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ECONOMIC INCENTIVES AND COMPARATIVE ADVANTAGE IN INDONESIAN FOOD CROP PRODUCTION

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CONTENTS

TABLES

ILLUSTRATIONS

FOREWORD

Recognizing that the green revolution has resulted in considerable success in production of rice and wheat in many Asian countries, which are now self-sufficient or surplus in these cereals, IFPRI believes that further growth in agriculture will rely on the ability of these countries to diversify their agricultural production, while improving productivity in cereals through management and human capital-intensive increases in yield levels.

Indonesia is an important example of a country where policy successes in rice production combined with other domestic and world developments in the economic environment of agriculture encouraged policymakers to consider agricultural diversification policies. Key developments leading to an increased interest in diversification in the mid-1980s included the successes of the rice production program, which eliminated imports of rice in several years; the likely increase in difficulty in maintaining rice production growth in the future, because of high levels of attainment in use of modern varieties, fertilizer, and irrigation, and the high costs associated with replicating these achievements in more marginal areas; the tightening of resources available for agriculture due to declining oil prices, government revenues, and budgetary expenditures; declining world commodity prices, which have put an additional squeeze on the agricultural sector by reducing the economic profitability of investment in agriculture; and the increase in competition for land among agricultural commodities and between agricultural and nonagricultural uses.

In this changing environment, the success of diversification efforts will depend on price and investment policies in relation to the comparative advantage of alternative crops in domestic and foreign markets. This study assesses trends in government policy and in growth in area, yield, and production, analyzes nominal and effective rates of protection, and examines comparative advantage as import substitutes or exports for major Indonesian food crops, including rice, corn, cassava, soybean, and sugar. The results are used to suggest policy directions for agricultural diversification in Indonesia.

This work, together with ongoing IFPRI research in Sub-Saharan Africa and Bangladesh, adds to the growing IFPRI knowledge on development of strategies to diversify agricultural and livestock products, based on comparative advantage. It draws on past work on the comparative advantage of different crops in Sri Lanka, Senegal, Burkina Faso, Mali, and Niger.

This research was carried out in collaboration with the Center for Agro Economic Research (now the Center for Agro Socioeconomic Research), Bogor, Indonesia. IFPRI is grateful for support received from the Asian Development Bank and the Australian Centre for International Agricultural Research during the course of this research.

Per Pinstrup-Andersen
Director General

1

SUMMARY

Production of rice, the primary food crop in Indonesia, increased rapidly at 5 percent a year during the period 1970-88, largely because of government pricing, research, and investment policies favorable to rice. The rice program has been so successful in increasing yields that some land could be diverted to other crops, thus increasing competition for scarce resources across commodities. As a result, the government is reexamining its economic incentive structure for several important crops. Should the government promote rice as an export crop? Should it continue to subsidize inputs? Should it provide incentives to production of other crops that may have comparative advantage?

To address these policy questions, this report examines trends in government policies and production of five major food crops—rice, corn, soybeans, sugar, and cassava; analyzes the effects of government input-output pricing policies on domestic production incentives for these food crops; and assesses their relative comparative advantage under three trade regimes: import substitution, interregional trade, and export promotion.

The measures used to assess economic incentives include direct, indirect, and total nominal and effective protection rates. The nominal protection rate is the amount by which a tradable output deviates from its border price, and the effective protection rate measures the net effects of policy interventions and market distortions on economic incentives. The domestic resource cost method, in which market prices are adjusted net of taxes and subsidies, is used to determine the social opportunity cost of domestic resources in earning or saving foreign exchange.

In addition to sharp increases in rice yields, growth in corn production has also been impressive, averaging 4.8 percent a year, largely due to the introduction of improved varieties and increased use of fertilizer on corn. The gap between farm yields and those on experiment stations is still wide, however, indicating that there is potential for improvement.

At 4.6 percent a year, increases in soybean production have been impressive since 1982, when government programs to encourage expansion of soybean area off Java were implemented. Although the area under intensification programs is large, these programs have not had a dramatic effect on soybean yields.

Growth in cassava production was weak—only 1.7 percent a year—as a result of a steady loss in cassava area in the face of government interventions favorable to rice. Sugar production, predominantly on Java but gradually shifting off Java, grew by 4.2 percent during the period. This growth can be attributed to area expansion in response to a government quota system for sugar area. The trend for sugar yields was actually downward.

Over the years, Indonesia has subsidized the major agricultural inputs, particularly irrigation, fertilizer, and pesticides, and supported and stabilized the domestic prices of food crops. The average implicit subsidy on the domestic price of fertilizer reached a peak of 55 percent in 1980-82, but declined steadily after the mid-1980s to about 35 percent. The cost of irrigation was also subsidized more than 75 percent. Before the government decided to encourage integrated pest management, pesticides were subsidized more than 60 percent. Pesticide subsidies have now been eliminated.

The degree of output price protection for food crops has varied over time. Through a combination of exchange rate and pricing policies, the government has kept domestic rice prices generally in line with trends in the world price of rice, while stabilizing domestic prices against short-run fluctuations in the world rice price. Domestic prices were permitted to follow the world price down during the mid- to late 1980s, with a nominal protection rate on rice averaging 16 percent in 1986-88. Corn has fluctuated between moderate protection and moderate taxation on output prices. Sugar and soybeans have generally received high protection. In 1986-88, the nominal protection rate for sugar averaged 70 percent, while the direct nominal protection rate for soybeans was 52 percent.

This study finds that Indonesian rice has comparative advantage as an import substitute but not as an export crop because of poor quality and a thin world rice market. Corn is the most efficient of the five crops as an import substitute, however. If corn productivity continues to improve with the adoption of pest-resistant, open-pollinated or hybrid varieties, it could become competitive as an export crop. Soybean production, despite rapid expansion, is not efficient because modern technology has not been adapted to Indonesia's agroclimatic conditions. Hence soybeans are of poor quality and gains in yield from application of inputs have been limited. Soybeans often displace more efficient crops like corn or cassava. Sugar is also economically inefficient. Without a quota system, it is likely that there would be a significant shift of land planted away from sugar.

In light of the amount of cassava quota that Indonesia has held for the European Community, the quantity produced has not been enough to meet export demand and domestic needs, indicating that Indonesia should invest in research and dissemination of technology to increase cassava production. However, export markets could disappear if trade policy reform in the European Community eliminates quotas.

Indonesia's highly successful policies to promote agricultural development became increasingly costly by the mid-1980s, particularly output price supports and input subsidies. For example, input subsidies caused fertilizer to be used beyond appropriate levels. Consequently, fertilizer subsidies are being phased out, pesticide subsidies have been eliminated altogether, and price supports for rice have been reduced in the face of declining world rice prices. Although price supports and subsidies are being phased out for major crops such as rice and corn, other crops continue to receive support, even though they are economically inefficient, in order to encourage crop diversity. A better strategy for diversification would be for producers' incentives to be crop-neutral and linked to border prices. The government should continue to invest in agricultural research to generate new technologies, expand extension efforts to deliver appropriate technologies to farmers, and improve infrastructure to ease movement of goods to market.

2

INTRODUCTION

Technological change, investment in irrigation, and favorable government policies have contributed to strong growth in domestic production of rice and achievement of near balance in domestic production and consumption of rice in Indonesia, as in many Asian countries. The increase in rice output per hectare has enabled rice area to be released for alternative crops and provided the potential for a realignment of policies to pursue a sustainable and more diversified growth path in agriculture. Agricultural diversification implies a broadening of traditional production patterns to permit a more flexible crop mix. Crops such as corn have a high income elasticity of demand for livestock feed, and crops such as soybeans have a higher value added than raw soybeans when they are processed for food or for livestock feed. As a result of the rapidly rising per capita income and fast pace of urbanization in Indonesia, the pattern of food demand is changing, shifting from a heavy reliance on rice to foods other than rice.

This evolving economic environment in Indonesia suggests the need for innovative policies to maintain productivity growth in rice, while adjusting policies to address the potentials and problems arising from the changing structure of agricultural production and demand. The changing policy perspective has been further stimulated by the tightening of resources available for agriculture due to declining oil prices and hence declining government revenues and budgetary expenditures. Declining world commodity prices have put an additional squeeze on agriculture by reducing the economic profitability of investment in agriculture.

Within this changing economic environment, what policies should the government adopt for rice and other major food crops? Should the government provide incentives or investments to promote rice as an export crop? What has been the impact of government policies on the international competitiveness of other commodities? Is there a continuing role for large input subsidies? Or should these subsidies be eliminated?

In order to address these and other policy questions, this report examines trends in the policies and production of five major food crops (rice, corn, soybeans, sugar, and cassava) in Indonesia during 1970-88; analyzes the effects of government input-output pricing policies on domestic production incentives for these food crops; assesses their relative comparative advantage under the three trade regimes of import substitution, interregional trade, and export promotion; and discusses the policy implications arising from the analysis.

3

PRODUCTION AND POLICY TRENDS FOR FOOD CROPS

This chapter first presents an overview of the contribution of agriculture and the food-crop sector to the Indonesian economy. Then it examines trends in area, yield, and production and reviews government policies affecting the production of rice, corn, soybeans, cassava, and sugar.

Agriculture in the Indonesian Economy

Agriculture is the largest sector in the Indonesian economy. More than half the labor force (Table 1) and one-fourth of the gross domestic product (GDP) are generated in agriculture. Two data series of GDP are available for Indonesia, which give somewhat different sectoral shares of GDP. To look at trends going back to 1971, it is necessary to use the old series, based on constant 1973 prices in rupiah[1] (Rp) (Table 2). This series and the sectoral employment series in Table 1 show that the relative size of the agriculture sector in the economy declined between 1971 and 1980, but agriculture remained the largest sector. The food crop sector also declined in relative size during this period, accounting for 26 percent of total GDP in 1970 and 18 percent of total GDP in 1980.

Beginning in 1984, Indonesia's Central Bureau of Statistics (CBS) released a new GDP series using 1983 as the base year in order to capture changes in prices, especially the oil price and the price of a basket of goods. The total and sectoral shares of GDP for 1978-88 are presented in Tables 3 and 4. According to the new GDP series, the overall economy grew 5.5 percent annually during 1978-88, the agriculture sector grew at almost 4.0 percent per year, and the food crop subsector grew at a rate of 4.3 percent per year. Agriculture's contribution to the GDP declined during this period from 24.7 percent in 1978 to 21.2 percent in 1988. The share of the food crop subsector decreased from 14.4 percent in 1978 to 13 percent in 1988. The sustained growth of GDP at more than 5 percent per year can be attributed to continued strong growth in agriculture and remarkably rapid growth in the manufacturing subsector. This subsector grew by more than 10 percent per year from 1978 to 1988, nearly doubling its share of GDP (Tables 3 and 4).

Rice Production and Policy Trends, 1970-88

Trends in area, yield, and production of rice on Java, off Java, and for Indonesia as a whole are summarized in Figure 1 and Table 5. Rice production grew at a rate of 4.8 percent per year over the full period, with about two-thirds of growth accounted for by yield growth and one-third by area growth. Throughout the period 1970-88, Java

[1]US$1.00 = Rp 1,463 in 1986, on average.

Table 1—Total employment by economic sector, 1971 and 1980

Economic Sector	Population Census, 1971	Percent	Population Census, 1980	Percent	Increment, 1971-80	Percent
	(1,000)		(1,000)		(1,000)	
Agriculture	25,169	66.4	28,040	54.8	2,871	21.6
Industry	3,350	8.8	6,388	12.5	3,038	22.9
Mining and quarrying	80	0.2	369	0.7	289	2.2
Processing industry	2,591	6.8	4,631	9.0	1,770	13.3
Electricity, gas, and water	35	0.1	85	0.2	59	0.4
Construction	664	1.7	1,573	3.1	929	7.0
Services	8,966	23.6	16,051	31.3	7,084	53.4
Transportation and communication	902	2.4	1,468	2.9	566	4.3
Trade	4,086	10.8	6,611	12.9	2,525	19.0
Financial institutions and banking	96	0.3	232	0.4	136	1.0
Miscellaneous services	3,882	10.0	7,739	15.1	3,857	29.1
Others	438	1.2	713	1.4	275	2.1
Total	37,923	100.0	51,192	100.0	13,268	100.0

Source: CBS (Central Bureau of Statistics), *Population Census* (Jakarta: CBS, 1971); Indonesia, CBS (Central Bureau of Statistics), *Population Census* (Jakarta: CBS, 1980).

accounted for over 50 percent of area harvested and about 60 percent of production. Yields on Java are on average about 40 percent higher than off Java. However, production growth has been broad-based, with regions off Java showing strong growth, in addition to the continued growth in traditionally productive rice areas on Java.

The most impressive growth in rice production was during the period 1976-82, with production growth of 6.8 percent per year and yield growth of 5.2 percent annually. This

Table 2—Gross domestic product (GDP) by economic sector, 1971 and 1980, constant 1973 prices

Sector	1971 GDP	Percent	1980 GDP	Percent
	(Rp billion)		(Rp billion)	
Agriculture	2,441	44.0	3,424.9	30.7
Food crops	1,436	...	2,039.7	...
Other crops and livestock	302	...	549.7	...
Estate crops	154	...	315.9	...
Forestry	160	...	337.9	...
Fishery	131	...	181.7	...
Mining and quarrying	551	9.9	1,034.6	9.3
Processing industry	490	8.8	1,704.0	15.3
Electricity, gas, and water	25	0.5	77.9	0.7
Construction	171	3.1	639.3	5.7
Commerce	924	16.7	1,851.9	16.6
Communication	210	3.8	609.4	5.5
Banking and finance	64	1.2	207.8	1.9
Housing	93	1.7	335.8	3.0
Government	326	5.9	971.7	8.7
Other services	250	4.5	311.3	2.8
Total	5,545	...	11,169.2	...

Source: CAER (Center for Agro-socioeconomic Research, *Menbangun Pertanian yang Tangguh*: CAER, 1984.

Table 3—Gross domestic product (GDP) by industrial origin, at constant 1983 market prices, 1978-88

Sector	1978	1983	1985	1986	1987	1988
			(Rp billion)			
Agriculture	14,381.2	17,696.2	19,300.0	19,799.1	20,223.5	21,168.3
Farm food crops	8,399.8	11,057.4	11,985.6	12,286.6	12,415.4	12,974.0
Farm nonfood crops	1,442.5	2,059.5	2,575.7	2,580.5	2,693.1	2,835.0
Estate crops	437.6	610.7	510.8	561.8	564.5	577.7
Livestock products	1,247.6	1,754.3	2,036.5	2,063.7	2,110.8	2,211.7
Forestry	1,871.2	994.2	850.7	888.7	967.9	1,013.0
Fishery	982.5	1,220.1	1,340.7	1,417.8	1,471.8	1,556.9
Mining and quarrying	16,363.8	13,967.9	15,480.4	16,308.6	16,365.5	15,892.8
Oil and natural gas	15,923.0	13,346.2	14,512.6	15,237.0	15,219.3	14,691.6
Other	440.8	621.7	967.8	1,071.6	1,146.2	1,201.2
Industry	5,107.5	8,211.3	13,430.5	14,678.1	16,235.3	18,182.3
Refinery oil	147.8	129.4	766.6	927.2	937.7	981.2
Liquefied natural gas	725.1	1,871.2	2,918.5	2,922.8	3,233.2	3,594.5
Manufacturing	4,234.6	6,210.7	9,745.4	10,828.1	12,064.4	13,606.6
Electricity, gas, and water	243.7	524.3	360.9	429.8	494.6	548.9
Construction	2,904.1	4,597.2	4,508.0	4,609.0	4,802.9	5,259.1
Trade	8,231.6	12,009.4	12,398.6	13,398.5	14,356.2	15,656.9
Retail and wholesale trade	6,887.3	10,411.7	10,412.0	11,238.1	12,004.9	13,035.4
Hotels and restaurants	1,344.3	1,597.7	1,986.6	2,160.4	2,351.3	2,621.5
Transport and communications	2,505.8	3,978.0	4,487.0	4,668.4	4,938.5	5,211.5
Transport	2,366.3	3,693.7	4,031.8	4,178.1	4,393.7	4,626.0
Communications	139.5	284.3	455.2	490.3	544.8	585.5
Banking and financial institutions	1,121.5	2,039.2	3,020.3	3,483.1	3,659.3	3,752.2
Ownership of dwellings	1,461.7	1,961.8	2,461.0	2,545.1	2,653.9	2,762.2
Public administration and defense	3,385.2	5,711.5	6,455.1	6,862.1	7,366.1	7,932.1
Other services	2,483.8	3,000.8	3,180.1	3,298.7	3,422.1	3,569.7
Total GDP	58,189.9	73,697.6	85,081.9	90,080.5	94,517.8	99,936.0
Oil GDP	16,795.9	15,346.6	18,197.7	19,087.0	19,390.2	19,267.3
Nonoil GDP	41,394.0	58,351.0	66,884.2	70,993.5	75,127.6	80,668.7

Source: Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

rapid growth was in large part the result of rapid adoption of high-yielding rice varieties, rapid growth in fertilizer use, and a substantial expansion of rice area under irrigation. During 1982-88 world and domestic rice prices declined rapidly, and the rate of dissemination of modern varieties was significantly reduced. The rate of growth in fertilizer use and investment in irrigation declined from the already high levels achieved. Production growth dropped substantially to 3.4 percent per year, and yield growth to 1.7 percent. Government policies played a prominent role in both the rapid growth of rice

Table 4—Distribution of gross domestic product (GDP) by industrial origin, at constant 1983 market prices, 1978-88

Sector	1978	1983	1985	1986	1987	1988
			(percent)			
Agriculture	24.7	24.0	22.6	21.9	21.4	21.2
Farm food crops	14.4	15.0	14.1	13.6	13.1	12.9
Farm nonfood crops	2.5	2.8	3.0	2.9	2.8	2.8
Estate crops	0.8	0.8	0.6	0.6	0.6	0.6
Livestock products	2.1	2.4	2.4	2.3	2.2	2.2
Forestry	3.2	1.3	1.0	1.0	1.0	1.0
Fishery	1.7	1.7	1.6	1.6	1.6	1.6
Mining and quarrying	28.1	18.6	18.2	18.1	17.3	15.9
Oil and natural gas	27.4	18.1	17.1	16.9	16.1	14.7
Other	0.7	0.5	1.1	1.2	1.2	1.2
Industry	8.8	11.1	15.8	16.3	17.2	18.2
Refinery oil	0.3	0.2	0.9	1.0	1.0	1.0
Liquefied natural gas	1.2	2.5	3.4	3.2	3.4	3.6
Manufacturing	7.3	8.4	11.4	12.0	12.8	13.6
Electricity, gas, and water	0.4	0.7	0.4	0.5	0.5	0.6
Construction	5.0	6.2	5.3	5.1	5.1	5.3
Trade	14.2	16.3	14.6	14.9	15.2	16.7
Retail and wholesale trade	11.8	14.1	12.2	12.5	12.7	13.0
Hotels and restaurants	2.4	2.2	2.4	2.4	2.5	3.7
Transport and communications	4.3	5.4	5.3	5.1	5.2	5.2
Transport	4.0	5.0	4.7	4.6	4.6	4.6
Communications	0.3	0.4	0.6	0.5	0.6	0.6
Banking	1.9	2.8	3.6	3.9	3.9	3.8
Ownership of dwellings	2.5	2.7	2.9	2.8	2.8	2.8
Public administration and defense	5.8	7.7	7.6	7.6	7.8	7.9
Other services	4.3	4.5	3.7	3.7	3.6	3.6
Total GDP	100.0	100.0	100.0	100.0	100.0	100.0
Oil GDP	28.9	20.8	21.4	21.2	20.5	19.3
Nonoil GDP	71.1	79.2	78.6	78.8	79.5	80.7

Source: Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

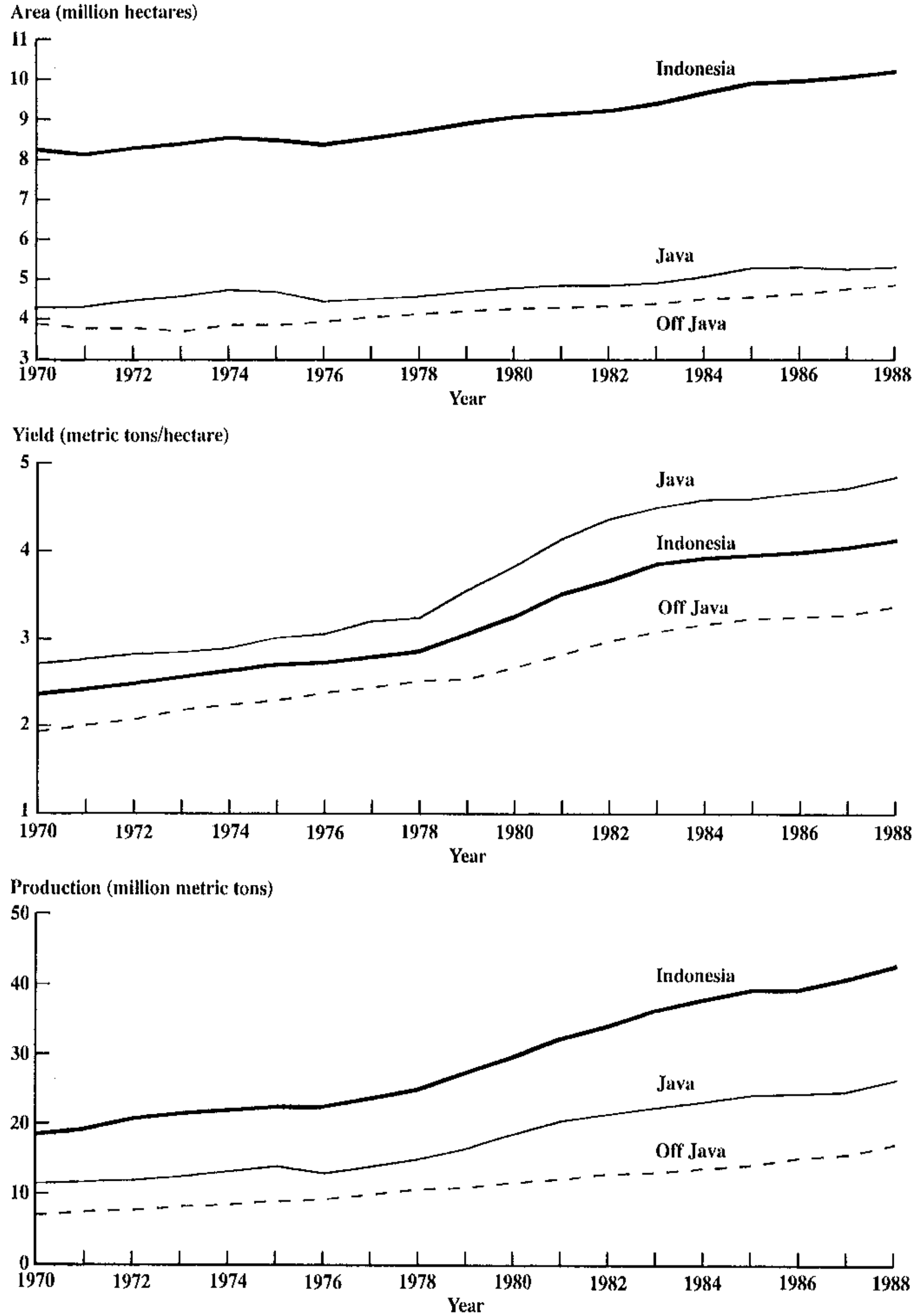
Note: Numbers may not add to totals due to rounding.

production and the relative slowdown in growth after 1982 in response to the changing economic environment.

Government Rice Production Policy

The rice production policies of the government of Indonesia that contributed the most to the rapid growth in production are intervention in rice marketing and rice price support;

Figure 1—Rice area, yield, and production, 1970-88



Source: Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

Table 5—Annual growth rates in area, yield, and production of rice, based on three-year moving averages, 1970-88

Period	Area			Yield			Production		
	Java	Off Java	Indonesia	Java	Off Java	Indonesia	Java	Off Java	Indonesia
					(percent)				
1970-88	1.16	1.51	1.32	3.76	3.19	3.51	4.92	4.70	4.84
1970-76	0.99	0.42	0.73	2.02	3.26	2.55	3.01	3.67	3.28
1976-82	1.50	1.60	1.55	6.27	3.59	5.20	7.76	5.20	6.75
1982-88	1.53	2.05	1.78	1.60	1.89	1.67	3.13	3.94	3.44

Source: Indonesia, CBS (Central Bureau of Statistics, *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

fertilizer subsidies; research, development, and dissemination of modern varieties; rice intensification programs (BIMAS, INMAS, and INSUS), which promote a technology package and provide credit and fertilizer subsidies and intensive extension programs at the village level; and investment in irrigation development.

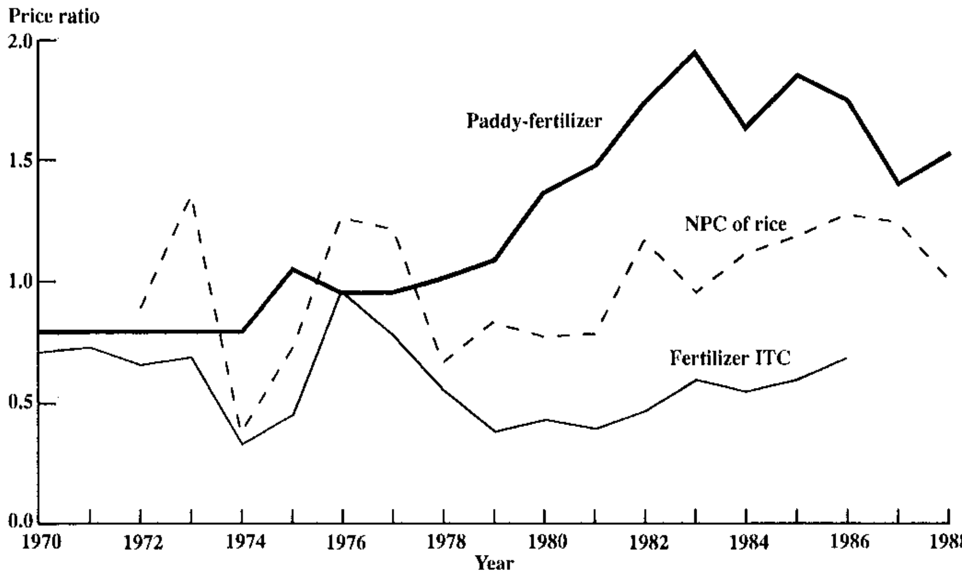
Output and Input Price Policy

The impact of government price policy on the structure of incentives for rice production will be described in detail in Chapters 6 and 7 but is briefly summarized here. The government has encouraged rice production by maintaining stable and favorable rice prices, compared with highly subsidized fertilizer prices. The main instruments of rice price policy have been a farm-level floor price, a ceiling price for consumers, and control of international trade in rice. The floor price of rice at the farm level is set annually, taking into account a number of factors, including costs of rice production, farm income, potential inflationary effects, and the costs to the government of supporting the floor price. The floor price is implemented by the grain stabilization agency, Badan Urusan Logistic (BULOG), which procures rice in major rice-producing regions.

The ceiling price has been maintained by holding substantial rice stocks and releasing rice on urban markets from stocks, domestic procurement, and imports. As shown by trends in the nominal protection coefficient (which equals 1 when the domestic price is equal to the border price of rice), the government has in general kept domestic prices in line with world prices, while counteracting short-term fluctuations in the world rice price (Figure 2). Thus the only large departure from world prices occurred when the government protected consumers from the extraordinarily high world prices in 1974. The ceiling price and the actual wholesale price of rice have been much less variable than world market prices, indicating that BULOG has generally been successful in insulating domestic prices from short-term fluctuations in world prices. From 1972 to 1989, the coefficient of variation in the world rice price was 0.53, compared with a coefficient of variation in the domestic wholesale price of rice of 0.16 (Sudaryanto et al. 1992).

