassava, Soybean, Corn, and Sugarcane" by Romeo M. Bautista, Nu Nu San, Dewa Swastika, Sjaiful Bachri, and Hermanto (June 1997)

Copies can be obtained by calling
Maria Cohan at 202-862-5627
or e-mail m.cohan@cgnet.com