In conjunction with rice price support and stabilization policies, the price of fertilizer has been highly subsidized as an incentive to increased production. The level of subsidy relative to world prices of fertilizer is described in more detail in Chapter 6. However, Figure 2 summarizes the implicit tariff coefficient and the paddy-urea price ratio for 1970-88. The paddy-fertilizer price ratio increased sharply from the early 1970s to the early 1980s, reaching a peak of 1.92 in 1983. Even in the early 1970s the paddy-fertilizer price ratio in Indonesia was about double the ratios in the Philippines and Thailand, and in the

Figure 2—Nominal protection coefficient (NPC) of rice, implicit tariff coefficient (ITC) of fertilizer (urea), and paddy-fertilizer price ratio, 1970-88



Source: Domestic price data based on Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); world prices on World Bank, *Commodity Prices and Price Projections* (Washington, D.C.: World Bank, various years).

early 1980s it was triple. The favorable paddy-fertilizer price ratio thus has provided a strong incentive for fertilizer use in Indonesia. Since 1984, the level of fertilizer subsidy (as shown by the increase in the implicit tariff coefficient) and the paddy-urea price ratio have declined as the result of government decisions to reduce both the budgetary and the economic cost of the fertilizer subsidy, because distorted prices had led to misallocation of resources.

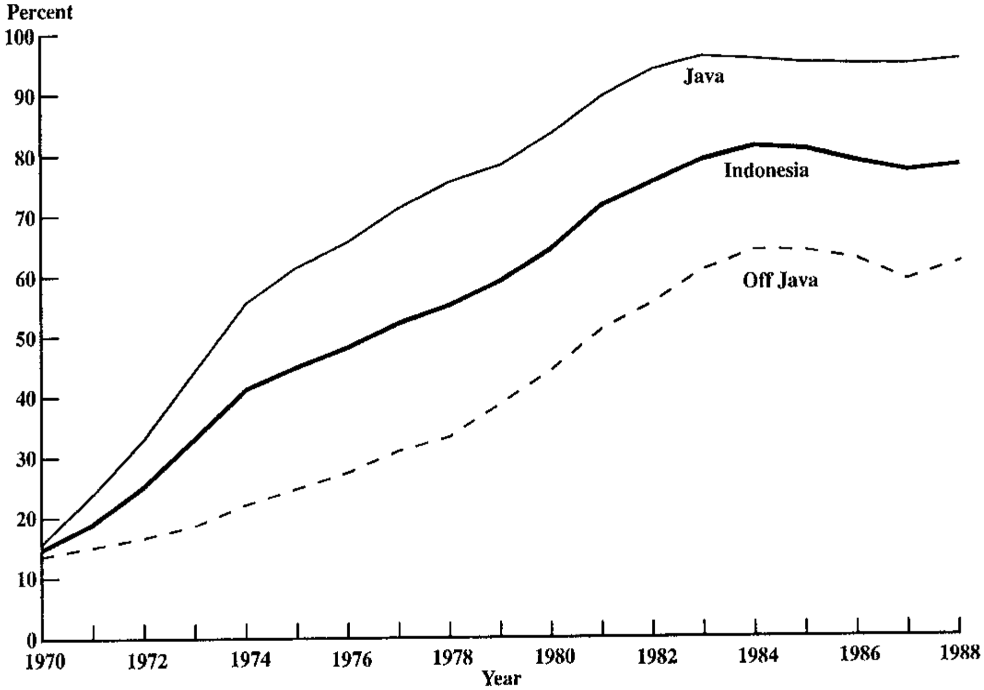
Adoption of Modern Rice Varieties

Government breeding programs and extension services (primarily through the intensification programs) assisted in the rapid spread of modern, high-yielding, pest-resistant varieties of rice in the 1970s and 1980s. The growth in the percentage of rice area under modern varieties is shown in Figure 3. The growth curve for Indonesia follows the usual pattern for diffusion of new technology, with a period of rapid growth followed by a slowing period as a high level of adoption was achieved. Modern varieties were used on about four-fifths of rice area for Indonesia as a whole in 1986-88, up from just one-fifth in 1970-72. During 1986-88, the area sown with modern varieties on Java was nearly 95 percent of total rice area, and off Java,62 percent.

Rice Intensification Programs

The primary vehicles for promoting rice production through government extension programs for rice are the intensification programs, which provide a package of modern technologies along with credit and fertilizer subsidies and intensive extension contacts (see Sudaryanto et al. 1992 for a discussion of the main elements of the various

Figure 3—Percentage of rice area under modern varieties, 1970-88



Source: Data provided by Indonesia, Ministry of Agriculture, Directorate General of Food Crops.

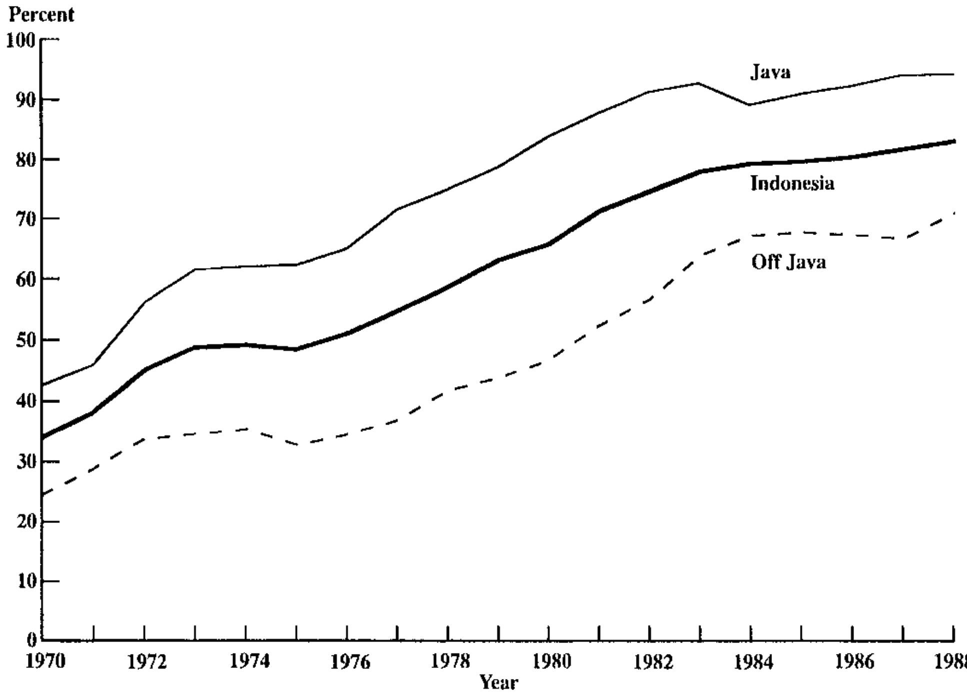
intensification programs). The growth in the percentage of rice area covered by BIMAS, INMAS, or INSUS intensification programs is shown in Figure 4. The percentage of rice area covered by these programs also increased rapidly before leveling off at high levels of program effort. Approximately 90 percent of rice area on Java and 70 percent off Java were under intensification programs by the mid-1980s.

Irrigation Investment

Investment in the expansion and improvement of irrigation has been the other major contributor to growth in rice production. In addition to investment in new irrigation, the government has made substantial investments in the rehabilitation of existing systems and in development of tertiary distribution systems within existing systems (Rosegrant et al. 1987b). Trends in public irrigation development, which account for virtually all the growth in irrigated area over the past two decades, are shown in Figure 5.

As can be seen, the irrigation development program grew relatively rapidly through the early 1980s, but the completion of new service area slowed significantly thereafter. This slowdown was the result of budgetary cutbacks due to declining government revenues, declining world rice prices, and the increasing costs of investment in new irrigation (Rosegrant and Pasandaran 1992). The growth in irrigated service area was higher off Java, mainly because there is little exploitable area for irrigation development remaining on Java. Despite its lower growth rates in irrigated area, Java still accounts for more than 60 percent of total public works irrigated service area.

Figure 4—Percentage of rice area under intensification programs, 1970-88



Source: Indonesia, CBS (Central Bureau of Statistics) and Mass Guidance Board, *Data Compilation on Harvested Area, Yield, and Rice Production (kompilasi data luas panen, hasil per hektar dan produksi padi)* (Jakarta: CBS, various years).

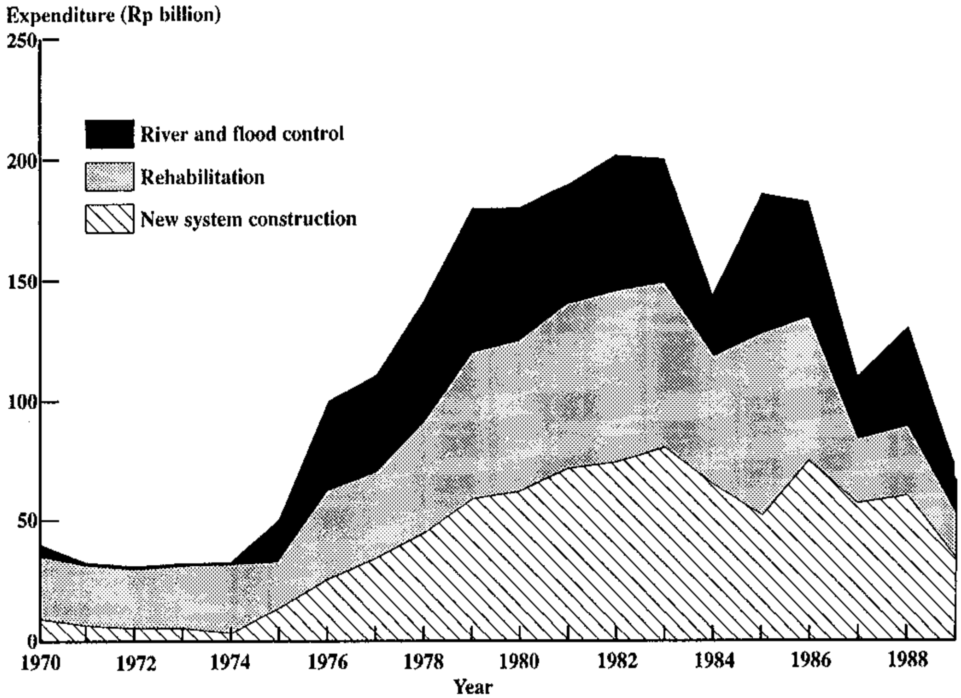
Corn Production and Policy Trends, 1970-88

Figure 6 summarizes the area, yield, and production of corn on Java, off Java, and for Indonesia as a whole. Corn production grew at a rate of 4.8 percent per year during the period 1970-88. The rate of growth was highest in 1976-82, at 6 percent per year, but slowed slightly during the last subperiod (Table 6). Nearly 90 percent of this growth can be attributed to productivity gains, with yield growing at an annual rate of 4.2 percent over the full period. Average yields increased from 1.0 metric ton per hectare in 1970-73 to 1.9 tons per hectare in 1986-88.[2] Area harvested of corn was virtually stagnant on Java, but grew at a rate of 2.1 percent a year off Java.

Although data on adoption of modern varieties and input use on corn are not as extensive as for rice, available evidence indicates that the rapid yield growth in corn has been mainly due to the rapid adoption of fertilizer-responsive varieties, which induced growth in fertilizer use and yields. Evidence from field surveys indicates that the use of chemical fertilizer on corn tripled during the 1970s (Timmer 1987). Based on data from Indonesia's Central Bureau of Statistics, national average use of fertilizer on corn increased from 22 kilograms per hectare in 1969-72 to about 110 kilograms per hectare in 1986-88 (Indonesia, CBS various years h).

[2]All tons in this report are metric tons.

Figure 5—Irrigation development expenditures, 1969/70-1988/89, at 1975/76 prices



Source: M. W. Rosegrant and E. Pasandaran, "Determinants of Public Investment: Irrigation in Indonesia," International Food Policy Research Institute, Washington, D.C., 1992 (mimeo).

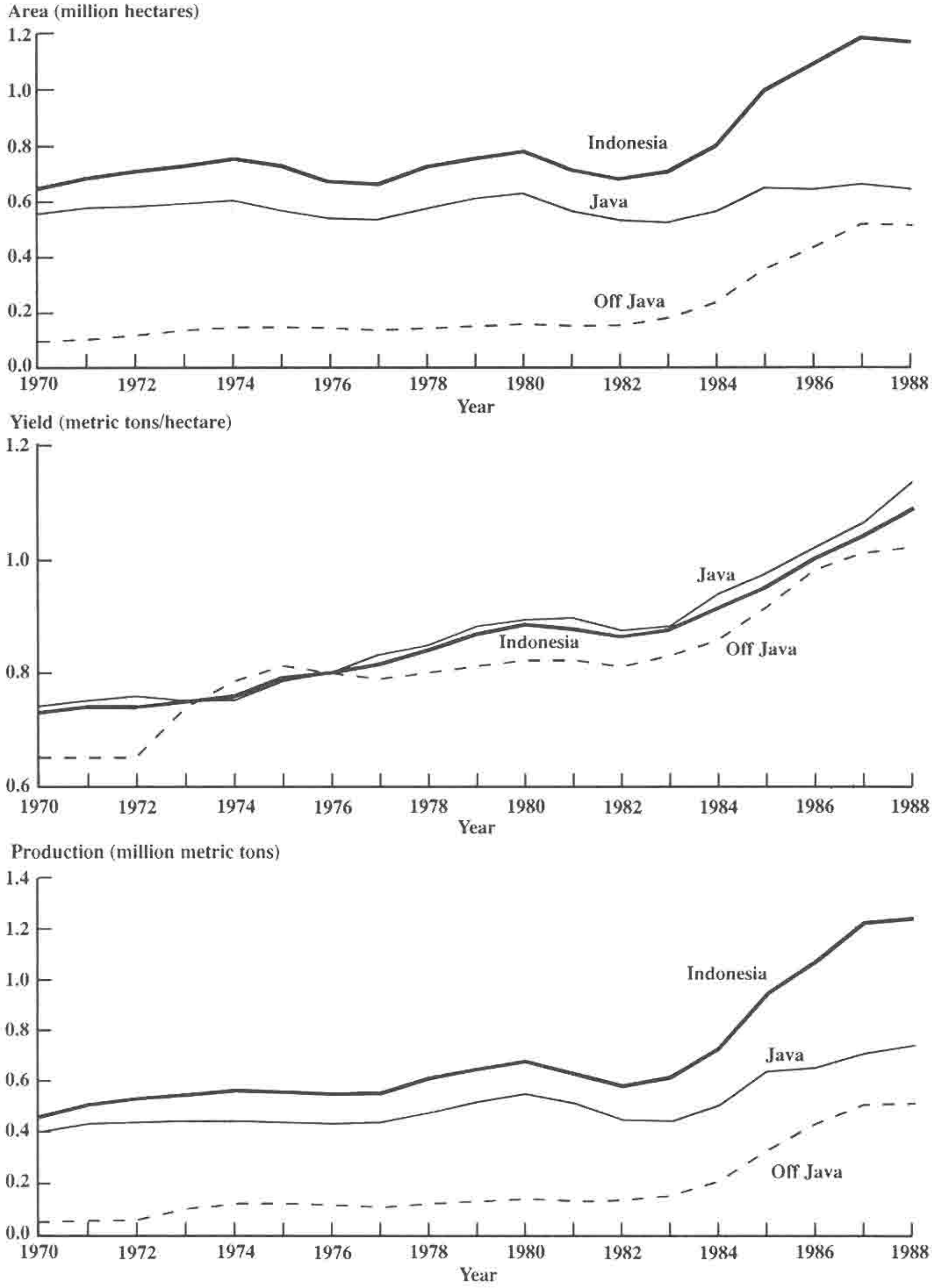
Price policy has not played a major role in the growth of corn production in Indonesia. As will be shown in Chapter 6, government policy has generally resulted in slightly negative price protection for corn at the wholesale level. Government floor prices for corn, instituted in 1978, have not affected production incentives, because the market prices of corn have been consistently above the floor price. Government purchases of corn have generally amounted to less than 1 percent of corn production (Sudaryanto et al. 1992).

Increase in fertilizer use has, however, been encouraged by subsidized fertilizer prices, which are the same as for rice and other crops. In addition, intensification programs promoting the adoption of improved varieties and fertilizer use have expanded rapidly since 1975 (Figure 7). The share of corn area under intensification programs has grown at an annual rate of 5 percent nationwide since 1977, reaching levels of 96 percent on Java and 64 percent off Java.

Soybean Production and Policy Trends, 1970-88

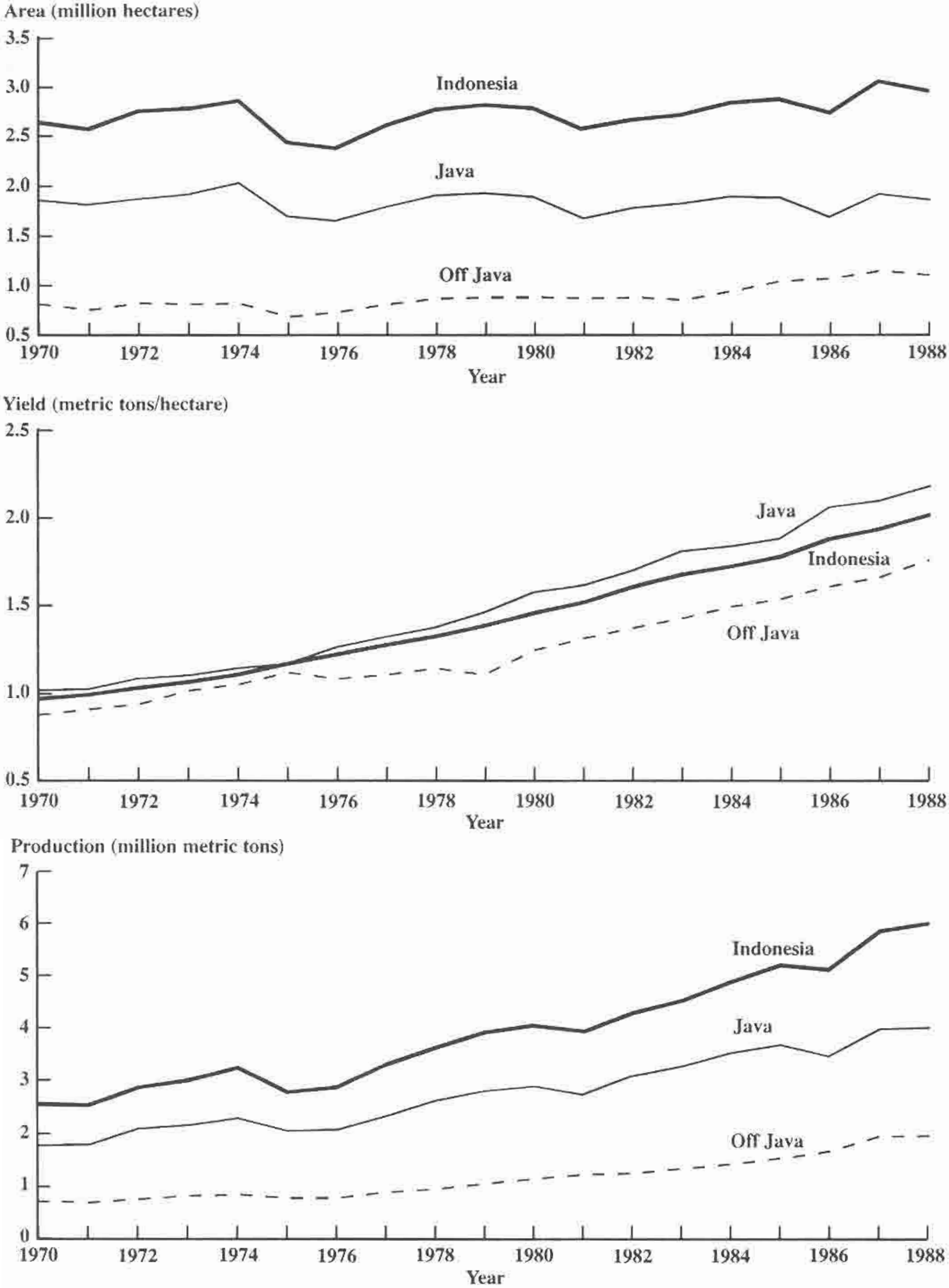
Trends in area, yield, and production of soybeans are shown in Figure 8. Growth in soybean production averaged 4.6 percent per year over the period as a whole, but virtually all of this growth occurred after 1982, as a direct result of government price and production policy initiatives. After 1982, area growth jumped from less than 1 percent per year to more than 10 percent per year, while yield growth increased from 1.3 to 4.1 percent per year (Table 7). Area growth thus accounted for more than two-thirds of production growth in the period 1982-88.

Figure 8—Soybean area, yield, and production, 1970-88



Source: Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

Figure 6—Corn area, yield, and production, 1970-88



Source: Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

Table 6—Annual growth rates in area, yield, and production of corn, based on three-year moving averages, 1970-88

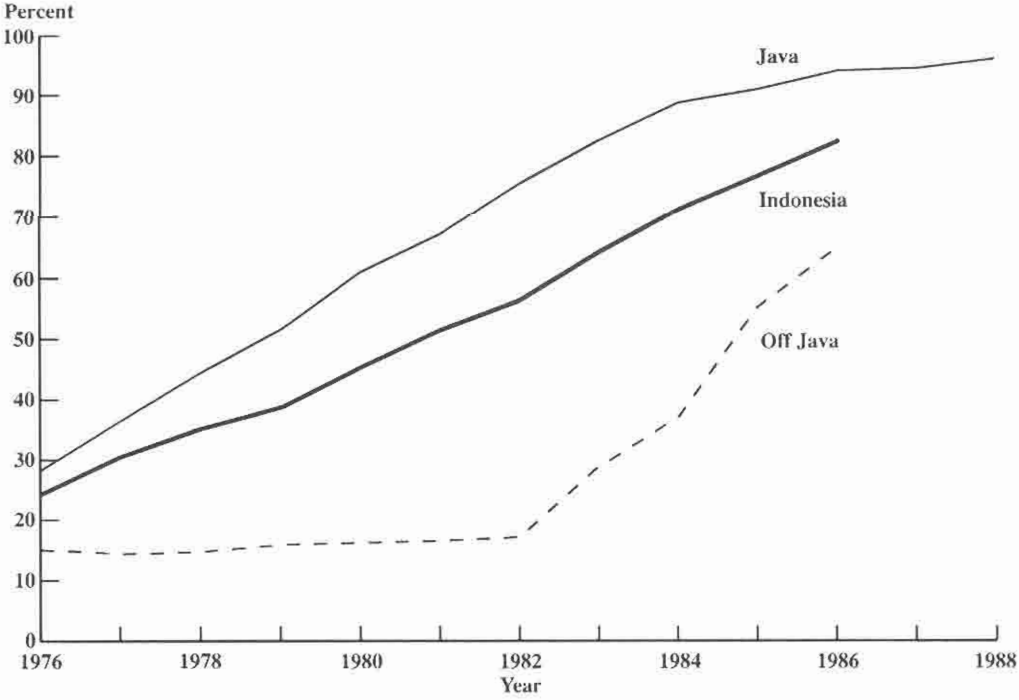
Period	Area			Yield			Production		
	Java	Off Java	Indonesia	Java	Off Java	Indonesia	Java	Off Java	Indonesia
	(percent)								
1970-88	-0.11	2.11	0.63	4.49	3.72	4.19	4.38	5.83	4.81
1970-76	-1.53	-1.86	-1.63	3.74	4.38	3.92	2.21	2.52	2.29
1976-82	0.45	3.36	1.39	5.13	3.73	4.61	5.58	7.09	6.01
1982-88	0.50	4.46	1.92	3.86	4.18	3.76	4.36	8.64	5.68

Source: Indonesia, CBS (Central Bureau of Statistics, *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

Although yields have improved, the yield gap between the farm and the research station is still very wide and the intensity of soybean cultivation relatively low, as reflected by the low rates of fertilizer application and the low level of use of improved varieties even in the major soybean region of East Java. Field data indicate only about 20 percent adoption of improved varieties in East Java (Rosegrant et al. 1987b).

The rapid expansion of soybean area coincided with government imposition of high price supports for soybean production combined with government targeting of substantial new areas of soybean production through establishment of intensification programs. The

Figure 7—Percentage of corn area under intensification programs, 1976-88



Source: Indonesia, CBS (Central Bureau of Statistics) and Mass Guidance Board, *Compilation of Input-Output Data of Palawija Crops* (Jakarta: CBS, various years).

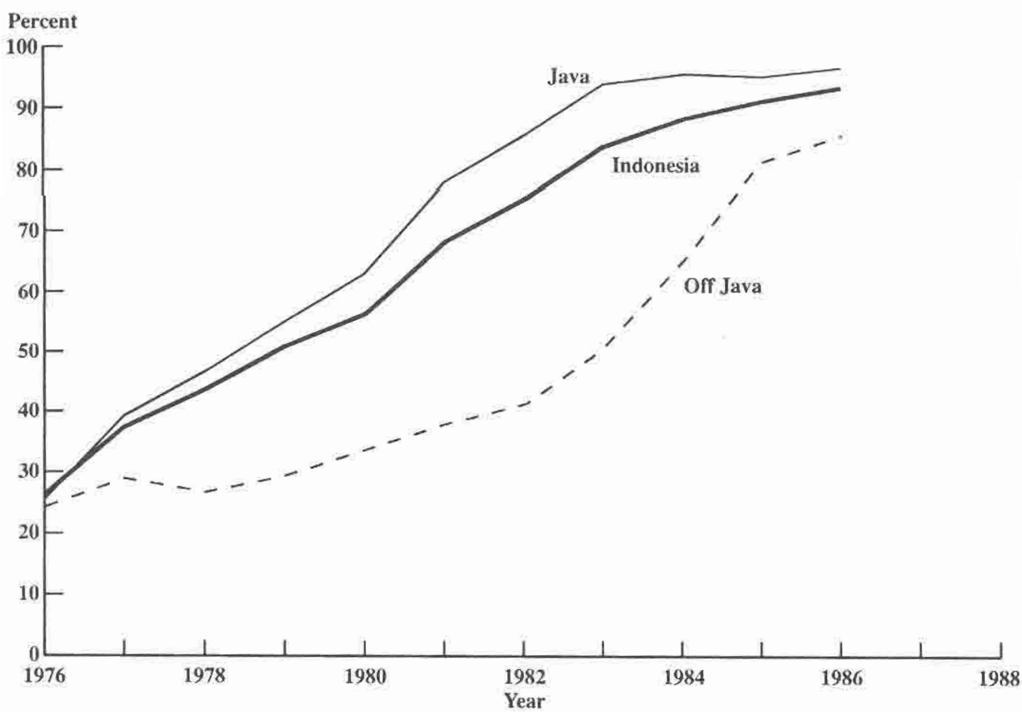
Table 7—Annual growth rates in area, yield, and production of soybeans, based on three-year moving averages, 1970-88

Period	Area			Yield			Production		
	Java	Off Java	Indonesia	Java	Off Java	Indonesia	Java	Off Java	Indonesia
	(percent)								
1970-88	0.52	8.17	2.60	2.11	2.12	2.01	2.63	10.29	4.60
1970-76	−0.34	8.25	1.18	1.02	4.22	1.51	0.68	12.47	2.69
1976-82	0.47	1.78	0.75	1.56	0.48	1.33	2.02	2.27	2.08
1982-88	4.50	22.13	10.40	4.41	4.24	4.09	8.91	26.37	14.49

Source: Indonesia, CBS (Central Bureau of Statistics, *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

domestic price of soybeans has been protected from the international market by government control of imports. BULOG imports soybeans and sells them to private traders at prices well above the import cost. The nominal protection rate for soybeans increased from an average of 7 percent during 1972-80 to 49 percent in 1981-88. In addition to the high level of price protection, the share of area in soybean intensification programs increased rapidly after 1976 at a rate of 5 percent per year (Figure 9). These programs, which combined a technology package of improved seeds, credit, and fertilizer subsidies with government suasion to plant soybeans rather than other crops, accounted for an average of nearly 90 percent of harvested areas of soybeans in 1984-86.

Figure 9—Percentage of soybean area under intensification programs, 1976-88



Source: Indonesia, CBS (Central Bureau of Statistics) and Mass Guidance Board, *Compilation of Input-Output Data of Palawija Crops* (Jakarta: CBS, various years).

Cassava Production and Policy Trends, 1970-88

Trends in area, yield, and production of cassava are summarized in Table 8 and Figure 9. Production of cassava grew at a rate of only 1.7 percent per year over the full period. Yield growth, which was fairly strong from 1970 to 1976 at 3.7 percent, declined to just 1.3 percent during 1976-82, but recovered to 3.5 percent thereafter. There was a slow decline in the national area harvested of cassava, as the result of a drop of 2 percent per year on Java, which was not quite offset by growth in area off Java. More rapid technological change in rice and corn and more favorable government interventions in rice, corn, and soybeans have increased the profitability of these crops relative to cassava, causing land to be shifted out of cassava and into other crops, particularly on Java. The modest expansion of cassava area in the outer islands, despite profitability trends, may largely be due to an increase in the availability of agricultural land in transmigration areas in Sumatera, Kalimantan, and Sulawesi. The transmigration program provides a package of economic incentives to induce families from Java to migrate to other islands.

The government has played only a small role in cassava marketing. No floor or ceiling prices for cassava have been implemented. Unnevehr (1984) shows that price formation in the cassava markets of Java (which still dominates production) is relatively efficient. When domestic wholesale prices are at or below the f.o.b. price, cassava prices on Java are largely determined by f.o.b. export prices in Surabaya port and East Java. But according to Timmer (1986), when domestic prices rise above the f.o.b. export price because of a crop shortfall or because the exchange rate is highly overvalued, domestic prices are determined by domestic supplies and the price of rice.

At current levels of relative prices and technology adopted by farmers, most cassava is grown in less favorable environments. With improved technology, particularly adoption of modern varieties and increased fertilizer application, the yield potential appears to be about 20 metric tons per hectare of fresh cassava, or nearly double the current farm yield. However, the government has made only limited efforts to boost cassava production. Some promising locally bred, improved varieties have been developed recently, but they have not yet received extensive field testing under a range of soil and moisture conditions (Falcon, Jones, and Pearson 1984).

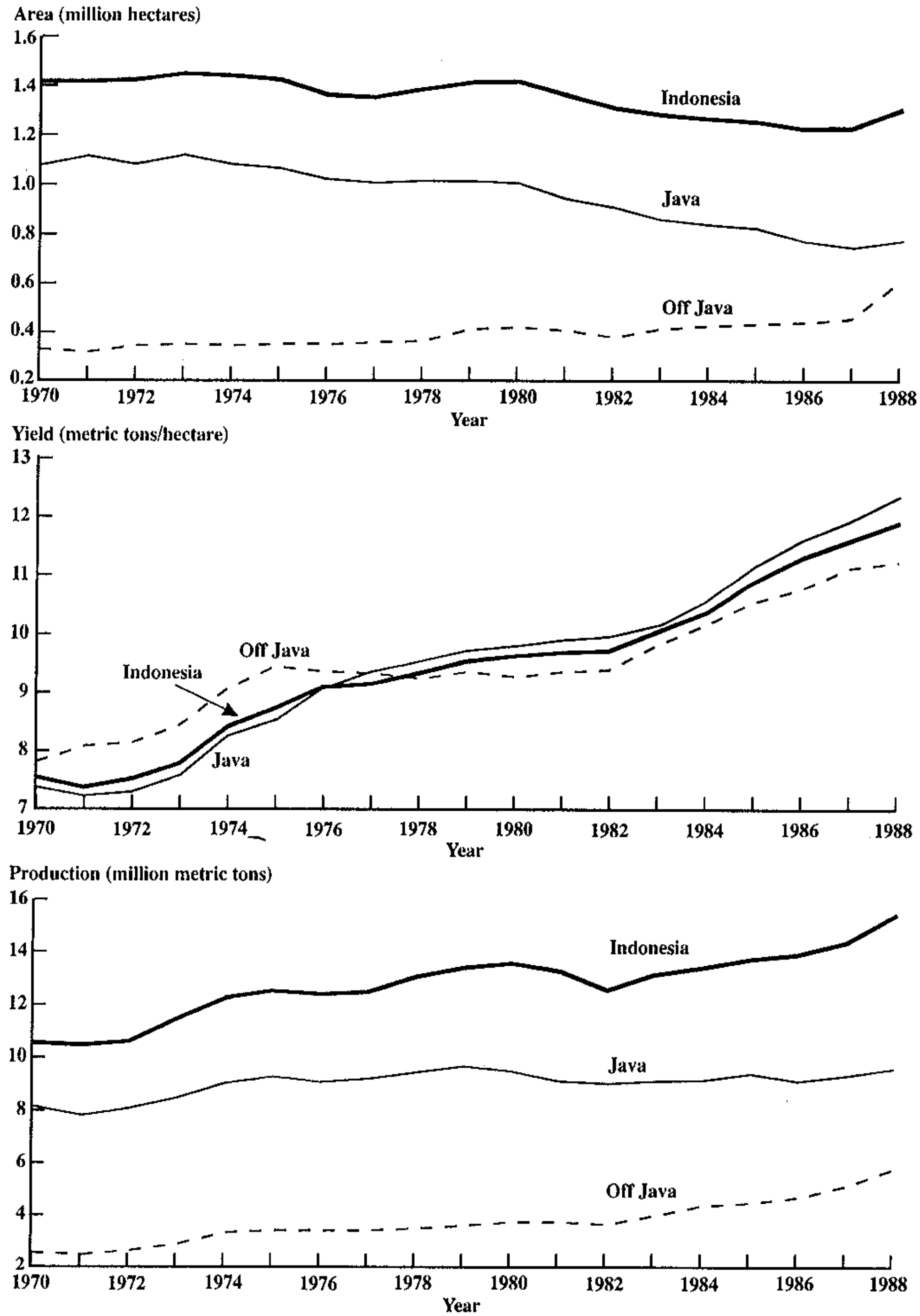
Cassava intensification programs were implemented and expanded rapidly in the 1980s (Figure 11). On a national basis, more than 50 percent of cassava area is under an intensification program. The lack of widely adopted improved cassava technology limits the effectiveness of intensification programs.

Table 8—Annual growth rates in area, yield, and production of cassava based on three-year moving averages, 1970-88

Period	Area			Yield			Production		
	Java	Off Java	Indonesia	Java	Off Java	Indonesia	Java	Off Java	Indonesia
	(percent)								
1970-88	-2.13	2.13	-0.87	2.89	1.77	2.57	0.76	3.90	1.70
1970-76	-0.94	1.59	-0.33	3.70	3.45	3.67	2.76	5.04	3.34
1976-82	-1.46	2.23	-0.43	1.85	0.10	1.25	0.38	2.33	0.93
1982-88	-2.87	3.82	-0.55	3.82	3.14	3.50	0.95	6.95	2.95

Source: Indonesia, CBS (Central Bureau of Statistics, *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

Figure 10—Cassava area, yield, and production, 1970-88



Source: Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

Sugar Production and Policy Trends, 1970-88

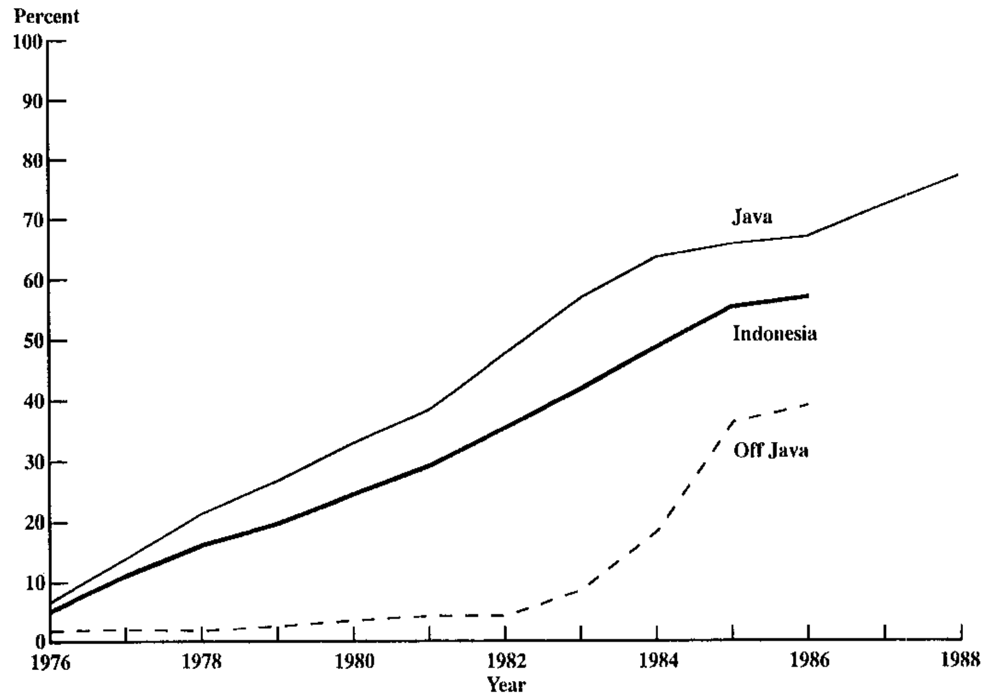
Figure 12 and Table 9 show trends in area of sugarcane and yield and production of sugar. Java accounted for virtually all the growth in sugarcane area prior to 1982, but after that, the area harvested on Java declined. Starting from a very small base, the sugarcane area harvested off Java increased significantly in the 1980s. The declining area trend on Java and the expansion of sugarcane area off Java, beginning in the early 1980s, reflect a gradual change in emphasis in government sugar production policy.

National sugar yields declined steadily until 1982, when a modest recovery began. Yields in the late 1980s, however, remained well below the yields achieved in the early 1970s. The long decline in yield appears to be the result of a failure to generate improved varieties of sugarcane, deterioration of sugar mills, and inadequate incentives for intensive farming in spite of government price supports and input subsidies.

The government of Indonesia has intervened heavily in the sugar industry. Prior to 1975, a compulsory land rental system was used on Java. Under this system, farmers were obligated to rent their land to the sugar mills, which then managed the lands as part of a large estate.

In 1975 this land rental system was replaced by a new production program designed to develop smallholder cane production. Under this new program, cane farmers, who previously were required to rent land to the sugar mills, are permitted to farm their own land. The farmers are in turn obliged to cultivate cane on this land and to turn over their

Figure 11—Percentage of cassava area under intensification programs, 1976-88



Source: Indonesia, CBS (Central Bureau of Statistics) and Mass Guidance Board, *Compilation of Input-Output Data of Palawija Crops* (Jakarta: CBS, various years).

Similarly, correcting for exchange rate misalignment, the adjusted domestic producer price, P_0^{d*}, is given by

$$P_o^{d*} = (E^*/E_o)\, P_o^d. \tag{5}$$

Then the indirect nominal protection rate, NPR_I, which is the same for all agricultural tradables, can be represented as

$$NPR_I = \frac{P_o^d/P_{NA}}{P_o^{d*}/P^*_{NA}} - 1 = \frac{P_o^d/P_{NA}}{(E^*/E_o)P_o^d/P^*_{NA}} - 1 = \frac{P^*_{NA}\, E_o}{P_{NA}\, E^*} - 1. \tag{6}$$

NPR_I measures the indirect effects due to trade policies on nonagriculture tradables, as well as the indirect effects of exchange rate misalignment.

The total effects of a country's trade and exchange rate policies, NPR_T, on relative agricultural prices, P_o^d/P_{NA}, is given by

$$NPR_T = \frac{P_o^d/P_{NA}}{(E^*/E_o)P_o^b/P^*_{NA}} - 1. \tag{7}$$

The total effects of price policies on P_o^d/P_{NA} are due to direct (sector-specific) price interventions (resulting in P_o^d instead of P_0^b), the exchange rate effect, and the effects of trade policies on the nonagricultural sector. NPR_T is the algebraic sum of NPR_D and NPR_I and their interactions:[7]

$$NPR_T = NPR_D + NPR_I (NPR_D \times NPR_I). \tag{8}$$

Effective Protection Rates

The NPRs can separately measure the sectoral and economy-wide effects on both the outputs and inputs, but not their net effects on the total agricultural production system. It is the effective protection rate (EPR) that measures these net effects through their effects on the value-added of the agricultural product. Formally, it is conventionally expressed as

$$EPR = \frac{P_o^d - \sum_j a_{oj} P_j^d}{P_o^b - \sum_j a_{oj} P_j^b} - 1 = \frac{V_o^d}{V_o^b} - 1, \tag{9}$$

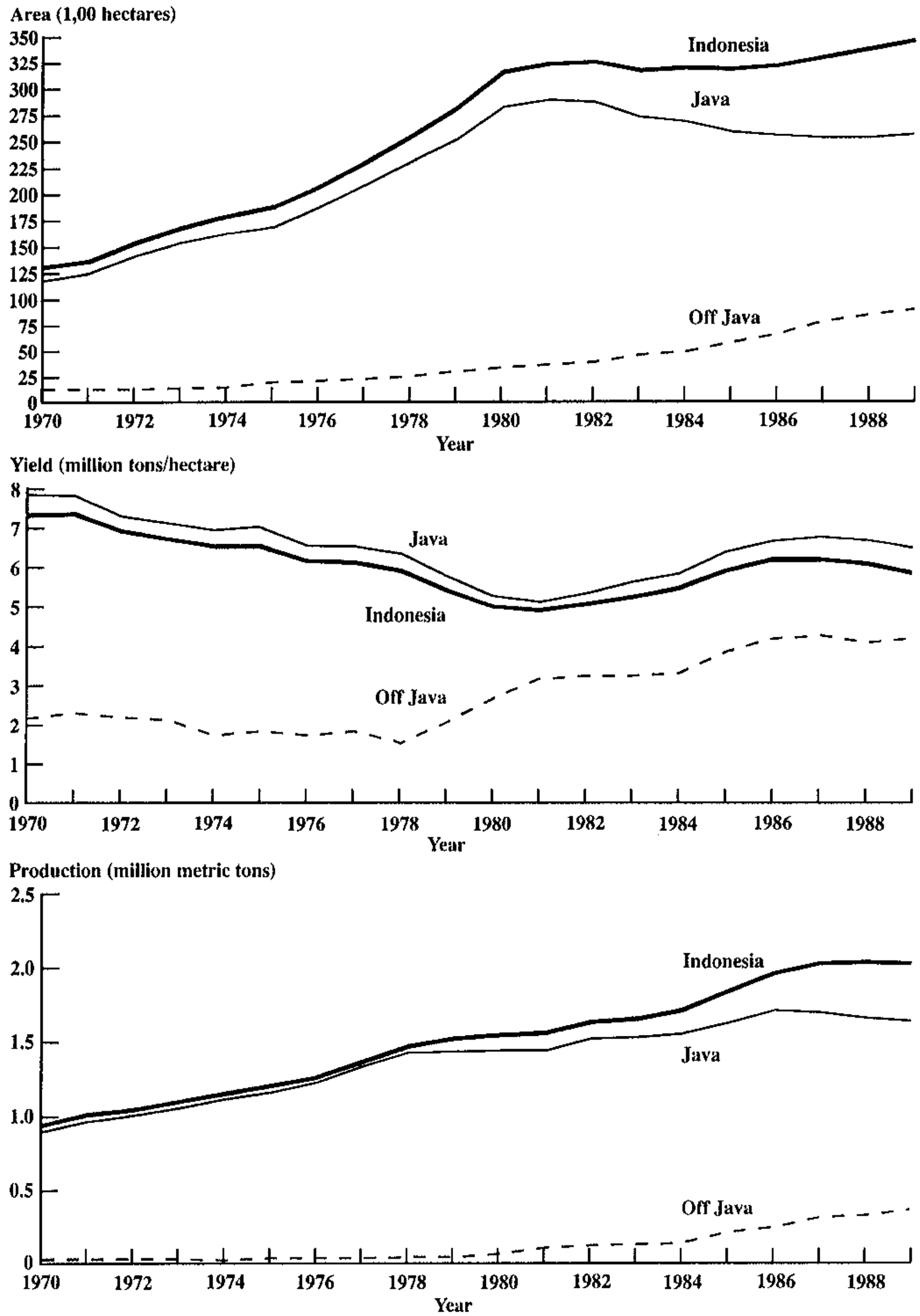
where

P_j^d = domestic price of input j,
P_j^b = border price of input j expressed in local currency,
a_{oj} = quantity of the jth input needed to produce one unit of output o,
V_o^d = value added in domestic prices,
V_o^b = value added in border prices expressed in local currency,

and the other variables are as previously defined.

[7]Krueger, Schiff, and Valdés (1988) define another nominal protection rate, npr_D, to make $NPR_T = npr_D + NPR_I$. In this study, however, NPR_Ds are the ones reported, since they reflect the effects of sector-specific price and trade policies.

Figure 12—Sugarcane area and yield and production of sugar, 1970-89



Source: Indonesia, Ministry of Agriculture, Directorate General of Estate Crops, *Estate Crop Statistics of Indonesia (Statistik perkebunan Indonesia)* (Jakarta: Ministry of Agriculture, various years).

Table 9—Annual growth rates in area, yield, and production of sugar, based on three-year moving averages, 1970-89

Period	Area			Yield			Production		
	Java	Off Java	Indonesia	Java	Off Java	Indonesia	Java	Off Java	Indonesia
					(percent)				
1970-89	4.30	11.66	5.37	−1.09	4.75	−1.22	3.21	16.41	4.15
1970-76	7.90	7.34	7.85	−3.04	−4.52	−3.04	4.86	2.82	4.81
1976-82	7.71	12.50	8.20	−4.68	11.99	−4.19	3.03	24.49	4.00
1982-89	−1.67	12.62	0.98	3.31	4.16	2.52	1.63	16.77	3.50

Source: Indonesia, Ministry of Agriculture, Directorate General of Estate Crops, *Estate crop statistics of Indonesia (Statistik perkebunan Indonesia)* (Jakarta: Ministry of Agriculture, various years).

entire crop to designated mills. As payment, farmers receive the proceeds on 60-65 percent of total sugar produced from their cane, depending on the sugar content.

Although the new cultivation system has improved farmer control over management of their land, the government has also retained area quotas in order to deliver targeted amounts of cane to the mills. It appears that much of the better-irrigated area under sugarcane quotas on Java would shift to rice and other crops if the area quotas were lifted. Despite the high price supports and input subsidies, the returns to alternative crops on Java are considerably higher (Nelson and Panggabean 1991; Rosegrant et al. 1987b).

In apparent recognition of the social costs of the sugar quota policy, the government has at least partly shifted its emphasis to expansion of sugar area off Java, developed mainly through the acquisition of large tracts of land by the government under land-use property rights. The government has seen expansion of sugar production in the outer islands not only as a way to increase domestic production, but also as a way to enhance regional development and to increase employment opportunities in these areas through development programs. The sugarcane industries are expected to perform as growth centers for the regions where they are established. In the 1970s a number of sugar factories and cane plantations were built off Java through government and private joint-venture investment.

In addition to the direct intervention in sugar production already outlined, the government has a monopoly on procurement, marketing, and distribution of sugar. BULOG purchases all sugar from the factories at a special quotation price determined by the government, based on production costs and reasonable consumption price levels. BULOG then distributes sugar to private wholesalers across the country. Retail prices are set to cover the ex-factory quotation price plus transportation and storage costs, plus a reasonable profit margin for wholesalers and local retailers. As will be shown in more detail in Chapter 6, the set of policies described here has resulted in domestic sugar prices well above world prices.

Conclusions

Expansion of rice production was the overriding concern of government agricultural policy in the 1970s and 1980s, although there was also heavy government intervention in production and pricing policy for sugar and soybeans, and to a lesser degree for corn and cassava. Government policy initiatives for nonrice crops increased in the 1980s, as a number of developments in the Indonesian and world economies converged to cause a substantial broadening of government agricultural policy concerns, beyond the rice production issues, to a greater concern with the effect of government policies on the incentive structure and comparative advantage across a range of crops.

Key developments leading to a broadening of government agricultural policy concerns included the following. First, the successes of the rice production program eliminated imports of rice for a number of years. Second, it was perceived that it would be difficult to maintain rice production growth in the future because high levels of attainment in use of modern varieties, fertilizer, and irrigation had already been reached and the costs associated with replicating these achievements in more marginal areas would be high. Third, resources available for agriculture had tightened due to declining oil prices prior to 1990 and declining government revenues and budgetary expenditures. Declining world commodity prices put an additional squeeze on the agricultural sector by reducing the economic profitability of investment in agriculture. Fourth, competition for land had increased among agricultural commodities and between agricultural and nonagricultural uses. Fifth, over the long-term the agriculture and nonagriculture sectors have become more integrated through investments in marketing and in rural infrastructure such as roads and communication. It is within the context of this evolving environment for agriculture that this report examines economic incentives and comparative advantage for Indonesian food crops.

4

METHODOLOGY FOR MEASURING ECONOMIC INCENTIVES AND COMPARATIVE ADVANTAGE

This study assesses the impact of government intervention on the relative incentives and competitiveness of the five selected food commodities under import substitution and export promotion trade regimes. Because agriculture is a dominant sector in Indonesia, government policies that promote agricultural production in general or affect relative incentives within agriculture can have substantial economy-wide effects.[3] It is also reasonable to expect that trade and exchange rate policies, even if specifically directed to other sectors of the economy, can exert an influence on incentives to agriculture and economic performance; therefore, indirect effects on incentives are also discussed (Bautista 1987).

The analysis of economic incentives in the production of food crops, using both the nominal and effective protection rates as indicators, measures the direct and economy-wide effects of government intervention. Assessment of comparative advantage centers on net social profitability, the domestic resource cost (DRC), and the resource cost ratio (RCR) as indicators. The methodologies for the computation of these measures of comparative advantage at the farm level for individual crops are well established (Herdt and Lacsina 1976; Pearson, Akrasanee, and Nelson 1976; Gonzales 1984; Byerlee 1985; Rosegrant et al. 1987a and 1987b; Appleyard 1987; Monke and Pearson 1989). Methodologies for measuring the direct, indirect, and total nominal protection rates for tradables are presented in Krueger, Schiff, and Valdés 1988; Bautista 1987; and Dorosh and Valdés 1990. The analysis here represents an extension of the literature in three ways: it provides greater detail on a regional basis; it disaggregates trade regimes or final markets to a greater extent; and it uses equilibrium exchange rates as shadow exchange rates in calculating protection rates and the competitiveness of food crop production systems at different levels of technology.

The DRC framework in comparative analysis is limited in two ways. First, it represents a set of fixed input-output coefficients, or a snapshot of the production and policy environment at a given point in time, without corresponding adjustments to price changes. In order to explore the implications of changes in the production and policy environment, it is necessary to assess the effects of changes in key factors such as world prices, domestic factor costs, and crop productivity. Second, the DRC calculations are based on mean values of interrelated random variables, without explicit regard to their underlying statistical distributions (McIntire and Delgado 1985). The robustness of the DRC measure can be enhanced if the underlying distributions and variability are assessed

[3]For example, the results of 18 developing-country studies show that the direct effects of sector-specific agricultural incentive policies are taxes on exportable goods (–11 percent on the average) and subsidies for importables (20 percent on average). The indirect effects also tax agriculture (–27 percent on average) and dominate the direct effects. The direct policies for both importables and exportables help stabilize domestic prices (Krueger, Schiff, and Valdés 1988).

and considered. To at least partially overcome these limitations, the assessment here uses sensitivity analysis of world prices and crop yields to examine the dynamic effects of changes in the factors on comparative advantage. Production system delineations are also made by distinct technology and geographic groupings to minimize the effects of technology and location on the variability of the different production and policy variables.

The analytical framework used here is particularly useful in identifying appropriate directions of change in policy and the first-round effects of these changes on incentives, profitability, and competitiveness. Although not undertaken in the present study, such results can be further strengthened with additional analysis of the responses of farmers to the changes in price and investment policy in order to assess their impact on area, yield, and production of crops and on utilization of inputs.[4]

Measures of Economic Incentives

A wide range of government policies influence economic incentives in agricultural production. Price and subsidy policies, import and export policies, and more general macroeconomic policies such as exchange rate and interest rate policies may affect relative incentives in agriculture. These effects can be measured by using the nominal and effective protection rates as indicators.[5]

Nominal Protection Rate

Border prices of commodities are used as reference prices in measuring the effects of government intervention policies. Without government intervention, the domestic producer prices are expected to be closely related to the border prices. The nominal protection rate (NPR) is then defined as the amount by which the domestic price of a tradable output deviates from its border price. It can be stated as

$$NPR = (P_o^d / P_o^b) - 1, \quad (1)$$

where P_o^d is the domestic producer price of a tradable agricultural product o, and P_o^b is the border price of o, evaluated at the official exchange rate, adjusted for quality, transport, storage, and other margins, measured under competitive conditions, and expressed in local currency. A positive NPR implies price protection and positive incentives for the production of the commodity.[6]

In calculating NPRs for agricultural tradables, the market point for comparison is of crucial importance. Since NPRs are indicators of output incentives or disincentives, there are two marketing points where comparisons can be made. One is at the production point to determine the incentives that farmers receive at the farm level. The other is at the wholesale or consumption point to determine the effects of pricing policy over a broader

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[4]See, for example, Rosegrant 1990 and Rosegrant et al. 1987b.

[5]Although not discussed or used here, other indicators of economic incentives are the producer subsidy equivalent and the consumer subsidy equivalent (see Scandizzo and Bruce 1980; Mergos 1987).

[6]A similar formulation for measuring the NPR of an input is to let P_i^d and P_i^b represent the domestic and border prices of the input, respectively. In contrast to output pricing, a positive NPR for inputs, sometimes called an implicit tariff rate (ITR), is considered an input tax, whereas a negative ITR is an input price subsidy. Also note that the only difference between NPC and ITC in Figure 2 and NPR and ITR is a change in the base from 1 to 0.

spectrum of farm production-processing-marketing activities. This study evaluates NPRs at both the farm and wholesale levels.

Direct and Indirect Effects on Agricultural Prices

Agricultural prices are affected by both the direct price interventions specific to agriculture and by the trade policies that affect nonagricultural products. They are also affected by the economy-wide policies that influence the exchange rate. A framework presented by Krueger, Schiff, and Valdés (1988) permits the estimation of the direct, indirect, and total effects of trade and exchange rate policies on NPRs.

The NPR due to direct price policies that affect an agricultural product o is given by NPR_D.

$$NPR_D = \frac{P_o^d/P_{NA}}{P_o^b/P_{NA}} - 1 = \frac{P_o^d}{P_o^b} - 1, \tag{2}$$

where P_{NA} is the price index of the nonagricultural sector.

Equation (2) calculates the impact of direct trade and price policies by comparing the actual domestic price with the free trade price that would prevail in the absence of direct intervention. Notice also that P_{NA} is unaffected by direct (sector-specific) trade and price policies, so that direct measures of interventions related to P_o^d or P_o^d/P_{NA} are the same.

Relative agricultural prices, P_o^d/P_{NA}, are also affected by the indirect trade policies that affect the nonagricultural sector and by the economy-wide policies that affect the real exchange rate.

The nonagricultural price index, P_{NA}, consists of tradable and nontradable components:

$$P_{NA} = \alpha P_{NAT} + (1 - \alpha)\, P_{NAH}, \tag{3}$$

where

P_{NAT} = price index of the tradable component of the nonagricultural sector,
P_{NAH} = price index of the nontradable component of the nonagricultural sector, and
α = share of tradables in nonagriculture.

When nonagricultural tradables are evaluated without trade taxes or subsidies, and when the tradable component is evaluated at the equilibrium exchange rate E^*, the nonagricultural price is given by

$$P_{NA}^* = \alpha \frac{E^*}{E_o} \frac{(P_{NAT})}{(1 + t_{NA})} + (1 - \alpha)P_{NAH}, \tag{4}$$

where

P^*_{NA} = nonagricultural price index that would prevail without trade policies affecting nonagricultural tradables and without exchange rate misalignment,
E^* = equilibrium nominal exchange rate,
E_o = official exchange rate, and
t_{NA} = effect of trade policies on the price of nonagricultural tradables.

The numerator is value-added expressed in actual domestic market prices, whereas the denominator is value added expressed in border prices converted to local currency. Again, border prices are used as the reference prices that would prevail in the absence of interventions. In effect, the ratio is a summary measure of the incentives or disincentives caused by government policies and market distortions in both the output and input markets. A positive EPR therefore implies that a particular production activity is receiving a positive incentive through protection at the existing exchange rate and trade policies, while a negative EPR indicates a production disincentive.

Following the Krueger, Schiff, and Valdés (1988) framework, the direct, indirect, and total EPRs can also be estimated using the following formulations:

$$EPR_D = \frac{P_o^d/P_{NA} - \sum_j a_{oj} P_j^d/P_{NA}}{P_o^b/P_{NA} - \sum_j a_{oj} P_j^b/P_{NA}} - 1 = \frac{P_o^d - \sum_j a_{oj} P_o^d}{P_o^b - \sum_j a_{oj} P_j^b} - 1 = \frac{V_o^d}{V_o^b} - 1, \qquad (10)$$

$$EPR_I = \frac{P_o^d/P_{NA} - \sum_j a_{oj} P_j^d/P_{NA}}{(E^*/E_o)\,(P_o^d/P_{NA}^*) - \sum_j a_{oj}\,(E^*/E_o)\,(P_j^d/P_{NA}^*)} - 1 = \frac{P_{NA}^* E_o}{P_{NA} E^*} - 1, \text{ and} \qquad (11)$$

$$EPR_T = \frac{P_o^d/P_{NA} - \sum_j a_{oj} P_j^d/P_{NA}}{(E^*/E_o)\,(P_o^b/P_{NA}^*) - \sum_j a_{oj}\,(E^*/E_o)\,(P_o^b/P_{NA}^*)} - 1$$

$$= \frac{V_o^d/P_{NA}}{(E^*/E_o)\,(V_o^b/P_{NA}^*)} - 1, \qquad (12)$$

where the *EPR* subscripts *D*, *I*, and *T* refer to direct, indirect, and total EPR, and the other terms are as previously defined.

Measures of Comparative Advantage

Comparative advantage in the production of a given food crop for a particular country or region is measured by comparing with its border price the social or economic opportunity costs of producing, processing, transporting, handling, and marketing an incremental unit of the food commodity. If the opportunity costs are less than the border price, then that country has a comparative advantage in the production of that particular food crop. In most developing countries, social or economic profitability deviates from private profitability because of distortions in the factor and output markets, externalities, and government policy interventions that tend to distort relative prices. Comparative advantage or comparative efficiency in the Indonesian economy is estimated here using three indicators: the net social or economic profitability (NSP), the domestic resource cost (DRC), and the resource cost ratio (RCR). These indicators are formally defined as follows:

$$NSP = (P_o^s - \sum a_{oj} P_j^s - \sum b_{ok} P_k^s) \times Y_o$$
$$= (P_o^b - \sum a_{oj} P_j^b - \sum b_{ok} P_k^s) \times Y_o\,, \tag{13}$$

$$DRC = \frac{\sum b_{ok} P_k^s}{P_{of}^b - \sum a_{oj} P_{jf}^b}\,, \text{ and} \tag{14}$$

$$RCR = \frac{\sum b_{ok} P_k^s}{(P_{of}^b - \sum a_{oj} P_{jf}^b)\, E^*} = \frac{DRC}{E^*}\,, \tag{15}$$

where world (border) prices are taken as shadow prices of tradable inputs and outputs, $P_o^s = P_o^b$ and $P_j^s = P_j^b$. The terms are defined as follows:

P_o^s = shadow price of output *o*;
P_j^s = shadow price of tradable input *j*;
P_k^s = shadow price of nontradable input *k*;
a_{oj} = quantity of the *j*th input needed to produce a unit of output *o*;
b_{ok} = quantity of the *k*th input needed to produce a unit of output *o*;
Y_o = yield per hectare of output *o*;
P_{of}^b = border-price equivalent of output *o* in foreign currency, adjusted for transport, storage, distribution, and quality differences;
P_{jf}^b = border-price equivalent of input *j* in foreign currency, adjusted for transport, storage, distribution, and quality differences; and
E^* = equilibrium nominal exchange rate, taken as the shadow value of the exchange rate.

Net Social Profitability

NSP is calculated on a per hectare basis. It is the difference between gross revenue and total costs expressed in economic prices. As an indicator of comparative advantage, the interpretation of NSP is straightforward. A production activity has comparative advantage if the NSP is greater than zero.

Domestic Resource Cost

The DRC of foreign exchange earned or saved from a particular production activity can be expressed as a ratio of the domestic (nontradable) factor costs in shadow prices per unit of output to the difference between the border price of output and foreign (tradable) costs (both expressed in foreign currency). In effect, the DRC is the "own exchange rate" of a particular production activity, since the numerator is expressed in local currency whereas the denominator is in foreign currency. DRC measures the social opportunity cost of domestic resources employed in earning or saving a marginal unit of foreign exchange. As a measure of comparative advantage, DRC can be used to determine the economic competitiveness of a production activity by comparing it with the shadow exchange rate (SER) of the currency.[8] Thus, an activity is economically competitive, or displays

[8]The DRC approach in this study uses the equilibrium exchange rate (EER) as an estimate of SER, the deflator, in calculating the RCRs.

comparative advantage, if the opportunity cost of earning or saving an incremental unit of foreign exchange is less than the SER. The smaller the DRC relative to the SER, the greater the activity's comparative advantage. Those activities with the smallest DRCs display the greatest relative comparative advantage.[9]

The Resource Cost Ratio

In comparing the DRC with the SER, one can arrive at an efficiency measure of comparative advantage. The RCR, which is the ratio of DRC and SER, is a measure of resource use efficiency because market prices used in the calculations have been adjusted net of taxes and subsidies. As a criterion for comparative advantage, the following relationships hold: $RCR < 1$ signifies an advantage, $RCR = 1$ is neutral, and $RCR > 1$ indicates a disadvantage.

[9]Note, however, that from equation (14), the relevant DRC values should be positive. Production activities with negative DRCs mean that the price of output cannot even cover the costs of the tradable inputs used, and should be construed as having no comparative advantage at all.

5

DATA SOURCES AND GENERAL ASSUMPTIONS

Farm and regional data are used in this analysis of economic incentives and comparative advantage in Indonesia. They can be grouped categorically as follows: (1) Technical input-output coefficients are used at the regional level for rice, corn, soybeans, sugar, and cassava. The coefficients are further delineated by technology (seed variety) and by region, wherever applicable. (2) Domestic market prices for inputs and outputs and resources are used at different levels of production and marketing chains. (3) Border prices (import and export) for inputs and outputs, including costs of freight, insurance, internal costs of marketing, processing, transport, and handling of outputs to the relevant market points by trade regimes are used.

For rice, corn, soybeans, and cassava, the major sources of data used in the domestic resource cost (DRC) analysis are unpublished cost-of-production surveys for 1983, 1985, and 1986, conducted by Indonesia's Directorate General for Food Crops (DGFC) and Central Bureau of Statistics (CBS). Data on improved technologies are supplemented by data from studies on corn (Timmer 1987) and cassava (Falcon et al. 1984; Nelson 1984). Data on soybeans are supplemented by data from the Center for Coarse Grains, Pulses, Roots and Tubers (CGPRT) and data gathered by the International Irrigation Management Institute (IIMI) on irrigated *palawija* (nonrice annual) crops (IIMI 1986a, 1986b). For example, the input-output data for hybrid corn and improved soybeans and cassava production technologies come from the latter source. Data are then synthesized and allocated to the major producing regions where applicable for the crops. For sugar, the input-output coefficients come from Hutabarat et al. 1986.

A major difference between an earlier IFPRI report on Indonesia (Rosegrant et al. 1987b) and the present analysis is that all the costs of current inputs and miscellaneous expenses in the regional input-output data sets, including output prices, have been updated to 1986.

The actual 1986 border prices for output of cassava, as reported by the World Bank and BULOG, were used in the estimation of DRCs and economic incentives under the interregional trade and import substitution regimes (World Bank various years). For the export scenarios, border prices projected by the World Bank to 1995 are used as long-term world prices.

Regional Transportation and Handling Costs

In order to analyze regional comparative advantage, the costs of transportation and distribution are differentiated on a regional basis. The analysis therefore delineates the costs at farm level of processing, transport, and distribution to the appropriate wholesale market channels, depending on whether the region under consideration has a surplus or deficit in the commodity. The economic value or import parity price of rice, corn, soybeans, and sugar in deficit regions is the adjusted c.i.f cost of these imports to the regional port, plus internal costs of transportation and handling to the major inland wholesale market within the region. This value is compared with farm-level production costs, processing (for rice and sugar), and transport-distribution costs from the farm to the major wholesale market within the deficit region. The economic import price parities of rice, corn, sugar, and soybeans for surplus-producing regions are the c.i.f. costs plus internal transport and handling costs to the wholesale market at the port of destination of the deficit region that is the primary trading partner of the surplus region.

Trade Regimes

The term "trade regimes" here refers to the final market point where the commodity is traded. To analyze the regional comparative advantage of the five food commodities, the production, processing, transport, and distribution costs are also differentiated on a regional basis, under average and improved technologies and three different trade regimes. Under the import substitution regime, the feasibility of each region's competing against direct imports of each commodity is assessed. The wholesale market of the importing region is the relevant market chain. Under the interregional trade regime, the major surplus regions are assumed to supply the commodity to the deficit regions. Transport and handling costs include those from the farm in the producing region to the wholesale market of the deficit region. Under the export promotion regime, whether it is feasible for a region to export a crop is assessed. The movement of the commodity is from the farm to the nearest port of the exporting region. Each trade scenario implies different sets of economic and wholesale prices of commodities and different levels of transport, marketing, and distribution costs. For this study, the analysis focuses more on the import substitution and export promotion trade regimes.

Transport Costs and Border Prices

The regional transport costs from farms to wholesale markets are computed on a per kilometer basis using rates provided by private truckers and the Ministry of Transportation. The basic transport rates taken from the Ministry of Transportation are based on average quality roads and grouped by major islands. The region composed of East and Central Java, Bali, and Lampung has a better network of roads; therefore, the per unit cost of transport is lower than that of other regions.

Region	Road Rate (Rp/ton/kilometer)
East and Central Java, Bali, and Lampung	66
North Sumatera, East Java, and Riau	82
South Sulawesi and Southeast Sulawesi	96
Other provinces	106

Based on informal interviews with selected truckers and given the kilometer distances from major trading centers to the port, direct transport and handling costs are estimated by province and by commodity. Handling costs include costs of insurance, losses, letters of credit for export, sacks or packaging, distributor's fees, and loading and unloading expenses. Estimates of the transport and handling cost components from farm to wholesale and from farm to port for rice, corn, soybeans, and cassava are given in Tables 10-13. Because of the lack of detailed information on sugar at the farm level, the computations are done at the factory level, so no detailed table on sugar is given. The border prices, f.o.b. from the source and adjusted economic import parity (c.i.f.), for the five commodities are presented in Tables 14 and 15, respectively. Border prices for rice, corn, and soybeans have generally declined since 1981. Except for cassava, which is at the f.o.b. economic price, the c.i.f. import economic parity prices of rice, corn, soybeans, and sugar are adjusted for marketing costs from port to wholesale (Table 15). The adjustment costs by major islands (that is, handling and transport costs from port to wholesale markets) are presented in Table 16. The difference in the financial and economic costs is due to an implicit 10 percent tax on transport, consisting of oil, spare parts, and gasoline. This may be overstated because the subsidy on diesel fuel is not accounted for due to inadequate data. The allocation of transport costs, 51 percent domestic and 39 percent foreign, is based on the 1980 input-output table for Indonesia (Indonesia, CBS 1980a).

Table 10—Transport and handling costs for rice, farm to wholesale and farm to port, by region, trade regime, and destination, 1986

Region	Trade Regime	Route	Marketing Cost		Wholesale Market or Port of Destination
			Transport	Handling	
			(Rp/kilogram)		
West Java	IRT	Farm-Bandung/Jakarta	4.75	10.50	Jakarta
	IS	Farm-Bandung	4.75	10.50	Bandung
	EP	Farm-Bandung-port	13.08	22.50	Jakarta
Central Java	IS	Farm-Semarang	8.08	10.50	Semarang
	EP	Farm-Semarang-port	12.08	22.50	Semarang
East Java	IRT	Farm-Semarang	14.17	10.50	Semarang
	IS	Farm-Surabaya	9.50	10.50	Surabaya
	EP	Farm-Surabaya-port	13.50	22.50	Surabaya
West Sumatera	IRT	Farm-rest of Sumatera	20.98	10.50	Rest of Sumatera
	IS	Farm-Padang	5.54	10.50	Padang
	EP	Farm-Padang-port	10.50	22.50	Padang
Rest of Sumatera	IS	Farm-wholesale	5.54	10.50	Rest of Sumatera
	EP	Farm-wholesale-port	10.50	22.50	Rest of Sumatera
South Sulawesi	IRT	Farm-rest of Sulawesi	29.64	10.50	Rest of Sulawesi
	IS	Farm-Ujung Pandang	17.75	10.50	Ujung Pandang
	EP	Farm-Ujung Pandang-port	23.55	22.50	Ujung Pandang
Rest of Sulawesi	IS	Farm-wholesale	17.75	10.50	Rest of Sulawesi
	EP	Farm-wholesale-port	23.55	22.50	Rest of Sulawesi
Rest of Indonesia	IS	Farm-wholesale	14.92	10.50	Rest of Indonesia
	EP	Farm-wholesale-port	21.32	22.50	Rest of Indonesia

Sources: Unpublished data obtained from Indonesia, Ministry of Transportation and Ministry of Finance, and private companies.

Notes: IRT is interregional trade, IS is import substitution, and EP is export promotion.

Table 11—Transport and handling costs for corn, farm to wholesale and farm to port, by region, by trade regime, and destination, 1986

Region	Trade Regime	Route	Marketing Cost: Transport	Marketing Cost: Handling	Wholesale Market or Port of Destination
			(Rp/kilogram)		
West Java	IS	Farm-Bandung	4.75	10.50	Bandung
	EP	Farm-Bandung-port	13.08	18.50	Jakarta
Central Java	IRT	Farm-Jakarta	23.20	10.50	Jakarta
	IS	Farm-Semarang	8.08	10.50	Semarang
	EP	Farm-Semarang-port	12.08	18.50	Semarang
East Java	IRT	Farm-Jakarta	28.77	10.50	Jakarta
	IS	Farm-Surabaya	9.50	10.50	Surabaya
	EP	Farm-Surabaya-port	13.50	18.50	Surabaya
Sumatera	IRT	Farm-Medan/Lampung -Jakarta	18.58	12.25	Jakarta
	IS	Farm-Medan/Lampung	9.32	10.50	Medan/Lampung
	EP	Farm-Medan/Lampung-port	14.28	18.50	Medan/Lampung
Bali and Nusa Tenggara	IRT	Farm-wholesale-Kalimantan	25.04	12.67	Kalimantan
	IS	Farm-wholesale	14.92	10.50	Bali and Nusa Tenggara
	EP	Farm-wholesale-port	20.12	18.50	Bali and Nusa Tenggara
South Sulawesi	IRT	Farm-rest of Sulawesi	29.64	12.67	Rest of Sulawesi
	IS	Farm-Ujung Pandang	17.75	10.50	Ujung Pandang
	EP	Farm-Ujung Pandang-port	23.55	18.50	Ujung Pandang
Kalimantan	IRT	Farm-wholesale	8.25	10.50	Kalimantan
	EP	Farm-wholesale-port	14.65	18.50	Kalimantan

Source: Unpublished data obtained from Indonesia, Ministry of Transportation and Ministry of Finance, and private companies.

Notes: IRT is interregional trade, IS is import substitution, and EP is export promotion.

For the analysis of Indonesia's comparative advantage by crops and regions, the provinces of Indonesia are grouped into eight regions for rice (see the map, Figure 13, p.52). These regions are West Java (including Jakarta), Central Java (including Yogyakarta), East Java, West Sumatera, the rest of Sumatera (including Aceh, North and South Sumatera, Bengkulu, Lampung, Riau, and Jambi), South Sulawesi, the rest of Sulawesi (North, Central, and Southeast), and the rest of Indonesia (Kalimantan, Bali, East and West Nusa Tenggara, East Timor, Maluku, and Irian Jaya). Although both West and North Sumatera are rice-surplus regions, the rice DRC analysis uses West Sumatera instead of North Sumatera in the eight-region classification because cost data on rice marketing, transport, and distribution are more accessible in West Sumatera than in North Sumatera. Because input-output data are insufficient for corn, soybeans, and cassava, the analysis for those crops is based on seven major regions including West Java, Central Java, East Java, Bali and Nusa Tenggara, Sumatera, Sulawesi, and Kalimantan. The analysis for sugar is divided into Java and off Java.

Table 12—Transport and handling costs for soybeans, farm to wholesale and farm to port, by region, trade regime, and destination, 1986

Region	Trade Regime	Route	Marketing Cost: Transport	Marketing Cost: Handling	Wholesale Market or Port of Destination
			(Rp/kilogram)		
West Java	IS	Farm-Bandung	4.75	10.50	Bandung
	EP	Farm-Bandung-port	13.08	22.75	Jakarta
Central Java	IRT	Farm-Jakarta	23.20	10.50	Jakarta
	IS	Farm-Semarang	8.08	10.50	Semarang
	EP	Farm-Semarang-port	12.08	22.75	Semarang
East Java	IRT	Farm-Jakarta	33.82	10.50	Jakarta
	IS	Farm-Surabaya	9.50	10.50	Surabaya
	EP	Farm-Surabaya-port	13.50	22.75	Surabaya
Sumatera	IS	Farm-wholesale	11.88	10.50	Sumatera
	EP	Farm-wholesale-port	16.84	22.75	Sumatera
Bali and Nusa Tenggara (surplus)	IRT	Farm-wholesale -Kalimantan/Sulawesi	25.04	11.17	Kalimantan/Sulawesi
	IS	Farm-wholesale	14.92	10.50	Bali and Nusa Tenggara
	EP	Farm-wholesale-port	20.12	22.75	Bali and Nusa Tenggara
Sulawesi	IS	Farm-wholesale	17.75	10.50	Sulawesi
	EP	Farm-wholesale-port	23.55	22.75	Sulawesi
Kalimantan	IS	Farm-wholesale	8.25	10.50	Kalimantan
	EP	Farm-wholesale-port	14.65	22.75	Kalimantan

Source: Unpublished data obtained from Indonesia, Ministry of Transportation and Ministry of Finance, and private companies.

Notes: IRT is interregional trade, IS is import substitution, and EP is export promotion.

Fertilizers and Chemicals

Urea and Triple Sulfate (TSP) Fertilizers

Indonesia exports urea fertilizers. The economic price of urea is computed to equal the f.o.b. value at the source (Palembang), which is 100 percent tradable and adjusted to reflect transport and distribution costs to the different provinces. Transport and distribution costs are for nontradable goods, but with tradable and primary domestic components. According to the 1980 input-output table (Indonesia, CBS 1980a), the components of the transport costs are 43.6 percent foreign, 48.6 percent domestic, and 7.8 percent tax. The breakdown of distribution costs is 30.5 percent foreign, 60.2 percent domestic, and 9.3 percent tax. For TSP fertilizer, the economic price is equal to the c.i.f. price (that is, f.o.b. international + freight + insurance) plus adjustments in domestic transport and distribution costs. The shares of foreign and domestic components of TSP are the same as those for urea.

Indonesia heavily subsidizes its fertilizer. This was especially true during the 1970s. In the mid-1980s, however, the fertilizer subsidy declined to an average of 35 percent across nitrogen, phosphorus, and potassium (NPK) grades.

Table 13—Transport and handling costs for dry cassava (*gaplek*), farm to wholesale and farm to port, by region, trade regime, and destination, 1986

Region	Trade Regime	Route	Marketing Cost: Transport	Marketing Cost: Handling	Wholesale Market or Port of Destination
			(Rp/kilogram)		
West Java	EP	Farm-Bandung	4.75	10.50	Jakarta
		Bandung-port	8.33	8.92	
		Total	13.08	19.42	
Central Java	EP	Farm-Semarang	8.08	10.50	Semarang
		Semarang-port	4.00	8.92	
		Total	12.08	19.42	
East Java	EP	Farm-Surabaya	9.50	10.50	Surabaya
		Surabaya-port	4.00	8.92	
		Total	13.50	19.42	
Sumatera	EP	Farm-wholesale	11.88	10.50	Sumatera
		Wholesale-port	4.96	8.92	
		Total	16.84	19.42	
Bali and Nusa Tenggara	EP	Farm-wholesale	14.92	10.50	Bali and Nusa Tenggara
		Wholesale-port	5.20	8.92	
		Total	20.12	19.42	
Sulawesi	EP	Farmer-wholesale	17.75	10.50	Sulawesi
		Wholesale-port	5.80	8.92	
		Total	23.55	19.42	
Kalimantan	EP	Farmer-wholesale	8.25	10.50	Kalimantan
		Wholesale-port	6.40	8.92	
		Total	14.65	19.42	

Source: Unpublished data obtained from Indonesia, Ministry of Transportation and Ministry of Finance, and private companies.

Note: EP is export promotion.

Pesticides

Most pesticides used are formulated in Indonesia. However, the raw materials are imported. The economic price of pesticides is assumed to equal the market price adjusted for the transport and marketing costs minus taxes. For both liquid and solid pesticides, the foreign component is 30.4 percent, the domestic cost is 56.3 percent, and the tax is 13.3 percent.

Like fertilizer, chemicals were also heavily subsidized during the peak of the BIMAS, later INMAS, rice production program. Calculations show that in 1986 the domestic prices of chemicals were subsidized at 40-65 percent, depending on the type. Therefore, these subsidies are adjusted as part of the foreign economic cost for pesticides.

Tractor and Thresher Services

Tractor and thresher services are input costs with both tradable and nontradable components. A comprehensive study on the mechanization of rice production in Java is

Table 14—Free-on-board (f.o.b.) prices of five selected commodities, 1971-89

Year	Rice[a]	Corn[b]	Soybeans[c]	Sugar[d]	Dry Cassava[e]
			(US$/metric ton)		
1971	109	58	126	99	...
1972	125	56	140	160	...
1973	297	98	290	208	...
1974	459	132	227	654	66
1975	313	120	220	449	77
1976	223	112	231	255	73
1977	237	95	280	179	72
1978	336	101	268	172	71
1979	309	116	298	213	97
1980	395	125	296	632	111
1981	418	131	288	374	88
1982	251	109	245	186	76
1983	247	136	282	187	109
1984	235	136	282	115	99
1985	199	112	224	90	84
1986	165	88	208	133	103
1987	200	76	215	149	112
1988	262	107	304	225	113
1989	278	112	275	282	75

Sources: Basic data from World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years); Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years).

[a] Rice price is for Thai, 5 percent broken f.o.b. Bangkok, adjusted for quality at 25 percent.
[b] U.S. No. 2 yellow corn f.o.b. Gulf ports.
[c] Soybeans are United States, c.i.f. Rotterdam; can be converted to f.o.b. U.S. Gulf ports if time series data on freight and insurance are available. Unfortunately, they were not available for all years.
[d] Sugar is the world International Sugar Agreement daily price, f.o.b. main Caribbean ports.
[e] Cassava is dried, f.o.b. Jakarta.

used in subdividing the foreign and domestic components of these mechanical services (Saefudin 1983). The economic costs of tractorization and mechanical threshing consisted of 64 percent foreign and 36 percent domestic cost.

Irrigation

Irrigation is a major input in the production of rice and to a minimal extent of secondary crops in Indonesia. The estimate of the average subsidy for irrigation services across systems is 87 percent, based on two earlier studies (Rosegrant et al. 1987a; Djamaluddin 1978). This subsidy level is comparable to that estimated for the Philippines during the same period (Rosegrant et al. 1987b). The economic cost of irrigation in Indonesia is disaggregated to 64 percent foreign and 36 percent domestic components.

Labor

The shadow price or opportunity cost of labor is simply equal to the marginal value product, that is, the marginal output of labor forgone elsewhere because of its use in the production activity (Squire and van der Tak 1988). In a perfectly competitive economy,

Table 15—Border prices (c.i.f.) of five commodities, by region, 1986

Province	Rice		Corn		Soybeans		Sugar		Cassava[a]
	At port	At wholesale (adjusted)	At port	At wholesale (adjusted)	At port	At wholesale (adjusted)	At port	At wholesale (adjusted)	At port
					(US$/metric ton)				
West Java (Jakarta)	193.48	202.91	103.71	112.37	185.15	195.40	194.96	202.80	102.90
West Java (Bandung)	195.86	205.29	112.17	120.86	182.83	193.08	198.43	206.27	102.90
Central Java	193.47	202.91	101.32	110.01	207.58	217.83	195.02	202.80	102.90
East Java	193.48	202.91	101.32	110.01	207.58	217.83	194.96	202.80	102.90
West Sumatera	195.15	205.18	104.99	113.34	211.69	222.58	199.24	207.69	102.90
Rest of Sumatera	195.73	205.74	104.55	112.90	211.02	221.91	198.58	207.03	102.90
(All of Sumatera)	195.67	205.69	104.55	112.90	211.02	221.91	198.67	207.12	102.90
South Sulawesi	199.55	209.98	97.70	106.45	207.59	218.85	195.41	204.24	102.90
Rest of Sulawesi	199.43	209.98	103.65	112.53	216.52	227.97	204.36	213.38	102.90
(All of Sulawesi)	197.93	208.45	102.12	111.00	214.22	225.67	202.12	211.09	102.90
Kalimantan	213.07	224.04	114.54	121.38	222.34	234.24	210.35	219.82	102.90
Bali and Nusa Tenggara	213.73	224.18	112.61	121.38	232.39	243.85	220.10	229.12	102.90
Rest of Indonesia	210.10	221.13	109.76	118.42	226.93	238.92	220.41	230.09	102.90

Sources: World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years); unpublished data provided by BULOG (Badan Urusan Logistik), Jakarta, Indonesia.

Notes: C.i.f. import economic parity price at port = f.o.b. price + freight rate + insurance.
C.i.f. import economic parity price at wholesale = c.i.f. price at port + internal marketing cost.

[a] Since cassava is exported, prices are f.o.b.

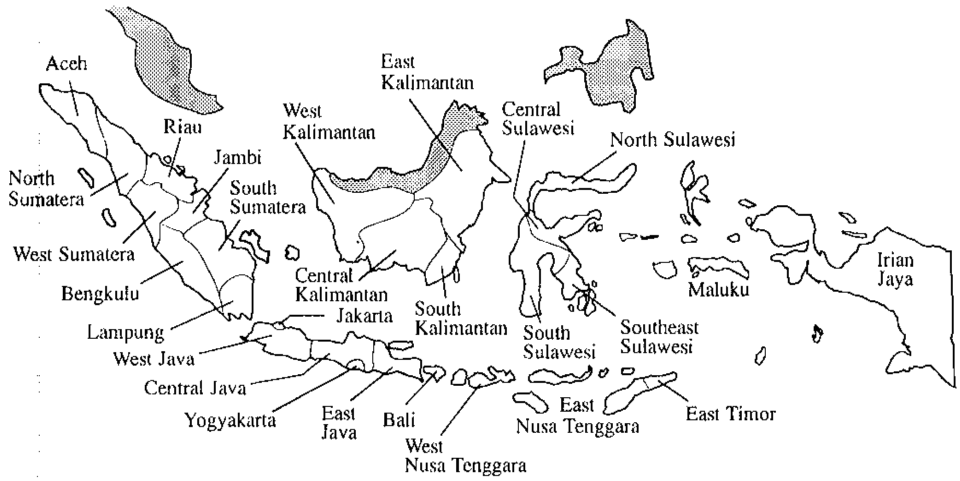
Table 16—Marketing cost from major port to major wholesale market, by region and crop, 1986

Region	Marketing	Rice	Corn	Soybeans	Cassava	Sugar
				(Rp/kilogram)		
West Java	Transport	4.00	4.00	4.00	4.00	4.00
	Handling	13.04	10.01	14.53	7.53	10.19
	Total (F)	17.04	14.01	18.53	11.53	14.19
	(E)	15.49	12.73	16.85	10.47	12.89
Central Java	Transport	4.00	4.00	4.00	4.00	4.00
	Handling	13.07	10.04	14.57	7.53	10.19
	Total (F)	17.07	14.04	18.57	11.53	14.19
	(E)	15.52	12.76	16.88	10.47	12.89
East Java	Transport	4.00	4.00	4.00	4.00	4.00
	Handling	13.04	10.01	14.53	7.53	10.19
	Total (F)	17.04	14.01	18.53	11.53	14.19
	(E)	15.49	12.73	16.85	10.47	12.89
West Sumatera	Transport	4.96	4.96	4.96	4.96	4.96
	Handling	13.17	10.14	14.72	7.53	10.34
	Total (F)	18.13	15.10	19.68	12.49	15.30
	(E)	16.48	13.72	17.89	11.34	13.90
Rest of Sumatera	Transport	4.96	4.96	4.96	4.96	4.96
	Handling	13.15	10.12	14.70	7.53	10.32
	Total (F)	18.11	15.08	19.66	12.49	15.28
	(E)	16.46	13.70	17.87	11.34	13.88
All of Sumatera	Transport	4.96	4.96	4.96	4.96	4.96
	Handling	13.16	10.12	14.70	7.53	10.32
	Total (F)	18.12	15.08	19.66	12.49	15.28
	(E)	16.47	13.70	17.87	11.34	13.88
South Sulawesi	Transport	5.80	5.80	5.80	5.80	5.80
	Handling	13.07	10.04	14.57	7.53	10.19
	Total (F)	18.87	15.84	20.37	13.33	15.99
	(E)	17.14	14.38	18.51	12.10	14.52
Rest of Sulawesi	Transport	5.80	5.80	5.80	5.80	5.80
	Handling	13.29	10.26	14.91	7.53	10.53
	Total (F)	19.09	16.06	20.71	13.33	16.33
	(E)	17.34	14.59	18.82	12.10	14.83
All of Sulawesi	Transport	5.80	5.80	5.80	5.80	5.80
	Handling	13.24	10.20	14.82	7.53	10.44
	Total (F)	19.04	16.00	20.62	13.33	16.24
	(E)	17.30	14.53	18.74	12.10	14.75
Kalimantan	Transport	6.40	6.40	6.40	6.40	6.40
	Handling	13.44	10.41	15.13	7.53	10.75
	Total (F)	19.84	16.81	21.53	13.93	17.15
	(E)	18.02	15.26	19.56	12.64	15.57
Bali and Nusa Tenggara	Transport	5.20	5.20	5.20	5.20	5.20
	Handling	13.70	10.66	15.51	7.53	11.13
	Total (F)	18.90	15.86	20.71	12.73	16.33
	(E)	17.18	14.41	18.83	11.56	14.83
Rest of the region	Transport	6.40	6.40	6.40	6.40	6.40
	Handling	13.55	10.52	15.29	7.53	11.13
	Total (F)	19.95	16.92	21.69	13.93	17.53
	(E)	18.12	15.36	19.71	12.64	15.92

Sources: World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years); unpublished data provided by BULOG (Badan Urusan Logistik), Jakarta, Indonesia.

Notes: F = financial price; E = economic price.

Figure 13—Map of the provinces of Indonesia and the regions used for different crops



Rice regions

1. West Java (including Jakarta)
2. Central Java (including Yogyakarta)
3. East Java
4. West Sumatera
5. The rest of Sumatera (including Aceh, North and South Sumatera, Bengkulu, Lampung, Riau, and Jambi)
6. South Sulawesi
7. The rest of Sulawesi (including North, Central, and Southeast Sulawesi)
8. The rest of Indonesia (including Kalimantan, Bali, East and West Nusa Tenggara, East Timor, Maluku, and Irian Jaya)

Corn, cassava, and soybean regions

1. West Java
2. Central Java
3. East Java
4. Bali and Nusa Tenggara
5. Sumatera
6. Sulawesi
7. Kalimantan

Sugar regions

1. On Java
2. Off Java

the shadow price of labor would be equal to the wage. In Indonesia, widespread interregional labor movements exist, and an increasing number of active rural family households depend on earnings from wage labor. Although this is not a perfectly competitive market, the geographical integration of the labor market in Indonesia indicates that actual agricultural wages can be used as a close proxy for the economic value of labor.

Land

Financial land rents are estimated from land rent data in the cost-of-production surveys for 1983-86 provided by the Directorate General for Food Crops. To reflect land quality and variability in land class by crop, average values are computed by crop for Java and off Java. At the margin, land rents are higher in Java because they reflect better agroclimatic conditions and the presence of infrastructure that complements the use of land. Financial land rents are shown in Table 17. The rents are expressed on the basis of cropping seasons, so the apparently high rents for cassava are indicative of the long length of its growing season, averaging about 15 months.

In principle, the social or economic value of land should be equal to its highest alternative productive use. Determining the highest alternative productive use of land for

Table 17—Financial land rents used in the domestic resource cost analysis, 1986

Crop/Technology	Java	Off Java	South Sulawesi and West Sumatera
		(Rps/hectare/season)	
Rice			
Irrigated technology	186,732	106,591	140,559
Corn			
Open-pollinated technology	78,721	37,056	...
Hybrid corn technology	132,726	71,823	...
Soybeans			
Traditional technology	132,726	71,823	...
Improved technology	132,726	71,823	...
Cassava			
Traditional and improved technology	377,124	146,082	...
Sugar			
Medium technology	393,145	180,453	...

Source: Derived from Indonesia, Ministry of Agriculture, Directorate General for Food Crops, *Farm Management Surveys, 1983-85* (Jakarta: Ministry of Agriculture, 1985).

multiple crops, however, requires a complete and clear knowledge of cropping patterns, costs, and returns of the various enterprises over time. This type of data set was not available at the time this study was conducted. The alternative approach is to adjust the financial rents, which reflect the market opportunity costs of land, for the effects of government intervention. Thus, the economic value of land is estimated as the financial rent for land, adjusted for the government input subsidies provided to farmers, which have tended to be capitalized into financial land rents. In this study a conversion factor of 0.85 estimated by Ghanem and Walton (1984) is used to convert the financial rents to the economic price of land for each crop.

Interest Rate

The interest rate is the payment for the use of capital. Generally, the rate varies depending on the supply and demand of loanable funds (capital) in a given economy. As in the estimation of the shadow prices for land and other production factors, the shadow price of capital is the opportunity cost of money, that is, the marginal productivity of additional investment in the best alternative uses (Squire and van der Tak 1988).

The estimation of the opportunity cost or the social rate of return for capital in Indonesia uses the formula suggested in Monke and Pearson 1989:

$$i^R = \frac{1 + i^O}{1 + f} - 1, \qquad (16)$$

where

i^R = real interest rate,

i^0 = observed interest rate, and

f = inflation rate.

At low interest and inflation rates, the real rate of interest can be calculated as just the simple difference of the observed interest rate and the inflation rate, $(i^0 - f)$. For the period under study, the observed interest rates in Indonesia varied from money market and deposit rates of 15 percent to a lending rate of 21.13 percent (IMF 1988). The lending rate of 21.13 percent is used in this report, as it reflects a long-term view of the potential marginal rate for incremental investment in Indonesia.

Inflation, on the other hand, is calculated as the yearly changes in consumer prices, or 5.25 percent during 1986 (Asian Development Bank 1990). Thus, using the Monke and Pearson formula, the real interest rate is calculated to be approximately 15 percent. For the financial analysis, an interest rate of 12 percent is used. This was the actual lending rate to Indonesian farmers by agricultural financial intermediaries during the period of the study.

Official and Shadow Exchange Rates

In measuring the domestic value of a tradable resource, two rates of exchange can be used. One is the official exchange rate (OER) and the other, the shadow exchange rate (SER). Some developing countries adopt an official exchange rate, which may be misaligned and therefore may not reflect the true domestic value of the tradable good. The SER instead represents the rate of exchange that will clear the supply and demand for foreign exchange in the absence of any controls or trade restrictions.

This study used the real equilibrium exchange rate as an approximation of SER, as estimated by Gonzales (1991) using the omega function approach. He estimated that in 1986 the OER of Rp 1,463 to US$1.00 represented an overvaluation of 16.6 percent.

6

ANALYSIS OF INCENTIVES AND GOVERNMENT INTERVENTION

Historically, Indonesia has used a number of policy instruments, including government monopolies on trade, producer support prices, and input subsidies on fertilizer and irrigation to influence agricultural output prices and the costs of production. Indonesia's import substitution strategy and protection of industry resulted in a moderately overvalued exchange rate in 1986.

As discussed in Chapter 4, the framework developed by Krueger, Schiff, and Valdés (1988) is used in estimating the direct and indirect effects of trade, price, and exchange rate policies on five selected food crops. The direct, indirect, and total effects of trade, price, and exchange rate policies at the producers' level were measured in terms of incentive indicators, the nominal and effective protection rates, based on the 1986 cost-of-production surveys of the Indonesian Department of Agriculture (various years b). Before analyzing these rates, trends in the relationship between domestic and border prices are presented.

Price Trends for Food Crops and Fertilizer

A direct comparison of historical domestic wholesale prices of food commodities with their economic prices, translated at the official exchange rate, shows different trend patterns for food commodities. Among the importables, the price trends of rice and corn contrasted with those of soybeans and sugar. Price trends from 1972 to 1986 indicate that the domestic wholesale prices of rice (Figure 14) and corn (Figure 15) were generally lower than their economic import parity prices (adjusted c.i.f. at wholesale). After 1983 for rice and 1986 for corn, however, domestic wholesale prices were slightly higher than their import parity prices. In general, domestic rice prices have followed trends in border prices.

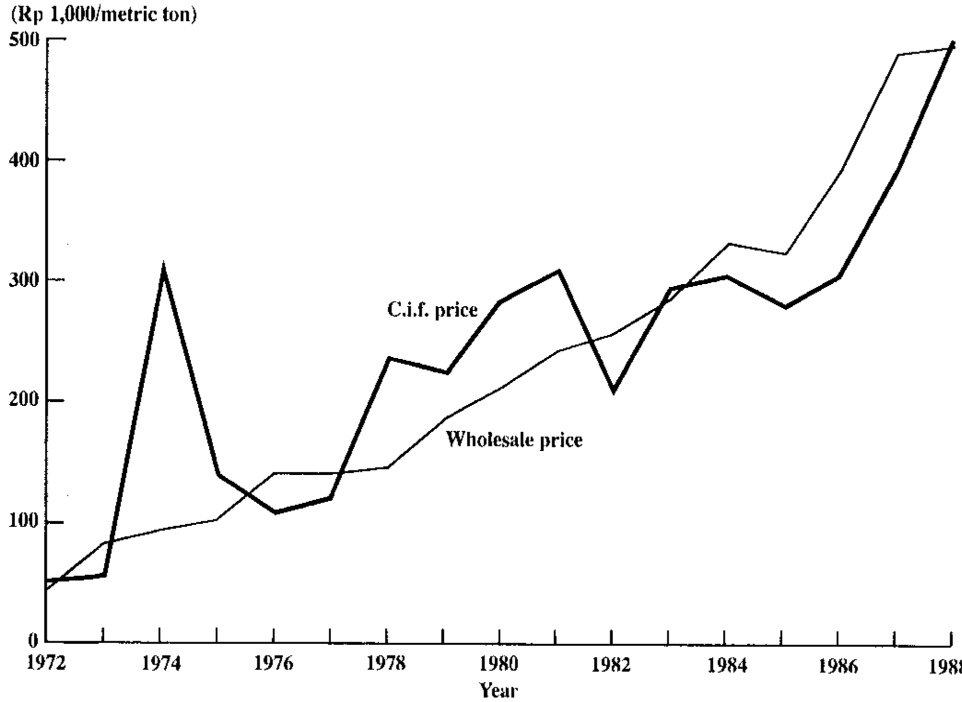
The nominal protection coefficient, the ratio of domestic to parity prices at the official exchange rate, averaged 0.83 from 1975 to 1981 and 1.14 from 1982 to 1988 for rice. A similar pattern is observed for corn: the nominal protection coefficient averaged 0.92 from 1975 to 1981, 0.88 from 1982 to 1985, and 1.21 from 1986 to 1988. Domestic prices for these major crops have thus been reasonably close to long-run world prices.

For soybeans (Figure 16) and sugar (Figure 17), domestic wholesale prices were substantially higher than their import parity prices at the official exchange rate. From 1980 to 1988, the ratios of wholesale domestic prices to import parity prices averaged 1.43 for soybeans and 1.90 for sugar.

For dried cassava, an exportable crop, domestic wholesale prices were generally lower than export parity prices, although quality differences could account for this disparity (Figure 18).

The output price trends point out the relative importance of domestic price policies in determining agricultural incentives. Two aspects of prices factor in agricultural perfor-

Figure 14—Domestic wholesale price and economic import parity (c.i.f.) price of rice, 1972-88



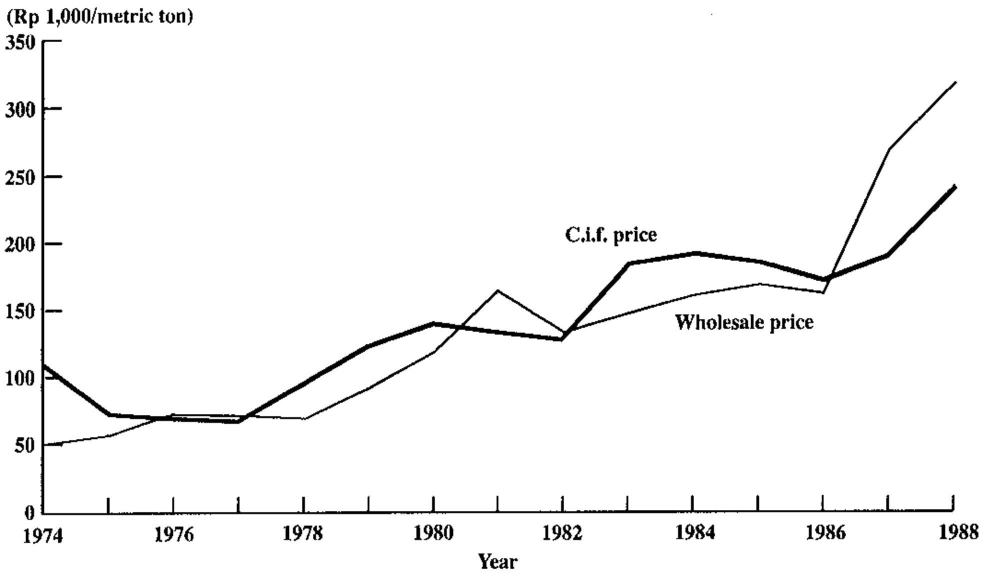
Sources: Wholesale price data are from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); border price data are from World Bank, *Commodity Prices and Price Projections* (Washington, D.C.: World Bank, various years); and transport and internal marketing costs are from data provided by BULOG (Badan Urusan Logistik), Jakarta, and private transport companies.

mance. One is the role of government interventions and the other relates to independent changes in world commodity prices, which are separate from government policies (Bautista 1990). These two aspects of prices are demonstrated by the developments in domestic pricing and policies in Indonesia and changes in the world prices of agricultural commodities during the decades of the 1970s and 1980s. For example, during 1974/75, 1978-81, and 1983/84, controlled domestic prices of rice and corn were generally below world or economic prices, implying that government pricing policies have a direct disincentive effect. It was also during these periods, however, that world prices of food commodities were generally at high levels.

During the period examined, the domestic pricing policies (official procurement prices for most food crops) and government monopoly in trade were responsible for insulation of the domestic food market from changes in world prices. Indonesia also provided substantial incentives for agricultural production through subsidies on agricultural inputs. Fertilizer was the most subsidized material input during the decade. In part, this was to support the food (rice) self-sufficiency program of the government, which began in the early 1970s.

A comparison of domestic and economic parity prices of urea (Figure 19) and triple sulfate (TSP) (Figure 20) from 1970 to 1986 shows that domestic prices of fertilizer were

Figure 15—Domestic wholesale price and economic import parity (c.i.f.) price of corn, 1974-88



Sources: Wholesale price data are from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); border price data are from World Bank, *Commodity Prices and Price Projections* (Washington, D.C.: World Bank, various years); and transport and internal marketing costs are from data provided by BULOG (Badan Urusan Logistik), Jakarta, and private transport companies.

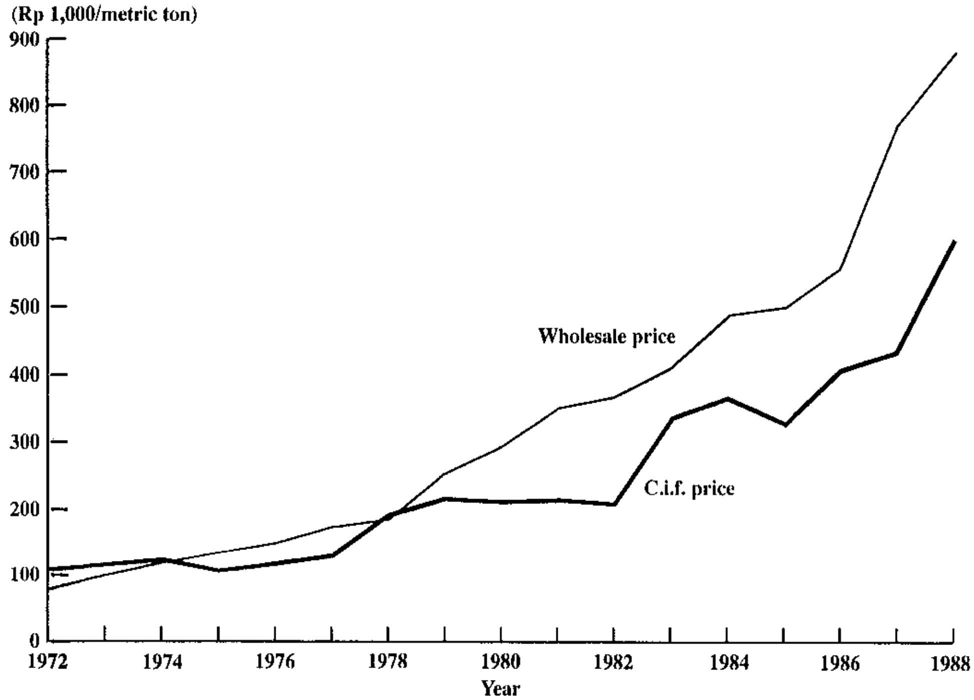
lower than their import parity prices. Subsidies on urea and TSP fertilizer reached their peaks during the early 1980s, ranging from 40 to 65 percent depending on the type of fertilizer. Although time-series data on prices for other inputs are not available, data for 1985/86 indicate that the other key purchased agricultural inputs (chemicals, pesticides, and irrigation) were also subsidized at rates ranging from 60 to 78 percent (Saefudin 1983).

Another major reason why the government intervenes in the agricultural markets is to provide greater annual stability in prices for both producers and consumers. Government domestic trade and price policies have resulted in greater stability (as shown by lower coefficients of variation) for producers of the five food crops (Table 18). The coefficients of variation, especially for the domestic prices of rice, soybeans, and sugar, are lower than their import parity prices, implying more stability in the domestic prices of these commodities, compared with world prices.

Effects on Output Prices: Nominal Protection Rates

In this section, the direct, indirect, and total effects of trade, price, and exchange rate policies are measured at the producers' level and disaggregated by producing provinces and regions. The domestic prices of outputs used are average farmgate prices received by farmers in 1985/86 by specific producing regions. The economic or border prices (c.i.f. for importables and f.o.b. for exportables) are also defined at the farm level, adjusted for product quality, and costs of processing, handling, transport, and marketing from the appropriate ports and domestic wholesale markets.

Figure 16—Domestic wholesale price and economic import parity (c.i.f.) price of soybeans, 1972-88

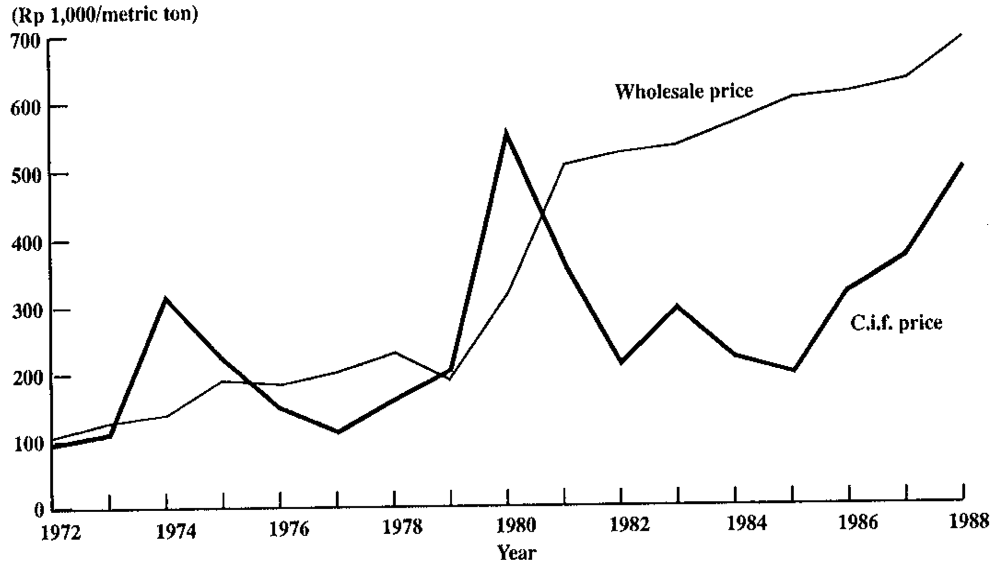


Sources: Wholesale price data are from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); border price data are from World Bank, *Commodity Prices and Price Projections* (Washington, D.C.: World Bank, various years); and transport and internal marketing costs are from data provided by BULOG (Badan Urusan Logistik), Jakarta, and private transport companies.

As discussed in Chapter 4, the direct NPRs measure the impact of direct policies ($P_o^d/P_{NA} - P_o^b/P_{NA}$) as a percentage of the relative prices (P_o^b/P_{NA}) that would have prevailed in the absence of sector-specific interventions at the official exchange rate E_O. The indirect NPRs, which are common to all sectors, measure the terms of trade between agriculture and nonagriculture, as well as the effects of exchange rate misalignment. The change in the relative price of a commodity to the price of nonagricultural goods is an appropriate measure of the incentives. And because trade and exchange rate policies affect the prices of agricultural and nonagricultural goods, the total effects of nominal protection measure the combined effects of sectoral and economy-wide price interventions in agricultural prices (Dorosh and Valdés 1990).

The direct, indirect, and total NPRs at the producers' level for rice, corn, soybeans, sugar, and cassava are presented in Tables 19-23. For rice, the direct NPR was highest in West Sumatera and the rest of Indonesia (13 percent) and lowest in South Sulawesi (–14 percent) (Table 19). The indirect effect of exchange rate misalignment in 1985/86 is estimated at –16 percent across regions. The estimated total effects of sectoral and economy-wide policies on rice producers was small, with general output disprotection averaging –13 percent for Indonesia, –15 percent for Java, and –13 percent off Java. At the provincial level, the rice farmers of the outer islands of South Sulawesi and the rest of Indonesia were clearly disprotected, with total NPRs averaging –17 percent.

Figure 17—Domestic wholesale price and economic import parity (c.i.f.) price of sugar, 1972-88



Sources: Wholesale price data are from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); border price data are from World Bank, *Commodity Prices and Price Projections* (Washington, D.C.: World Bank, various years); and transport and internal marketing costs are from data provided by BULOG (Badan Urusan Logistik), Jakarta, and private transport companies.

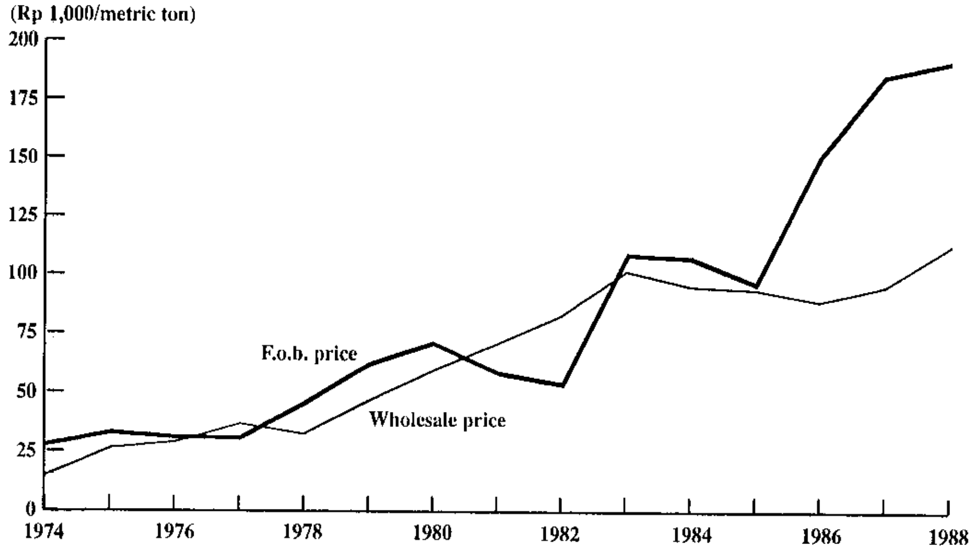
Output price incentives to corn producers followed the general pattern of small total nominal disprotection, with modest direct protection offset by negative indirect protection (Table 20). Total NPRs across all producing provinces average –13 percent, whereas total NPRs on Java were –23 percent and off Java –5 percent. At the provincial level, only the corn farmers of Sumatera and Sulawesi had positive total NPRs in 1986.

Production of soybeans (Table 21) and sugar (Table 22) were highly protected, with very high direct NPRs ranging from 86-114 percent across producing provinces. The high direct NPRs for soybeans and sugar outweighed the negative indirect effects of trade and exchange rate policies, resulting in high total NPRs of 102 for soybeans and 77 for sugar for Indonesia.

Finally, the NPRs of cassava, the only exportable food crop examined in the study, indicate slightly negative effects of trade, price, and exchange rate policies at the producers level (Table 23). The average total NPR for Indonesia was –21 percent, with Java and off Java showing total NPRs of –36 percent and –9 percent, respectively. As noted above, however, quality differentials may account for most of this apparent disprotection.

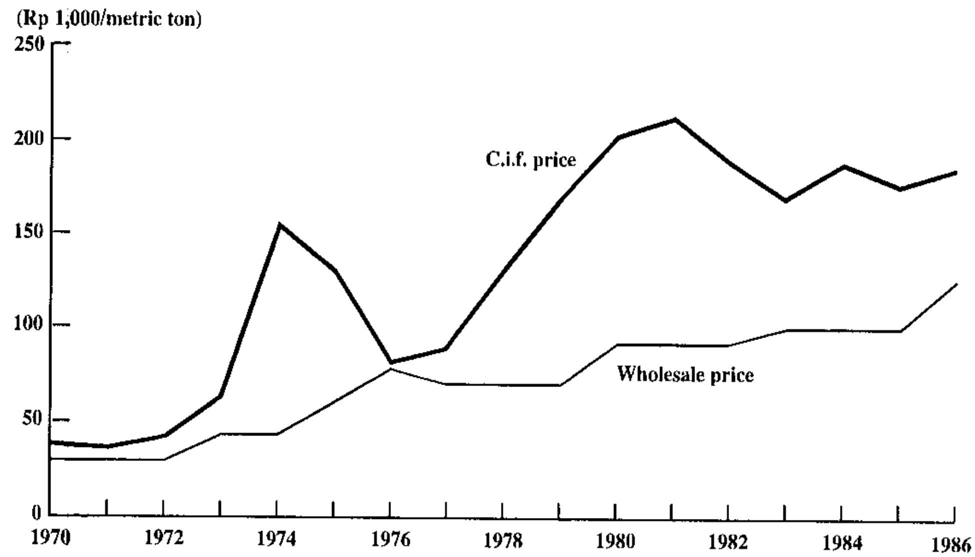
At the Jakarta wholesale market, the NPRs for the five crops studied exhibited the same patterns of output price protection as at the farmers' level (Table 24). In 1985 and 1986, rice, corn, and cassava had small to moderate negative total NPRs, whereas the total NPRs for soybeans and sugar averaged 66 percent. In 1987, however, the total NPRs for all crops except dried cassava became positive, with total NPRs ranging from 3 to 46 percent because declines in world prices were not fully reflected in domestic price declines.

Figure 18—Domestic wholesale price and economic export parity (f.o.b.) price of cassava, 1974-88



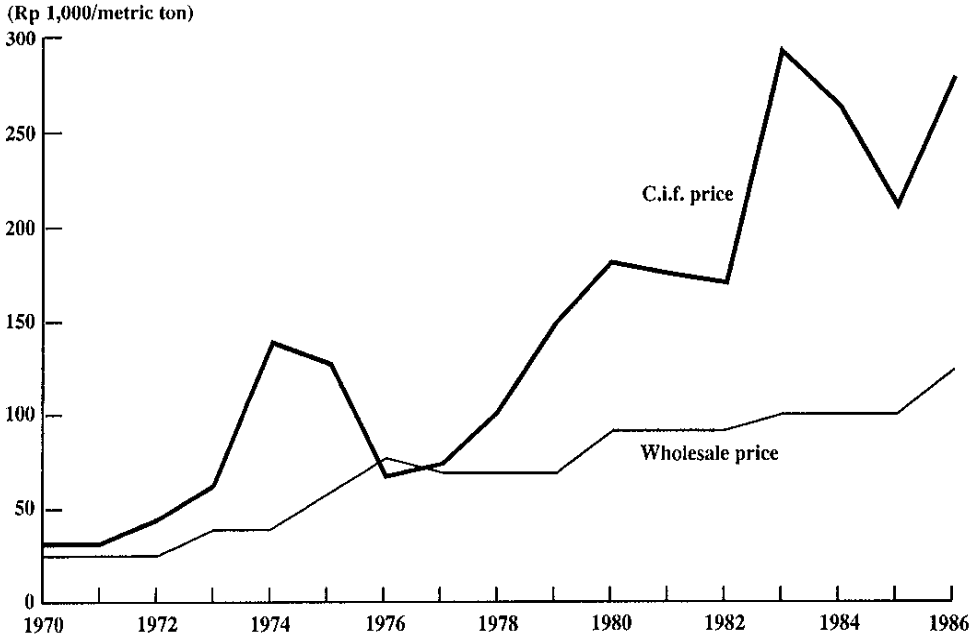
Sources: Wholesale price data are from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); border price data are from World Bank, *Commodity Prices and Price Projections* (Washington, D.C.: World Bank, various years); and transport and internal marketing costs are from data provided by BULOG (Badan Urusan Logistik), Jakarta, and private transport companies.

Figure 19—Domestic wholesale price and economic import parity (c.i.f.) price of urea fertilizer, 1970-86



Sources: Wholesale price data are from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); border price data are from World Bank, *Commodity Prices and Price Projections* (Washington, D.C.: World Bank, various years); and transport and internal marketing costs are from data provided by BULOG (Badan Urusan Logistik), Jakarta, and private transport companies.

Figure 20—Domestic wholesale price and economic import parity (c.i.f.) price of triple sulfate fertilizer, 1970-86



Sources: Wholesale price data are from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); border price data are from World Bank, *Commodity Prices and Price Projections* (Washington, D.C.: World Bank, various years); and transport and internal marketing costs are from data provided by BULOG (Badan Urusan Logistik), Jakarta, and private transport companies.

Effective Protection Rates

The effective protection rates (EPRs) measure the net effects of government intervention on both outputs and inputs, as reflected in value added. The estimated EPRs to rice

Table 18—Coefficients of variation of prices and correlation coefficients between wholesale and economic parity prices, 1972-88

Commodity/ Fertilizer	Domestic Wholesale Price	Economic Parity Price	Correlation Coefficient
Rice	8.14	54.27	0.25
Corn	13.23	32.23	0.26
Soybeans	9.05	28.28	–0.32
Sugar	16.84	57.33	0.003
Cassava	16.83	18.96	–0.35
Urea	28.39	38.14	0.42
Triple sulfate	28.39	32.05	0.15

Sources: World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years); unpublished data provided by BULOG (Badan Urusan Logistik), Jakarta, Indonesia.

Notes: Prices are deflated by the wholesale price index (excluding petroleum), instead of the nonagricultural price index, because the latter has limited numbers of observations. The economic parity price is based on the f.o.b. price for cassava; the others are import parity prices (adjusted c.i.f. prices at the final wholesale market).

Table 19—Direct, indirect, and total nominal protection rates to rice producers, by region, import substitution scenario, 1986

Region	Direct	Indirect	Total
		(percent)	
West Java	-5	-16	-20
Central Java	7	-16	-10
East Java	3	-16	-13
West Sumatera	13	-16	-5
Rest of Sumatera	10	-16	-8
South Sulawesi	-14	-16	-28
Rest of Sulawesi	-2	-16	-18
Rest of Indonesia	13	-16	-5
Java	1	-16	-15
Off Java	4	-16	-13
Indonesia	3	-16	-13

Note: $NPR_T = NPR_D + NPR_I + (NPR_D \times NPR_I)$, where NPR_T is the total nominal protection rate, NPR_D is direct, and NPR_I is indirect.

Table 20—Direct, indirect, and total nominal protection rates to corn producers, by region, import substitution scenario, 1986

Region	Direct	Indirect	Total
		(percent)	
West Java	-7	-16	-22
Central Java	-8	-16	-23
East Java	-9	-16	-24
Sumatera	21	-16	2
Sulawesi	27	-16	7
Kalimantan	15	-16	-3
Bali and Nusa Tenggara	-6	-16	-21
Java	-8	-16	-23
Off Java	13	-16	-5
Indonesia	4	-16	-13

Note: $NPR_T = NPR_D + NPR_I + (NPR_D \times NPR_I)$, where NPR_T is the total nominal protection rate, NPR_D is direct, and NPR_I is indirect.

Table 21—Direct, indirect, and total nominal protection rates to soybean producers, by region, import substitution scenario, 1986

Region	Direct	Indirect	Total
		(percent)	
West Java	155	-16	114
Central Java	150	-16	110
East Java	147	-16	107
Sumatera	140	-16	102
Sulawesi	121	-16	86
Kalimantan	145	-16	106
Bali and Nusa Tenggara	125	-16	89
Java	151	-16	111
Off Java	133	-16	96
Indonesia	140	-16	102

Note: $NPR_T = NPR_D + NPR_I + (NPR_D \times NPR_I)$, where NPR_T is the total nominal protection rate, NPR_D is direct, and NPR_I is indirect.

Table 22—Direct, indirect, and total nominal and effective protection rates to sugar producers and millers, by region, import substitution scenario, 1986

Protection Rates	Java	Off Java	Indonesia
		(percent)	
Nominal protection rates			
Direct	109	113	111
Indirect	–16	–16	–16
Total	76	77	77
Effective protection rates			
Direct	250	256	253
Indirect	–16	–16	–16
Total	194	199	197

Note: $NPR_T = NPR_D + NPR_I + (NPR_D \times NPR_I)$, where NPR_T is the total nominal protection rate, NPR_D is direct, and NPR_I is indirect.

Table 23—Direct, indirect, and total nominal protection rates to cassava producers, by region, 1986

Region	Direct	Indirect	Total
		(percent)	
West Java	–29	–16	–40
Central Java	–24	–16	–36
East Java	–18	–16	–31
Sumatera	–1	–16	–17
Sulawesi	14	–16	–4
Kalimantan	15	–16	–3
Bali and Nusa Tenggara	6	–16	–11
Java	–24	–16	–36
Off Java	8	–16	–9
Indonesia	–6	–16	–21

Note: $NPR_T = NPR_D + NPR_I + (NPR_D \times NPR_I)$, where NPR_T is the total nominal protection rate, NPR_D is direct, and NPR_I is indirect.

Table 24—Direct, indirect, and total nominal protection rates of selected food crops at the Jakarta wholesale market, 1985-87

Year/Commodity	Direct	Indirect	Total
		(percent)	
1985			
Rice	15	–16	–3
Corn	–10	–16	–24
Soybeans	44	–16	21
Sugar	173	–16	129
Cassava	–1	–16	–17
1986			
Rice	12	–16	–6
Corn	–6	–16	–21
Soybeans	31	–16	10
Sugar	81	–16	52
Cassava	–35	–16	–45
1987			
Rice	19	–16	0
Corn	36	–16	14
Soybeans	61	–16	35
Sugar	62	–16	36
Cassava	–40	–16	–50

Note: All commodities except cassava are importables.

Table 25—Direct, indirect, and total effective protection rates to rice producers, by region, import substitution scenario, 1986

Region	Direct	Indirect	Total
		(percent)	
West Java	10	−16	−8
Central Java	26	−16	6
East Java	22	−16	2
West Sumatera	44	−16	21
Rest of Sumatera	40	−16	18
South Sulawesi	4	−16	−13
Rest of Sulawesi	23	−16	3
Rest of Indonesia	46	−16	23
Java	19	−16	0
Off Java	31	−16	10
Indonesia	26	−16	6

Note: $EPR_T = EPR_D + EPR_I + (EPR_D \times EPR_I)$, where EPR_T is the total effective protection rate and EPR_D is direct and EPR_I indirect.

producers are shown in Table 25. The total EPR across rice-producing provinces was 6 percent, with Java neutral (0) and off Java at 10 percent EPR. Off Java, the rice producers of the regions of Sumatera and the rest of Indonesia had the highest total EPRs, ranging from 18 to 23 percent. These results were in contrast to the negative total NPRs for rice producers in these off-Java regions. The high input price subsidies on fertilizer, chemicals, and irrigation in rice production more than offset the modest output price disprotection.

The total EPRs for corn producers followed the same pattern as their NPRs (Table 26). Although the magnitude differed overall, the corn producers of Indonesia had negative net producers' incentives, averaging –6 percent during the period. The Java corn farmers were

Table 26—Direct, indirect, and total effective protection rates to corn producers, by region, import substitution scenario, 1986

Technology/Region	Direct	Indirect	Total
		(percent)	
Open-pollinated corn			
West Java	−3	−16	−19
Central Java	−1	−16	−17
East Java	1	−16	−15
Sumatera	30	−16	9
Sulawesi	31	−16	10
Kalimantan	18	−16	−1
Bali and Nusa Tenggara	−3	−16	−19
Java	−1	−16	−17
Off Java	19	−16	0
Indonesia	11	−16	−7
Hybrid corn			
Central Java	−3	−16	−19
East Java	−3	−16	−19
Sulawesi	39	−16	17
Java	−3	−16	−19
Off Java	22	−16	2
Indonesia	12	−16	−6

Note: $EPR_T = EPR_D + EPR_I + (EPR_D \times EPR_I)$, where EPR_T is the total effective protection rate and EPR_D is direct and EPR_I indirect.

more disprotected (–17 percent for open-pollinated and –19 percent for hybrid corn) than the off-Java producers (0 percent for open-pollinated and 2 percent for hybrid), as shown by their total EPRs. Since corn production is basically rainfed in Indonesia and utilizes relatively small amounts of fertilizer compared with rice production, input price subsidies on fertilizer had little effect on the total value added of corn production.

Soybean (Table 27) and sugar producers (Table 22) enjoyed high total EPRs during 1986. The average total EPRs across the Java and off-Java regions were 147 percent for soybean production (an average of traditional and improved technology) and 197 percent for sugar production. The highly favorable output price protection was reinforced by input subsidies.

Finally, the total EPRs for cassava producers averaged –20 percent for Indonesia, –35 percent for Java, and –7 percent off Java (Table 28). During the period, cassava producers in the three Java provinces were apparently disprotected, with total EPRs ranging from –31 to –40 percent. Again, quality differences may account for much of this apparent disprotection.

In summary, the incentive pattern resulting from government trade, price, and exchange rate policies indicates low-to-moderate disprotection to the producers of cassava and corn, moderate production incentives for rice producers, and very high protection rates for the producers of sugar and soybeans.

Table 27—Direct, indirect, and total effective protection rates to soybean producers, by region, import substitution scenario, 1986

Technology/Region	Direct	Indirect	Total
		(percent)	
Traditional technology			
West Java	181	–16	136
Central Java	192	–16	145
East Java	213	–16	163
Sumatera	220	–16	169
Sulawesi	168	–16	125
Kalimantan	170	–16	127
Bali and Nusa Tenggara	162	–16	120
Java	195	–16	148
Off Java	176	–16	132
Indonesia	183	–16	138
Improved technology			
Central Java	225	–16	173
East Java	227	–16	175
Java	222	–16	170
Indonesia	205	–16	156

Note: $EPR_T = EPR_D + EPR_I + (EPR_D \times EPR_I)$, where EPR_T is the total effective protection rate and EPR_D is direct and EPR_I indirect.

Table 28—Direct, indirect, and total effective protection rates to cassava producers, by region, export promotion scenario, 1986

Technology/Region	Direct	Indirect	Total
		(percent)	
Traditional technology			
West Java	–29	–16	–40
Central Java	–23	–16	–35
East Java	–18	–16	–31
Sumatera	–1	–16	–17
Sulawesi	14	–16	–4
Kalimantan	15	–16	–3
Bali and Nusa Tenggara	6	–16	–11
Java	–23	–16	–35
Off Java	9	–16	–8
Indonesia	–5	–16	–20
Improved technology			
Central Java	–22	–16	–34
East Java	–17	–16	–30
Sumatera	2	–16	–14
Java	–23	–16	–35
Off Java	12	–16	–6
Indonesia	–3	–16	–19

Note: $EPR_T = EPR_D + EPR_I + (EPR_D \times EPR_I)$, where EPR_T is the total effective protection rate and EPR_D is direct and EPR_I indirect.

7

REGIONAL COMPARATIVE ADVANTAGE OF FOOD CROPS

To provide indicators of comparative advantage and economic incentives for the Indonesian food-crop subsector, this analysis focuses on the regional level for several reasons. Resource endowments, agroclimatic patterns, distance to market outlets, and levels of infrastructure development, all of which may vary across regions, are major determinants of comparative advantage. At least some of this variability is captured in this analysis. Many developing countries, including Indonesia, implement input-output pricing policies (such as subsidies, taxes, and price supports) on a national basis for easier administration, but understanding of the effects of these policies at regional levels is sometimes limited. Regional analysis permits assessment of the net effects of government price policies at regional, commodity, and technological levels (to the extent that the data base permits). There are eight regional groups for rice and seven different ones for corn, soybeans, and cassava. Sugar is grouped only into Java or off Java categories.

Rice Production

As noted earlier, there has been remarkable growth in rice production over the past two decades. This was due to several interrelated factors: the government's intensified production programs (BIMAS, INMAS, and INSUS) aimed at attaining self-sufficiency in food; the adoption of modern rice varieties; expansion of irrigated areas; high subsidization of fertilizers, pesticides, and credit and extension services; and initiation of a price support system for rice. The challenge for the future is to maintain efficient productive capacity with appropriate policies and economically justifiable investments in the rice sector. This has become increasingly difficult for Indonesia due to the success of the green revolution in rice, which has led to a continuing deterioration in the world market price for rice. The problem has been accentuated by declining government revenues from oil exports, which were the major source of the Indonesian agricultural development budget. These recent developments highlight the need to reexamine the financial and economic viabilities of the rice production systems in Indonesia relative to alternative crop production systems.

Rice production in Indonesia can generally be characterized as an irrigated, smallholder production system using intensive purchased inputs and labor. Java has the most intensive rice production system in Indonesia. The high government subsidies on fertilizer and chemical inputs[10] also made fertilizer and pesticide use financially attractive to rice farmers. On average, yields are above most of the national rice yields of the rice-producing countries of Asia.

[10]Subsidies on chemicals were removed during the 1988/89 cropping season. Instead, Indonesia has opted to pursue the integrated pest management approach to pest control.

Yields, Prices, and Financial Profitability

Paddy yields, prices, and financial costs for rice production reflect regional variations in production technologies, proximity to major trading centers, and the state of development in market infrastructure (Table 29). For example, in 1986 the farmgate paddy price was highest in the deficit regions (rest of Indonesia), at Rp 211 per kilogram. In contrast, South Sulawesi, a surplus region, had the lowest farmgate price of Rp 151 per kilogram. Across the eight regions, the average paddy price received by farmers was about Rp 183 per kilogram.

The yields per hectare were highest in East Java at 5.0 tons of paddy per hectare, followed by Central Java with 4.8 tons and West Java with 4.5 tons per hectare (Table 29). West Sumatera and South Sulawesi of the outer islands also had yields of more than 4 tons per hectare, whereas the rest of the regions had yields from 3 to 4 tons per hectare.

Rice production across the eight regions was financially profitable. Net financial farm incomes per hectare, under the import substitution model, ranged from a high of Rp 441,012 in Central Java to a low of Rp 164,692 in the rest of Sulawesi. At wholesale, the financial net profits were also highly favorable across regions, averaging Rp 526,152 per hectare for Java and Rp 443,912 per hectare off Java.

Economic Efficiency

Estimates of the economic efficiency indicators for the regional rice production systems in Indonesia under different trade regimes are shown in Table 30. At the average official exchange rate of Rp 1,463 to US$1.00 in 1986 and a c.i.f. adjusted border price of rice ranging from US$203-$221 per ton (depending on the specific region and trade regime), domestic rice production in general is economically competitive with imports. This competitiveness is indicated by positive net economic profits and resource cost ratios (RCRs) of less than one. Maintenance of this comparative advantage of course depends on developments in the world trade of rice and on Indonesia's capacity to sustain and improve the prevailing rice production systems.

However, with a long-run projected export rice price of US$153 per ton (f.o.b.) (adjusted for quality based on the World Bank 1995 projected price of US$173 per ton, 5 percent broken Bangkok), as the border price, and given the 1985/86 cost structures of regional rice production systems in Indonesia, the results indicate that Indonesia has little or no comparative advantage in exporting rice. The eight regions analyzed show no comparative advantage in exporting rice, as shown by the RCRs for Indonesia as a whole, which average 1.12 (Table 30).

Sustainability of Comparative Advantage

Under what technological and economic conditions can Indonesia sustain comparative advantage in rice production? Given the quality of rice that Indonesia currently produces, the regional cost of production, and the 1986 border prices of rice, it is efficient to produce rice as an import substitute, including trade from surplus to deficit regions in Indonesia. The relatively low estimated break-even yields for rice production under the import substitution and interregional trade regimes across regions demonstrate this point (Table 31). These break-even yields were generally lower than the actual rice yields by region, implying that the current rice production technology of Indonesia has reached a degree of maturity sufficient to maintain economic efficiency in domestically producing rice as an import substitute. In the same manner, given the 1986 technology in the regional

Table 29—Summary of financial costs and returns of irrigated rice production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Yield: *Gabah* (Rough Rice)	Yield: Rice	Price of Output: Farmgate (*Gabah*)	Price of Output: Wholesale (Rice)	Current Inputs	Labor Costs	Land Rent	Capital and Other Costs	Total Production Costs	Processing or Marketing Costs	Total Costs	Net Financial Profit: Farm-gate	Net Financial Profit: Whole-sale
		(metric ton/hectare)		(Rp/kilogram)		(Rp/hectare)								
Irrigated														
West Java	IRT	4.516	2.935	170	350	75,455	180,101	186,732	64,870	507,158	78,717	585,875	260,562	441,375
East Java	IRT	4.984	3.240	179	372	89,323	166,938	186,732	55,870	498,863	117,418	616,281	393,273	588,999
West Sumatera	IRT	4.187	2.722	201	395	84,631	174,199	140,559	61,248	460,636	125,049	585,685	380,951	489,505
South Sulawesi	IRT	4.195	2.727	151	406	63,937	129,491	140,559	54,885	388,873	144,176	533,049	244,572	574,113
Java	IRT	4.765	3.097	175	361	80,851	165,285	186,732	56,239	489,106	97,648	586,755	342,386	531,262
Off Java	IRT	3.751	2.438	176	401	66,112	169,085	106,591	58,696	400,484	120,449	520,934	259,692	455,485
Indonesia	IRT	4.131	2.685	175	381	71,926	167,660	136,644	57,792	434,021	108,655	542,677	289,936	479,637
Irrigated														
West Java	IS	4.516	2.935	170	350	75,455	180,101	186,732	64,870	507,158	78,717	585,875	260,562	441,375
Central Java	IS	4.796	3.117	188	372	77,150	148,815	186,732	47,939	460,636	93,978	554,613	441,012	604,911
East Java	IS	4.984	3.240	179	350	89,323	166,938	186,732	55,870	498,863	102,287	601,150	393,273	532,850
West Sumatera	IS	4.187	2.722	201	406	84,631	174,199	140,559	61,248	460,636	83,021	543,657	380,951	561,475
Rest of Sumatera	IS	3.594	2.336	195	395	60,007	178,700	106,591	49,721	395,019	71,248	466,267	305,811	456,453
South Sulawesi	IS	4.195	2.727	151	322	63,937	129,491	140,559	54,885	388,873	111,752	500,625	244,572	377,469
Rest of Sulawesi	IS	3.551	2.308	172	360	61,162	201,905	106,591	76,421	446,080	94,582	540,662	164,692	290,218
Rest of Indonesia	IS	3.228	2.098	211	431	60,171	161,131	106,591	51,168	379,061	82,451	461,512	302,047	442,726
Java	IS	4.765	3.097	179	357	80,851	165,285	186,732	56,239	489,106	91,403	580,509	363,829	526,152
Off Java	IS	3.751	2.438	186	383	66,112	169,085	106,591	58,696	400,484	88,870	489,354	297,202	443,912
Indonesia	IS	4.131	2.685	183	373	71,926	167,660	136,644	57,792	434,021	90,887	524,909	323,501	477,268
Irrigated														
West Java	EP	4.516	2.935	170	350	75,455	180,101	186,732	64,870	507,158	138,385	645,544	260,562	381,706
Central Java	EP	4.796	3.117	188	372	77,150	148,815	186,732	47,939	460,636	143,850	604,485	441,012	555,039
East Java	EP	4.984	3.240	179	350	89,323	166,938	186,732	55,870	498,863	154,127	652,990	393,273	481,010
West Sumatera	EP	4.187	2.722	201	406	84,631	174,199	140,559	61,248	460,636	129,186	589,822	380,951	515,310
Rest of Sumatera	EP	3.594	2.336	195	395	60,007	178,700	106,591	49,721	395,019	110,867	505,886	305,811	416,834
South Sulawesi	EP	4.195	2.727	151	322	63,937	129,491	140,559	54,885	388,873	160,293	549,166	244,572	328,928
Rest of Sulawesi	EP	3.551	2.308	172	360	61,162	201,905	106,591	76,421	446,080	135,664	581,744	164,692	249,136
Rest of Indonesia	EP	3.228	2.098	211	431	60,171	161,131	106,591	51,168	379,061	121,055	500,115	302,047	404,123
Java	EP	4.765	3.097	179	357	80,851	165,285	186,732	56,239	489,106	145,425	634,531	363,829	472,130
Off Java	EP	3.751	2.438	186	383	66,112	169,085	106,591	58,696	400,484	131,740	532,224	297,202	401,043
Indonesia	EP	4.131	2.685	183	373	71,926	167,660	136,644	57,792	434,021	137,959	571,980	323,501	430,196

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Note: IRT is interregional trade, IS is import substitution, and EP is export promotion. Numbers may not add to totals due to rounding.

Table 30—Summary of economic efficiency indicators in irrigated rice production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Border Price		Yield	Gross Economic Returns	Economic Costs			Net Economic Profit	Domestic Resource Cost	Resource Cost Ratio
						Domestic	Foreign	Total			
		(US$/mt)	(Rp/mt)	(mt/hectare)		(Rp/hectare)				(Rp/US$)	
Irrigated											
West Java	IRT	202.91	296,857	2.935	871,276	499,907	201,147	701,054	170,222	1,091	0.640
East Java	IRT	202.91	296,857	3.240	961,818	524,786	237,720	762,506	199,312	1,060	0.622
West Sumatera	IRT	205.74	300,998	2.722	819,316	499,352	256,404	755,756	63,560	1,298	0.761
South Sulawesi	IRT	208.47	304,992	2.727	831,712	454,436	236,957	691,392	140,320	1,118	0.655
Java	IRT	202.91	296,857	3.097	919,367	501,391	214,333	715,724	203,643	1,040	0.610
Off Java	IRT	207.11	302,995	2.438	738,701	455,500	225,543	681,043	57,658	1,299	0.761
Indonesia	IRT	205.01	299,926	2.685	805,301	471,217	220,297	691,514	113,787	1,178	0.691
Irrigated											
West Java	IS	205.29	300,339	2.935	881,496	499,907	201,147	701,054	180,442	1,075	0.630
Central Java	IS	202.91	296,857	3.117	925,304	481,299	204,893	686,192	239,112	977	0.573
East Java	IS	202.91	296,857	3.240	961,818	517,024	231,819	748,843	212,975	1,036	0.607
West Sumatera	IS	205.18	300,178	2.722	817,085	477,792	240,013	717,805	99,280	1,211	0.710
Rest of Sumatera	IS	205.74	300,998	2.336	703,130	434,971	197,984	632,955	70,175	1,260	0.738
South Sulawesi	IS	209.98	307,201	2.727	837,736	437,802	224,311	662,113	175,623	1,044	0.612
Rest of Sulawesi	IS	209.98	307,201	2.308	709,019	475,155	204,637	679,792	29,227	1,378	0.808
Rest of Indonesia	IS	221.13	323,513	2.098	678,731	427,004	198,612	625,616	53,115	1,301	0.763
Java	IS	203.70	298,018	3.097	922,962	498,187	211,898	710,084	212,878	1,025	0.601
Off Java	IS	210.40	307,818	2.438	750,461	439,320	213,205	652,525	97,936	1,196	0.701
Indonesia	IS	207.89	304,143	2.685	816,624	462,215	213,245	675,460	141,164	1,121	0.657
Irrigated											
West Java	EP	153.00	223,839	2.935	656,967	534,920	220,297	755,217	−98,250	1,792	1.051
Central Java	EP	153.00	223,839	3.117	697,706	511,559	219,967	731,526	−33,820	1,567	0.918
East Java	EP	153.00	223,839	3.240	725,238	548,478	247,488	795,966	−70,728	1,680	0.985
West Sumatera	EP	153.00	223,839	2.722	609,290	505,558	254,196	759,754	−150,464	2,083	1.221
Rest of Sumatera	EP	153.00	223,839	2.336	522,888	458,800	210,155	668,955	−146,067	2,146	1.258
South Sulawesi	EP	153.00	223,839	2.727	610,409	466,794	239,413	706,207	−95,798	1,841	1.079
Rest of Sulawesi	EP	153.00	223,839	2.308	516,620	499,692	217,418	717,111	−200,491	2,443	1.432
Rest of Indonesia	EP	153.00	223,839	2.098	469,614	449,954	210,721	660,676	−191,062	2,543	1.491
Java	EP	153.00	223,839	3.097	693,229	530,545	228,618	759,163	−65,934	1,671	0.979
Off Java	EP	153.00	223,839	2.438	545,719	464,969	226,501	691,471	−145,752	2,131	1.249
Indonesia	EP	153.00	223,839	2.685	601,008	490,390	227,833	718,223	−117,215	1,923	1.127

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: mt is metric ton. IRT is interregional trade, IS is import substitution, and EP is export promotion.

Table 31—Break-even yield and border prices in irrigated rice production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Actual Yield	Break-even Yield	Actual Border Price, c.i.f. Adjusted	Break-even Border Price c.i.f. Adjusted	Break-even Border Price f.o.b. Source
		(metric ton/hectare)			(US$/metric ton)	
Irrigated						
West Java	IRT	4.516	3.165	202.91	146.69	108.48
East Java	IRT	4.984	3.408	202.91	145.10	106.89
West Sumatera	IRT	4.187	3.402	205.74	171.93	130.89
South Sulawesi	IRT	4.195	2.989	208.47	157.08	113.31
Java	IRT	4.765	3.205	202.91	142.21	104.00
Off Java	IRT	3.751	3.032	207.11	172.76	130.36
Indonesia	IRT	4.131	3.088	205.01	158.96	118.65
Irrigated						
West Java	IS	4.516	3.126	205.29	146.69	106.10
Central Java	IS	4.796	3.057	202.91	135.45	97.24
East Java	IS	4.984	3.358	202.91	142.45	104.24
West Sumatera	IS	4.187	3.254	205.18	163.17	122.69
Rest of Sumatera	IS	3.594	2.858	205.74	167.09	126.05
South Sulawesi	IS	4.195	2.858	209.98	150.34	105.06
Rest of Sulawesi	IS	3.551	3.006	209.98	181.29	136.01
Rest of Indonesia	IS	3.228	2.626	221.13	184.02	127.59
Java	IS	4.765	3.171	203.70	141.07	102.07
Off Java	IS	3.751	2.863	210.40	165.41	119.71
Indonesia	IS	4.131	2.980	207.89	155.20	112.01
Irrigated						
West Java	EP	4.516	4.698	153.00	158.15	158.15
Central Java	EP	4.796	4.472	153.00	144.45	144.45
East Java	EP	4.984	4.923	153.00	151.45	151.45
West Sumatera	EP	4.187	4.840	153.00	172.71	172.71
Rest of Sumatera	EP	3.594	4.265	153.00	176.63	176.63
South Sulawesi	EP	4.195	4.452	153.00	160.35	160.35
Rest of Sulawesi	EP	3.551	4.683	153.00	191.31	191.31
Rest of Indonesia	EP	3.228	4.334	153.00	194.38	194.38
Java	EP	4.765	4.685	153.00	150.88	150.88
Off Java	EP	3.751	4.432	153.00	175.30	175.30
Indonesia	EP	4.131	4.532	153.00	165.07	165.07

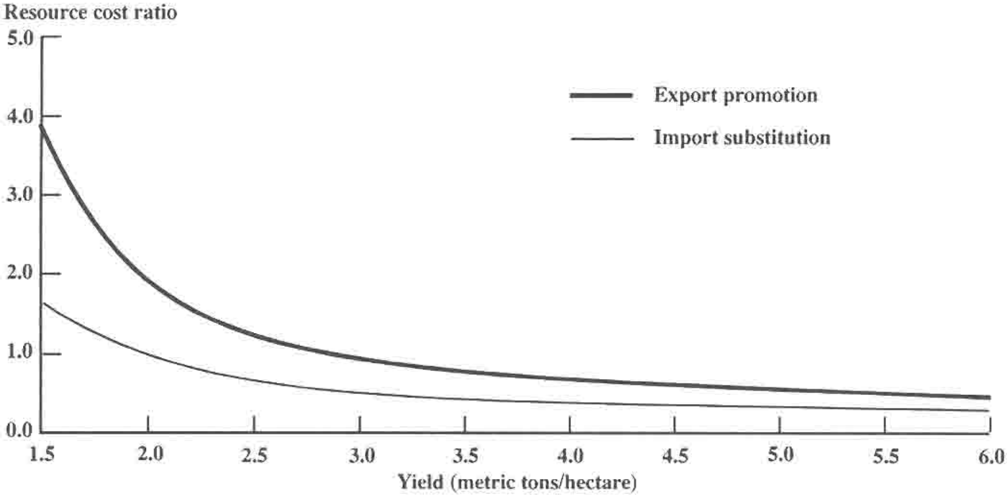
Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: IRT is interregional trade, IS is import substitution, and EP is export promotion.

rice production systems in Indonesia, the break-even border price of rice can range from US$107 to US$131 per ton (f.o.b.) under the interregional trade regime and from US$97 to US$136 per ton (f.o.b.) under the import substitution trade regime. The relationship between technology (average yields for Indonesia) and border prices, on the one hand, and the RCRs under the two trade regimes, on the other, are graphically shown in Figures 21 and 22. The relationship between RCR and border prices is also shown in Figure 22.

Except for Central and East Java, which have only marginal competitiveness, Indonesia appears to have no comparative advantage as a rice exporter at long-term world prices, according to the sensitivity analysis. Despite the devaluation in 1986, increases in input and marketing and transport costs rapidly reduced gains in competitiveness. Relatively slow projected productivity growth tends to weaken competitiveness.

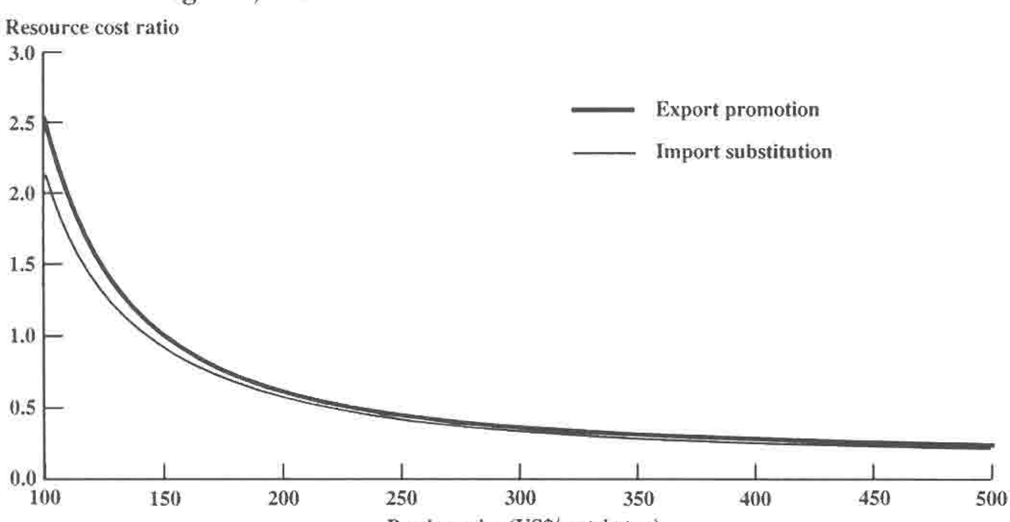
Figure 21—Sensitivity of resource cost ratio values to changes in yield levels of irrigated rice under export promotion and import substitution trade regimes, 1986



Note: The actual yield level is 2.69 metric tons per hectare.

The long-run prospect for Indonesia to export rice should also be viewed in the context of the international rice trade. The international market for rice is thin and unreliable (Siamwalla and Haykin 1983). Until recently Indonesia was a major importer in the international rice trade. Withdrawal of Indonesia from the world rice market as an importer has partly contributed to the current rice glut and deterioration of world market prices. If

Figure 22—Sensitivity of resource cost ratio values to changes in border prices of irrigated rice under export promotion and import substitution trade regimes, 1986



Notes: The actual border price is US$153.00 per metric ton and US$207.89 per metric ton under import substitution.

Indonesia attempts to become a major rice exporter in an already thin market, it will likely drive down world prices still further. Finally, the market for low-quality Indonesian rice is limited. Indonesia could attempt to produce high-quality rice for export, but the development needed for such a strategy would require a long gestation period with highly uncertain payoffs, and therefore cannot be viewed as a short- or medium-term solution.

Corn Production

Corn production had an impressive annual growth rate of 4.6 percent during the past two decades. This growth can be attributed to yield increases as a result of the introduction of improved open-pollinated varieties and greater use of fertilizer on corn. Locally bred varieties such as Harapan and Arjuna, which have partial resistance to downy mildew and are fertilizer responsive, have boosted the yield potentials in corn production. Hybrid corn seeds were also introduced in the early 1980s but adoption to date among small corn farmers is still limited. Corn is consumed as food, largely by those in the bottom fifth of the Indonesian income distribution in rural areas. But corn's use as feed in the growing chicken industry and its potential as an export crop are more important in the long-run expansion of corn demand than its use as food.

Financial Profitability

Corn prices at the farm level vary widely by regions in Indonesia (Table 32). Farmgate prices ranged from Rp 130 to Rp 184 per kilogram in 1986, and wholesale corn prices ranged from Rp 148 to Rp 210 per kilogram across regions. The total cost of production at the farm level for the open-pollinated varieties ranged from about Rp 126,900 per hectare to Rp 222,700 per hectare. The average cost per hectare was higher for hybrid varieties than for the open-pollinated varieties, ranging from Rp 271,700 per hectare to Rp 330,000 per hectare. However, because of relatively higher yields, the average net farm income from hybrid corn production was also higher than that from open-pollinated corn production in the same regions—Rp 225,700 per hectare with hybrids compared with Rp 80,200 per hectare with open-pollinated corn.

The average price of corn has generally been in the band between f.o.b. and c.i.f. prices in recent years. This is reflected in the moderately negative NPR relative to the c.i.f. price, but positive NPR relative to the f.o.b. price (Table 20). Seasonal corn price variability is so pronounced, however, that prices are often at or below the f.o.b. price immediately after harvest, rising above c.i.f. prices during the off-season.

Economic Performance

The economic indicators for corn production by region and production systems show that Indonesia has a comparative advantage in domestically producing corn as an import substitute. Computed at the 1986 average border price of US$115 per ton (c.i.f.) across regions under the import substitution and interregional trade regimes, the RCRs are all less than unity, ranging from 0.51 to 0.80 (Table 33). Bali and Nusa Tenggara and Sumatera appear to have the most economically efficient open-pollinated corn production systems, with RCRs of 0.51 and 0.58, respectively, for the import substitution trade regime. In general, as shown by their RCRs, the economic performance of the hybrid corn production systems was higher than that of open-pollinated corn in the regions where both production technologies were present.

Table 32—Summary of financial costs and returns of corn production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Yield	Price of Output: Farmgate	Price of Output: Wholesale	Current Inputs	Labor Costs	Land Rent	Capital and Other Costs	Total Production Costs	Processing/ Marketing Costs	Total Costs	Net Financial Profit: Farmgate	Net Financial Profit: Wholesale
		(mt/hectare)	(Rp/kilogram)		(Rp/hectare)								
Open-pollinated													
Central Java	IRT	1.999	132	161	30,358	66,786	78,721	35,602	211,467	67,366	278,833	52,401	43,006
East Java	IRT	1.904	130	161	30,358	72,967	78,721	17,804	199,850	74,770	274,620	47,670	31,924
Sumatera	IRT	1.863	178	161	25,431	90,789	37,056	19,288	172,564	57,436	230,000	159,050	69,943
Sulawesi	IRT	1.510	173	208	4,981	86,634	37,056	9,741	138,411	63,888	202,299	123,318	111,781
Bali and Nusa Tenggara	IRT	1.382	153	210	7,090	68,675	37,056	14,132	126,953	52,115	179,068	84,493	111,152
Java	IRT	1.876	131	161	31,939	75,685	78,721	25,066	211,411	68,446	279,857	34,345	22,179
Off Java	IRT	1.476	168	193	12,034	76,721	37,056	17,056	142,868	54,538	197,406	105,262	87,462
Indonesia	IRT	1.647	153	180	20,596	76,277	54,913	20,490	172,276	60,550	232,826	80,153	63,963
Hybrid													
Central Java	IRT	3.500	132	161	57,171	128,501	132,726	11,690	330,088	117,950	448,038	131,912	115,462
East Java	IRT	3.500	130	161	55,103	128,501	132,726	11,402	327,731	137,445	465,176	127,269	98,324
Sulawesi	IRT	3.500	173	208	56,959	128,501	71,823	14,450	271,733	148,085	419,818	334,922	308,182
Java	IRT	3.500	131	161	57,005	128,501	132,726	11,581	329,813	127,698	457,510	128,687	105,990
Off Java	IRT	3.500	168	193	57,273	128,501	71,824	14,462	272,060	129,325	401,385	316,325	274,115
Indonesia	IRT	3.500	153	180	57,239	128,501	112,425	12,547	310,712	128,674	439,386	225,719	191,314
Open-pollinated													
West Java	IS	1.725	140	161	34,908	87,302	78,721	21,784	222,715	26,306	249,022	18,785	28,703
Central Java	IS	1.999	132	154	30,358	66,786	78,721	35,602	211,467	37,141	248,608	52,401	59,238
East Java	IS	1.904	130	148	30,358	72,967	78,721	17,804	199,850	38,080	237,930	47,670	43,862
Sumatera	IS	1.863	178	204	25,431	90,789	37,056	19,288	172,564	36,925	209,489	159,050	170,563
Sulawesi	IS	1.510	173	202	4,981	86,634	37,056	9,741	138,411	42,658	181,068	123,318	123,453
Kalimantan	IS	1.147	184	210	10,833	60,787	37,056	25,071	133,746	21,506	155,253	77,302	85,617
Bali and Nusa Tenggara	IS	1.382	153	178	7,090	68,675	37,056	14,132	126,953	35,130	162,083	84,493	83,913
Java	IS	1.876	134	154	31,939	75,685	78,721	25,066	211,411	33,662	245,073	39,973	44,457
Off Java	IS	1.476	172	198	12,034	76,721	37,056	17,056	142,868	34,037	176,905	111,126	115,960
Indonesia	IS	1.647	156	180	20,596	76,277	54,913	20,490	172,276	34,368	206,644	84,263	89,033
Hybrid													
Central Java	IS	3.500	132	154	57,171	128,501	132,726	11,690	330,088	65,030	395,118	131,912	143,882
East Java	IS	3.500	130	148	55,103	128,501	132,726	11,402	327,731	70,000	397,731	127,269	120,269
Sulawesi	IS	3.500	173	202	56,959	128,501	71,823	14,450	271,733	98,875	370,608	334,922	335,237
Java	IS	3.500	134	154	57,005	128,501	132,726	11,581	329,813	62,802	392,614	139,187	147,552
Off Java	IS	3.500	172	198	57,273	128,501	71,824	14,462	272,060	80,710	352,770	330,229	341,692
Indonesia	IS	3.500	156	180	57,239	128,501	112,425	12,547	310,712	73,035	383,747	234,453	244,588

(Continued)

Table 32—Continued

Technology/ Region	Trade Regime	Yield	Price of Output		Current Inputs	Labor Costs	Land Rent	Capital and Other Costs	Total Production Costs	Processing/ Marketing Costs	Total Costs	Net Financial Profit	
			Farmgate	Wholesale								Farmgate	Wholesale
		(mt/hectare)	(Rp/kilogram)						(Rp/hectare)				
Open-pollinated													
West Java	EP	1.725	140	161	34,908	87,302	78,721	21,784	222,715	54,476	277,191	18,785	534
Central Java	EP	1.999	132	154	30,358	66,786	78,721	35,602	211,467	61,129	272,596	52,401	35,250
East Java	EP	1.904	130	148	30,358	72,967	78,721	17,804	199,850	60,928	260,778	47,670	21,014
Sumatera	EP	1.863	178	204	25,431	90,789	37,056	19,288	172,564	61,069	233,633	159,050	146,419
Sulawesi	EP	1.510	173	202	4,981	86,634	37,056	9,741	138,411	51,416	189,826	123,318	114,695
Kalimantan	EP	1.147	184	210	10,833	60,787	37,056	25,071	133,746	38,023	171,770	77,302	69,101
Bali and Nusa Tenggara	EP	1.382	153	178	7,090	68,675	37,056	14,132	126,953	53,373	180,325	84,493	65,671
Java	EP	1.876	134	154	31,939	75,685	78,721	25,066	211,411	58,881	270,292	39,973	19,237
Off Java	EP	1.476	172	198	12,034	76,721	37,056	17,056	142,868	51,143	194,011	111,126	98,853
Indonesia	EP	1.647	156	180	20,596	76,277	54,913	20,490	172,276	54,765	227,041	84,263	68,636
Hybrid													
Central Java	EP	3.500	132	154	57,171	128,501	132,726	11,690	330,088	107,030	437,118	131,912	101,882
East Java	EP	3.500	130	148	55,103	128,501	132,726	11,402	327,731	112,000	439,731	127,269	78,269
Sulawesi	EP	3.500	173	202	56,959	128,501	71,823	14,450	271,733	119,175	390,908	334,922	314,937
Java	EP	3.500	134	154	57,005	128,501	132,726	11,581	329,813	109,853	439,666	139,187	100,501
Off Java	EP	3.500	172	198	57,273	128,501	71,824	14,462	272,060	121,275	393,335	330,229	301,127
Indonesia	EP	3.500	156	180	57,239	128,501	112,425	12,547	310,712	116,380	427,092	234,453	201,243

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: IRT is interregional trade, IS is import substitution, and EP is export promotion. mt is metric ton. Numbers may not add to totals due to rounding.

Table 33—Summary of economic efficiency in corn production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Border Price		Yield	Gross Economic Returns	Economic Costs			Net Economic Profit	Domestic Resource Cost	Resource Cost Ratio
		In US$	In Rp			Domestic	Foreign	Total			
		(US$/mt)	(Rp/mt)	(mt/hectare)			(Rp/hectare)			(Rp/US$)	
Open-pollinated											
Central Java	IRT	110.01	160,945	1.999	321,728	211,351	73,091	284,442	37,286	1,244	0.729
East Java	IRT	110.01	160,945	1.904	306,439	217,140	75,202	292,342	14,097	1,374	0.805
Sumatera	IRT	110.01	160,945	1.863	299,840	186,554	53,262	239,816	60,024	1,107	0.649
Sulawesi	IRT	117.08	171,288	1.510	258,645	166,863	31,862	198,725	59,920	1,076	0.631
Bali and Nusa Tenggara	IRT	121.38	177,579	1.382	245,414	146,969	30,496	177,465	67,949	1,000	0.586
Java	IRT	110.01	160,945	1.876	301,932	217,765	67,593	285,358	16,574	1,360	0.797
Off Java	IRT	116.16	169,937	1.476	250,827	160,444	35,400	195,845	54,982	1,090	0.639
Indonesia	IRT	113.70	166,340	1.647	273,962	185,288	49,305	234,592	39,370	1,207	0.707
Hybrid											
Central Java	IRT	110.01	160,945	3.500	563,306	342,537	114,782	457,319	105,987	1,117	0.655
East Java	IRT	110.01	160,945	3.500	563,306	354,094	123,293	477,388	85,918	1,177	0.690
Sulawesi	IRT	117.08	171,288	3.500	599,508	309,037	126,831	435,868	163,640	957	0.561
Java	IRT	110.01	160,945	3.500	563,306	344,960	117,266	462,226	101,080	1,131	0.663
Off Java	IRT	116.16	169,937	3.500	594,780	298,304	118,953	417,258	177,522	917	0.538
Indonesia	IRT	113.70	166,340	3.500	582,191	330,663	118,216	448,879	133,312	1,043	0.611
Open-pollinated											
West Java	IS	112.39	164,427	1.725	283,636	205,611	39,951	245,563	38,073	1,234	0.724
Central Java	IS	110.01	160,945	1.999	321,728	195,846	61,303	257,149	64,579	1,100	0.645
East Java	IS	110.01	160,945	1.904	306,439	198,318	60,893	259,211	47,228	1,182	0.693
Sumatera	IS	112.90	165,173	1.863	307,717	175,624	45,644	221,268	86,449	980	0.575
Sulawesi	IS	111.00	162,393	1.510	245,213	155,562	23,966	179,528	65,685	1,029	0.603
Kalimantan	IS	121.38	177,579	1.147	203,683	128,051	16,374	144,424	59,259	1,000	0.586
Bali and Nusa Tenggara	IS	127.57	186,635	1.382	257,929	137,881	24,223	162,104	95,825	863	0.506
Java	IS	110.80	162,105	1.876	304,109	199,921	54,027	253,948	50,161	1,170	0.686
Off Java	IS	118.21	172,945	1.476	255,267	149,553	27,755	177,308	77,959	962	0.564
Indonesia	IS	115.04	168,299	1.647	277,189	171,606	39,328	210,934	66,255	1,055	0.619
Hybrid											
Central Java	IS	110.01	160,945	3.500	563,306	315,389	94,143	409,532	153,774	983	0.577
East Java	IS	110.01	160,945	3.500	563,306	319,495	96,990	416,485	146,821	1,002	0.588
Sulawesi	IS	111.00	162,393	3.500	568,376	282,843	108,528	391,371	177,005	900	0.528
Java	IS	110.80	162,105	3.500	567,368	311,668	91,957	403,625	163,743	959	0.562
Off Java	IS	118.21	172,945	3.500	605,307	272,477	100,825	373,302	232,005	790	0.463
Indonesia	IS	115.04	168,299	3.500	589,048	301,588	97,016	398,603	190,445	897	0.526

(continued)

Table 33—Continued

Technology/ Region	Trade Regime	Border Price In US$	Border Price In Rp	Yield	Gross Economic Returns	Economic Costs Domestic	Economic Costs Foreign	Economic Costs Total	Net Economic Profit	Domestic Resource Cost	Resource Cost Ratio
		(US$/mt)	(Rp/mt)	(mt/hectare)			(Rp/hectare)			(Rp/US$)	
Open-pollinated											
West Java	EP	68.00	99,484	1.725	171,610	221,787	49,323	271,110	−99,500	2,653	1.555
Central Java	EP	68.00	99,484	1.999	198,869	210,151	68,788	278,938	−80,069	2,364	1.386
East Java	EP	68.00	99,484	1.904	189,418	211,943	68,022	279,964	−90,546	2,554	1.497
Sumatera	EP	68.00	99,484	1.863	185,339	189,874	53,316	243,190	−57,851	2,104	1.233
Sulawesi	EP	68.00	99,484	1.510	150,221	160,055	27,381	187,436	−37,215	1,906	1.117
Kalimantan	EP	68.00	99,484	1.147	114,108	137,671	21,742	159,412	−45,304	2,181	1.278
Bali and Nusa Tenggara	EP	68.00	99,484	1.382	137,487	148,622	30,044	178,665	−41,178	2,024	1.186
Java	EP	68.00	99,484	1.876	186,632	214,734	62,107	276,841	−90,209	2,523	1.479
Off Java	EP	68.00	99,484	1.476	146,838	159,435	33,391	192,826	−45,988	2,056	1.205
Indonesia	EP	68.00	99,484	1.647	163,850	183,481	45,962	229,443	−65,593	2,277	1.335
Hybrid											
Central Java	EP	68.00	99,484	3.500	348,194	340,435	107,247	447,682	−99,488	2,067	1.212
East Java	EP	68.00	99,484	3.500	348,194	344,541	110,094	454,635	−106,441	2,117	1.241
Sulawesi	EP	68.00	99,484	3.500	348,194	293,257	116,445	409,702	−61,508	1,851	1.085
Java	EP	68.00	99,484	3.500	348,194	339,306	107,031	446,337	−98,143	2,058	1.207
Off Java	EP	68.00	99,484	3.500	348,194	295,912	114,188	410,100	−61,906	1,850	1.085
Indonesia	EP	68.00	99,484	3.500	348,194	326,824	111,112	437,936	−89,742	2,017	1.182

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: IRT is interregional trade, IS is import substitution, and EP is export promotion. mt is metric ton. Numbers may not add to totals due to rounding.

Moreover, the DRC estimates show that, given the 1986 corn input-output production coefficients and a 1995 projected corn border price of US$68 per ton, Indonesia has no comparative advantage in exporting corn. The RCRs for both the open-pollinated and hybrid corn production systems are greater than one, implying comparative disadvantage (Table 33). However, sensitivity analysis shows that Indonesia could have comparative advantage in corn exports, particularly with improved technology, if the f.o.b. price would climb to US$84 per ton (Table 34). Although some of the gains from the 1986 devaluation were reduced by cost increases, projected strong growth in corn yields could also achieve this competitiveness. The target should be off-Java hybrid production systems that have a higher comparative advantage than open-pollinated corn either on or off Java (Figures 23 and 24). A key to developing significant export capability is improvement in postharvest drying and storage, in order to maintain grain quality.

Soybean Production

Soybeans are an increasingly important commodity in the Indonesian diet, consumed in the form of tofu (bean curd), tempe (fermented soybeans), or other soybean derivatives. To satisfy domestic demand, the government of Indonesia imports soybeans but restricts imports to maintain high domestic prices. For example, during the period 1983-85, an average of 374,000 tons of soybeans each year were imported for food. In addition, soybean meal imports averaged 167,000 tons.

Since Indonesia imports both dried soybeans and soybean meal, production of dried soybeans and integrated processing of domestically produced soybeans into soybean meals are analyzed here. Unfortunately, no data on soybean crushing costs were available for the study period. Because of this data problem, the average processing costs of two soybean plants in the Philippines, with a total rated capacity of 600 tons of soybeans per day, were used to provide indicative results.

In this analysis, the border price of domestically produced beans is discounted 25 percent relative to world prices because the quality of domestically produced soybeans is inferior to the imported ones for some uses. Domestically produced soybeans are used for making tofu, tempe, and soy sauce. The tempe industry prefers imported soybeans to domestically produced beans because the imported beans are larger and of better quality. Imported soybeans significantly outyield domestically produced soybeans in tempe production (Santoso et al. 1986). Domestically produced soybeans are also inferior for processing into feed rations because they are smaller and more fibrous than the imported beans. Domestic beans are more competitive in the tofu industry, which uses both types of beans, and in the soy sauce industry, where the taste of the domestic beans is preferred.

In crushing soybeans, two products are extracted: soybean meal and soybean oil. A ton of dried soybeans yields 774.2 kilograms of meal, 176.4 kilograms of oil, 20 kilograms of impurities, and 29.4 kilograms of processing waste. The estimated financial processing cost is US$40.15 per ton of dried beans, net of impurities. This is approximately Rp 59,000 per ton, using the 1986 exchange rate. In computing for the economic returns, the economic value of soybean oil is also included.

Financial Profitability

The financial viability of soybean production is shown in Table 35. Two types of production technologies—traditional and improved—are analyzed. In the farm samples,

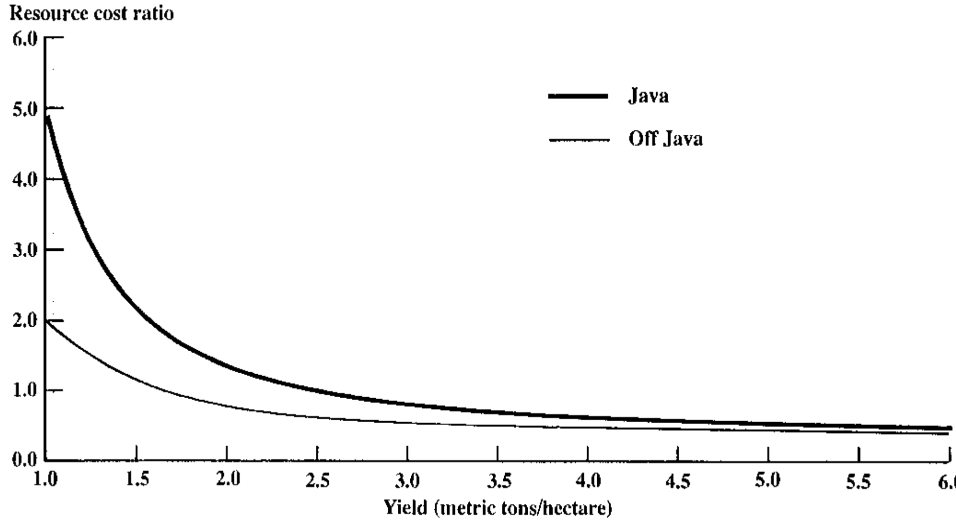
Table 34—Break-even yield and border prices in corn production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Actual Yield	Break-even Yield	Actual Border Price, c.i.f Adjusted	Break-even Border Price c.i.f Adjusted	Break-even Border Price f.o.b. Source
		(metric ton/hectare)			(US$/metric ton)	
Open-pollinated						
Central Java	IRT	1.999	1.493	110.01	86.97	51.96
East Java	IRT	1.904	1.554	110.01	93.85	58.84
Sumatera	IRT	1.863	1.224	110.01	78.24	43.23
Sulawesi	IRT	1.510	0.896	117.08	79.20	37.12
Bali and Nusa Tenggara	IRT	1.382	0.775	121.38	77.42	31.04
Java	IRT	1.876	1.512	110.01	92.68	57.67
Off Java	IRT	1.476	0.918	116.16	80.12	38.96
Indonesia	IRT	1.647	1.163	113.70	86.41	47.71
Hybrid						
Central Java	IRT	3.500	2.337	110.01	79.79	44.78
East Java	IRT	3.500	2.439	110.01	83.39	48.38
Sulawesi	IRT	3.500	1.977	117.08	76.53	34.45
Java	IRT	3.500	2.351	110.01	80.68	45.67
Off Java	IRT	3.500	1.922	116.16	73.19	32.03
Indonesia	IRT	3.500	2.173	113.70	78.47	39.77
Open-pollinated						
West Java	IS	1.725	1.282	112.39	85.70	48.31
Central Java	IS	1.999	1.364	110.01	78.39	43.38
East Java	IS	1.904	1.382	110.01	82.92	47.91
Sumatera	IS	1.863	1.114	112.90	72.01	34.11
Sulawesi	IS	1.510	0.878	111.00	71.24	35.24
Kalimantan	IS	1.147	0.669	121.38	75.20	28.82
Bali and Nusa Tenggara	IS	1.382	0.685	127.57	70.47	17.90
Java	IS	1.876	1.342	110.80	82.16	46.36
Off Java	IS	1.476	0.831	118.21	72.25	29.04
Indonesia	IS	1.647	1.047	115.04	77.40	37.36
Hybrid						
Central Java	IS	3.500	2.136	110.01	71.21	36.20
East Java	IS	3.500	2.169	110.01	72.45	37.44
Sulawesi	IS	3.500	1.937	111.00	68.57	32.57
Java	IS	3.500	2.087	110.80	70.16	34.36
Off Java	IS	3.500	1.741	118.21	65.33	22.12
Indonesia	IS	3.500	1.955	115.04	69.46	29.42
Open-pollinated						
West Java	EP	1.725	2.650	68.00	94.91	94.91
Central Java	EP	1.999	2.674	68.00	85.15	85.15
East Java	EP	1.904	2.730	68.00	89.67	89.67
Sumatera	EP	1.863	2.288	68.00	79.31	79.31
Sulawesi	EP	1.510	1.712	68.00	74.53	74.53
Kalimantan	EP	1.147	1.503	68.00	83.32	83.32
Bali and Nusa Tenggara	EP	1.382	1.678	68.00	77.90	77.90
Java	EP	1.876	2.686	68.00	89.73	89.73
Off Java	EP	1.476	1.805	68.00	78.79	78.79
Indonesia	EP	1.647	2.195	68.00	84.38	84.38
Hybrid						
Central Java	EP	3.500	4.187	68.00	77.96	77.96
East Java	EP	3.500	4.285	68.00	79.21	79.21
Sulawesi	EP	3.500	3.777	68.00	71.86	71.86
Java	EP	3.500	4.177	68.00	77.73	77.73
Off Java	EP	3.500	3.779	68.00	71.86	71.86
Indonesia	EP	3.500	4.100	68.00	76.44	76.44

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: IRT is interregional trade, IS is import substitution, and EP is export promotion.

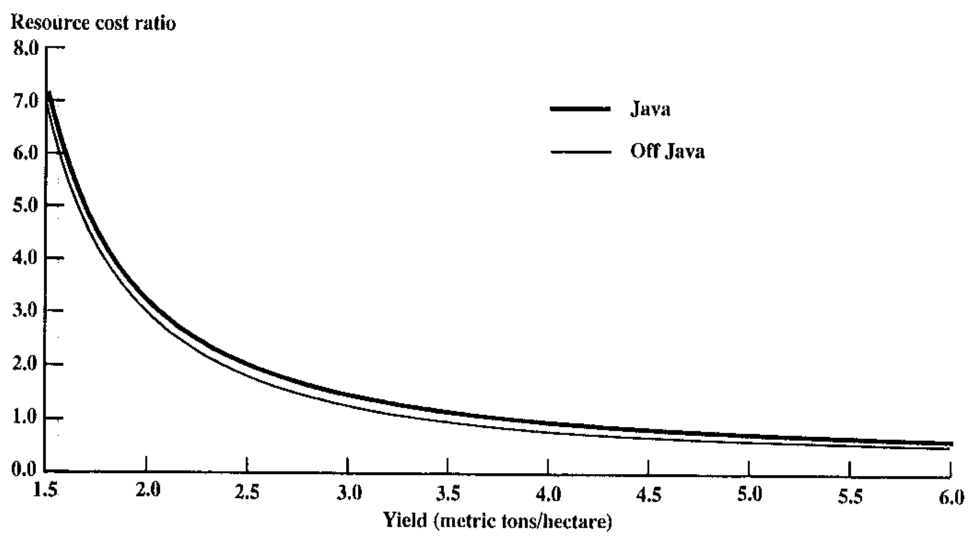
Figure 23—Sensitivity of resource cost ratio values to changes in yields of open-pollinated corn, Java and off Java, 1986



Note: On Java, the actual yield is 1.88 metric tons per hectare; off Java, the actual yield is 1.48 metric tons per hectare.

traditional soybean production technology has yields ranging from 0.8 ton per hectare (Kalimantan) to 1.0 ton per hectare (Central and East Java). Improved soybean technology has yields of 1.6 tons per hectare. However, with improved technology, the costs of material inputs (such as fertilizer) and labor are also higher. Margins between farmgate and wholesale prices are high for soybeans, averaging 21 percent. The financial data also

Figure 24—Sensitivity of resource cost ratio values to changes in yields of hybrid corn, under an export promotion trade regime, 1986



Note: On Java, the actual yield is 3.50 metric tons per hectare; off Java, the actual yield is also 3.50 metric tons per hectare.

Table 35—Summary of financial costs and returns of soybean production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Yield	Price of Output: Farmgate	Price of Output: Wholesale	Current Inputs	Labor Costs	Land Rent	Capital and Other Costs	Total Production Costs	Processing/ Marketing Costs	Total Costs	Net Financial Profit: Farmgate	Net Financial Profit: Wholesale
		(mt/hectare)	(Rp/kilogram)						(Rp/hectare)				
Traditional													
Central Java	IRT	1.019	488	613	40,576	129,860	132,726	15,352	318,514	34,340	352,854	178,758	271,793
East Java	IRT	1.060	478	613	40,108	116,173	132,726	21,713	310,720	46,979	357,699	195,960	292,081
Bali and Nusa Tenggara	IRT	0.875	490	639	31,638	115,888	71,823	17,174	236,524	31,684	268,207	192,226	290,918
Java	IRT	0.964	483	613	45,611	123,833	132,726	20,856	323,026	37,606	360,632	142,586	230,300
Off Java	IRT	0.858	490	639	30,349	113,011	71,824	19,517	234,700	31,068	265,768	185,720	282,494
Indonesia	IRT	0.903	485	622	36,864	117,649	97,925	20,090	272,527	34,383	306,911	165,729	254,454
Improved													
Central Java	IRT	1.600	488	613	75,656	144,115	132,726	16,831	369,327	53,920	423,247	411,473	557,553
East Java	IRT	1.600	478	613	74,295	144,115	132,726	17,209	368,345	70,912	439,257	396,455	541,543
Java	IRT	1.600	483	613	75,618	144,115	132,726	17,046	369,504	62,416	431,920	403,296	548,880
Indonesia	IRT	1.600	485	622	75,898	144,115	132,726	17,057	369,796	60,923	430,719	406,737	563,948
Traditional													
West Java	IS	0.813	512	613	56,936	125,467	132,726	25,535	340,664	12,398	353,062	75,592	145,307
Central Java	IS	1.019	488	582	40,576	129,860	132,726	15,352	318,514	18,933	337,447	178,758	255,611
East Java	IS	1.060	478	576	40,108	116,173	132,726	21,713	310,720	21,200	331,920	195,960	278,640
Sumatera	IS	0.833	471	565	26,618	119,845	71,823	19,569	237,855	18,643	256,498	154,488	214,147
Sulawesi	IS	0.939	431	525	32,536	114,695	71,823	21,943	240,997	26,527	267,524	163,712	225,451
Kalimantan	IS	0.785	522	639	30,851	101,615	71,823	19,390	223,678	14,719	238,397	186,092	263,218
Bali and Nusa Tenggara	IS	0.875	490	599	31,638	115,888	71,823	17,174	236,524	22,243	258,766	192,226	265,359
Java	IS	0.964	493	590	45,611	123,833	132,726	20,856	323,026	17,297	340,324	151,904	228,757
Off Java	IS	0.858	479	582	30,349	113,011	71,824	19,517	234,700	20,335	255,035	175,853	244,321
Indonesia	IS	0.903	485	586	36,864	117,649	97,925	20,090	272,527	19,173	291,701	165,041	237,070
Improved													
Central Java	IS	1.600	488	582	75,656	144,115	132,726	16,831	369,327	29,728	399,055	411,473	532,145
East Java	IS	1.600	478	576	74,295	144,115	132,726	17,209	368,345	32,000	400,345	396,455	521,255
Java	IS	1.600	493	590	75,618	144,115	132,726	17,046	369,504	28,709	398,214	418,762	546,320
Indonesia	IS	1.600	485	586	75,898	144,115	132,726	17,057	369,796	33,973	403,769	405,518	533,145

(continued)

Table 35—Continued

Technology/ Region	Trade Regime	Yield	Price of Output		Current Inputs	Labor Costs	Land Rent	Capital and Other Costs	Total Production Costs	Processing/ Marketing Costs	Total Costs	Net Financial Profit	
			Farmgate	Wholesale								Farmgate	Wholesale
		(mt/hectare)	(Rp/kilogram)						(Rp/hectare)				
Traditional													
West Java	EP	0.813	512	613	56,936	125,467	132,726	25,535	340,664	29,130	369,794	75,592	128,575
Central Java	EP	1.019	488	582	40,576	129,860	132,726	15,352	318,514	35,492	354,006	178,758	239,052
East Java	EP	1.060	478	576	40,108	116,173	132,726	21,713	310,720	38,425	349,145	195,960	261,415
Sumatera	EP	0.833	471	565	26,618	119,845	71,823	19,569	237,855	32,978	270,834	154,488	199,812
Sulawesi	EP	0.939	431	525	32,536	114,695	71,823	21,943	240,997	43,476	284,473	163,712	208,502
Kalimantan	EP	0.785	522	639	30,851	101,615	71,823	19,390	223,678	29,359	253,037	186,092	248,578
Bali and North Tenggara	EP	0.875	490	599	31,638	115,888	71,823	17,174	236,524	37,511	274,035	192,226	250,090
Java	EP	0.964	493	590	45,611	123,833	132,726	20,856	323,026	34,354	357,380	151,904	211,701
Off Java	EP	0.858	479	582	30,349	113,011	71,824	19,517	234,700	35,641	270,342	175,853	229,014
Indonesia	EP	0.903	485	586	36,864	117,649	97,925	20,090	272,527	35,226	307,753	165,041	221,018
Improved													
Central Java	EP	1.600	488	582	75,656	144,115	132,726	16,831	369,327	55,728	425,055	411,473	506,145
East Java	EP	1.600	478	576	74,295	144,115	132,726	17,209	368,345	58,000	426,345	396,455	495,255
Java	EP	1.600	493	590	75,618	144,115	132,726	17,046	369,504	57,019	426,523	418,762	518,010
Indonesia	EP	1.600	485	586	75,898	144,115	132,726	17,057	369,796	62,416	432,212	405,518	504,702

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Note: IRT is interregional trade, IS is import substitution, and EP is export promotion. mt is metric ton. Numbers may not add to totals due to rounding.

show that the improved soybean production system has the highest net farm financial income, averaging Rp 406,000 per hectare. Among the traditional soybean production systems in the region in 1986, East Java had the highest net farm income of Rp 195,960 per hectare, followed by Bali and Nusa Tenggara at Rp 192,226 per hectare. Soybean production in West Java has the lowest net financial farm income of all at Rp 75,592 per hectare.

Imports of soybeans and soymeals are controlled by BULOG, the national logistics (planning) agency, which also controls soybean pricing policies. Historically, the output price of soybeans is highly protected in Indonesia. That the total EPRs for soybeans are also very high implies that soybean producers benefit from domestic trade and pricing policies.

Economic Performance

Economic indicators regarding the production of dried soybeans are presented in Table 36. As noted earlier, to account for quality differences between domestically produced soybeans and imports, the border price of the domestically produced soybeans is adjusted downward. Given the current state of soybean production technology and production costs across regions, Indonesia in general has no comparative advantage in producing dried soybeans as an import substitute. This comparative disadvantage is shown by RCRs well above unity across regions in 1986. Such noncompetitiveness is also found in a more recent study (Pribadi and Sampath 1990).

Sensitivity analysis also indicates that even if the currently available improved soybean production technologies were more widely adopted, Indonesia lacks a comparative advantage because additional inputs have only a limited incremental impact on soybean yields. One of the major constraints that impede the economic viability of soybean production in Indonesia is the lack of quality seeds widely adapted to the agroclimatic conditions of Indonesia.

The analysis of the feasibility of integrating domestic production of soybeans with crushing and processing of dried beans into soybean meal and soybean oil under import substitution also indicates that Indonesia has no comparative advantage in pursuing this economic activity. The RCRs are all much greater than one, implying a comparative disadvantage (Table 37). However, these results should be interpreted with caution until soybean-crushing cost data become available for Indonesia.

Yields Needed to Attain Efficiency

Under current soybean production technology, Indonesia has no comparative advantage in production of dried soybeans for import substitution, for export, or for domestic processing of soybean meal. Under the production system using traditional technology, soybean yields on the average should not be lower than 1.24 tons per hectare for Indonesia to attain comparative advantage in domestically producing soybeans as a substitute for imports (Table 38). Under the improved technology system, the break-even point for yields of soybeans to be an efficient import substitute is about 1.835 tons per hectare, given the current border price adjusted for quality of imported soybeans. The break-even yields for domestic soybean production to be efficient as an export crop are much higher, 2.731 tons per hectare under improved technology and an average of 1.849 tons per hectare under traditional production technology (Table 38).

Table 36—Summary of economic efficiency in soybean production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Border Price			Gross Economic Returns	Economic Costs			Net Economic Profit	Domestic Resource Cost	Resource Cost Ratio
		In US$	In Rp	Yield		Domestic	Foreign	Total			
		(US$/mt)	(Rp/mt	(mt/hectare)		(Rp/hectare)				(Rp/US$)	
Traditional											
Central Java	IRT	144.81	211,857	1.019	215,882	318,011	45,691	363,702	–147,820	2,734	1.603
East Java	IRT	144.81	211,857	1.060	224,568	322,664	65,284	387,948	–163,380	2,964	1.737
Bali and Nusa Tenggara	IRT	164.33	240,407	0.875	210,357	247,702	41,373	289,075	–78,718	2,145	1.257
Java	IRT	144.81	211,857	0.964	204,230	321,259	46,607	367,866	–163,636	2,982	1.748
Off Java	IRT	164.33	240,415	0.858	206,276	242,002	41,863	283,865	–77,589	2,153	1.262
Indonesia	IRT	151.32	221,381	0.903	199,907	276,163	44,103	320,266	–120,359	2,593	1.520
Improved											
Central Java	IRT	144.81	211,857	1.600	338,971	373,927	102,645	476,572	–137,601	2,315	1.357
East Java	IRT	144.81	211,857	1.600	338,971	389,005	112,875	501,880	–162,909	2,517	1.476
Java	IRT	144.81	211,857	1.600	338,971	375,301	103,768	479,068	–140,097	2,334	1.368
Indonesia	IRT	151.32	221,381	1.600	354,210	374,164	102,381	476,544	–122,334	2,174	1.274
Traditional											
West Java	IS	146.60	214,468	0.813	174,363	317,165	23,742	340,906	–166,543	3,081	1.806
Central Java	IS	144.81	211,857	1.019	215,882	310,107	39,683	349,789	–133,907	2,575	1.509
East Java	IS	144.81	211,857	1.060	224,568	309,439	55,230	364,670	–140,102	2,673	1.567
Sumatera	IS	147.87	216,334	0.833	180,206	240,549	51,813	292,362	–112,156	2,741	1.607
Sulawesi	IS	150.69	220,459	0.939	207,011	246,755	45,562	292,316	–85,305	2,236	1.311
Kalimantan	IS	157.12	229,863	0.785	180,442	224,559	21,908	246,467	–66,025	2,072	1.215
Bali and Nusa Tenggara	IS	164.33	240,407	0.875	210,357	242,785	37,760	280,545	–70,188	2,058	1.206
Java	IS	145.41	212,735	0.964	205,076	310,840	38,687	349,528	–144,452	2,733	1.602
Off Java	IS	155.00	226,765	0.858	194,564	236,424	37,744	274,168	–79,604	2,206	1.293
Indonesia	IS	150.89	220,752	0.903	199,339	268,335	38,195	306,530	–107,191	2,436	1.428
Improved											
Central Java	IS	144.81	211,857	1.600	338,971	361,516	93,211	454,727	–115,756	2,152	1.262
East Java	IS	144.81	211,857	1.600	338,971	369,043	97,700	466,742	–127,771	2,238	1.312
Java	IS	145.41	212,735	1.600	340,376	358,009	90,622	448,631	–108,255	2,097	1.229
Indonesia	IS	150.89	220,752	1.600	353,203	360,293	91,912	452,206	–99,003	2,017	1.183

(continued)

Table 36—Continued

Technology/ Region	Trade Regime	Border Price In US$	Border Price In Rp	Yield	Gross Economic Returns	Economic Costs Domestic	Economic Costs Foreign	Economic Costs Total	Net Economic Profit	Domestic Resource Cost	Resource Cost Ratio
		(US$/mt)	(Rp/mt	(mt/hectare)		(Rp/hectare)				(Rp/US$)	
Traditional											
West Java	EP	115.31	168,702	0.813	137,155	326,993	29,102	356,095	–218,940	4,427	2.595
Central Java	EP	115.31	168,702	1.019	171,908	320,162	44,680	364,842	–192,934	3,682	2.158
East Java	EP	115.31	168,702	1.060	178,824	319,899	60,429	380,328	–201,504	3,953	2.317
Sumatera	EP	115.31	168,702	0.833	140,529	249,179	56,210	305,389	–164,860	4,323	2.534
Sulawesi	EP	115.31	168,702	0.939	158,411	256,887	50,826	307,713	–149,302	3,493	2.048
Kalimantan	EP	115.31	168,702	0.785	132,431	233,272	26,493	259,765	–127,334	3,221	1.888
Bali and Nusa Tenggara	EP	115.31	168,702	0.875	147,614	251,958	42,461	294,418	–146,804	3,505	2.055
Java	EP	115.31	168,699	0.964	162,625	321,066	43,957	365,024	–202,399	3,958	2.320
Off Java	EP	115.31	168,699	0.858	144,743	245,590	42,484	288,074	–143,331	3,514	2.060
Indonesia	EP	115.31	168,699	0.903	152,335	277,953	43,161	321,114	–168,779	3,725	2.184
Improved											
Central Java	EP	115.31	168,702	1.600	269,924	377,304	101,057	478,362	–208,438	3,269	1.916
East Java	EP	115.31	168,702	1.600	269,924	384,831	105,546	490,377	–220,453	3,425	2.008
Java	EP	115.31	168,699	1.600	269,918	374,982	99,370	474,351	–204,433	3,217	1.886
Indonesia	EP	115.31	168,699	1.600	269,918	377,335	100,712	478,047	–208,129	3,263	1.913

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: IRT is interregional trade, IS is import substitution, and EP is export promotion. mt is metric ton. Numbers may not add to totals due to rounding.

Table 37—Summary of economic efficiency in soybean meal and oil production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Border Price: Soybean Meal	Border Price: Soybean Oil	Yield: Soybean Meal	Yield: Soybean Oil	Gross Economic Returns	Economic Costs: Domestic	Economic Costs: Foreign	Economic Costs: Total	Net Economic Profit	Domestic Resource Cost	Resource Cost Ratio
		(Rp/metric ton)		(metric ton/hectare)			(Rp/hectare)				(Rp/US$)	
Traditional												
Central Java	IRT	238,147	351,120	0.59	0.14	188,384	341,906	62,508	404,414	–216,030	3,974	2.330
East Java	IRT	238,147	351,120	0.62	0.14	195,617	347,520	82,777	430,298	–234,681	4,506	2.641
Bali and Nusa Tenggara	IRT	276,214	351,120	0.51	0.12	181,047	268,220	55,813	324,033	–142,986	3,133	1.837
Java	IRT	238,147	351,120	0.56	0.13	178,306	343,864	62,516	406,380	–228,074	4,345	2.547
Off Java	IRT	276,214	351,120	0.50	0.11	177,582	262,122	56,022	318,145	–140,563	3,155	1.849
Indonesia	IRT	250,831	351,120	0.52	0.12	173,219	297,338	59,005	356,343	–183,124	3,809	2.233
Hybrid												
Central Java	IRT	238,147	351,120	0.93	0.21	295,676	411,446	129,050	540,496	–244,820	3,613	2.118
East Java	IRT	238,147	351,120	0.93	0.21	295,676	426,524	139,280	565,804	–270,128	3,990	2.339
Java	IRT	238,147	351,120	0.93	0.21	295,676	412,820	130,172	542,992	–247,316	3,649	2.139
Indonesia	IRT	250,831	351,120	0.93	0.21	307,460	411,683	128,785	540,468	–233,008	3,371	1.976
Traditional												
West Java	IS	241,629	351,120	0.47	0.11	151,970	336,229	37,159	373,388	–221,418	4,284	2.512
Central Java	IS	238,147	351,120	0.59	0.14	188,384	334,002	56,499	390,501	–202,117	3,705	2.172
East Java	IS	238,147	351,120	0.62	0.14	195,617	334,296	72,723	407,019	–211,402	3,980	2.333
Sumatera	IS	244,116	351,120	0.48	0.11	156,775	260,083	65,560	325,643	–168,868	4,171	2.445
Sulawesi	IS	249,617	351,120	0.55	0.12	179,580	268,774	61,058	329,832	–150,252	3,318	1.945
Kalimantan	IS	262,155	351,120	0.46	0.10	156,059	242,967	34,863	277,830	–121,771	2,933	1.719
Bali and Nusa Tenggara	IS	276,214	351,120	0.51	0.12	181,047	263,304	52,200	315,503	–134,456	2,990	1.753
Java	IS	239,303	351,120	0.56	0.13	178,953	333,446	54,596	388,042	–209,089	3,923	2.300
Off Java	IS	258,029	351,120	0.50	0.11	168,526	256,544	51,904	308,448	–139,922	3,218	1.887
Indonesia	IS	249,997	351,120	0.52	0.12	172,782	289,510	53,097	342,607	–169,825	3,539	2.075
Hybrid												
Central Java	IS	238,147	351,120	0.93	0.21	295,676	399,036	119,615	518,651	–222,975	3,316	1.944
East Java	IS	238,147	351,120	0.93	0.21	295,676	406,562	124,104	530,666	–234,990	3,467	2.032
Java	IS	239,303	351,120	0.93	0.21	296,750	395,529	117,027	512,555	–215,805	3,220	1.887
Indonesia	IS	249,997	351,120	0.93	0.21	306,685	397,813	118,317	516,130	–209,445	3,090	1.811

(continued)

Table 37—Continued

Technology/ Region	Trade Regime	Border Price		Yield		Gross Economic Returns	Economic Costs			Net Economic Profit	Domestic Resource Cost	Resource Cost Ratio
		Soybean Meal	Soybean Oil	Soybean Meal	Soybean Oil		Domestic	Foreign	Total			
		(Rp/metric ton)		(metric ton/hectare)			(Rp/hectare)				(Rp/US$)	
Traditional												
West Java	EP	174,024	351,120	0.47	0.11	120,060	346,057	42,519	388,576	–268,516	6,529	3.828
Central Java	EP	174,024	351,120	0.59	0.14	150,423	344,057	61,496	405,553	–255,130	5,660	3.318
East Java	EP	174,024	351,120	0.62	0.14	156,181	344,755	77,922	422,677	–266,496	6,445	3.778
Sumatera	EP	174,024	351,120	0.48	0.11	122,851	268,713	69,957	338,670	–215,819	7,432	4.357
Sulawesi	EP	174,024	351,120	0.55	0.12	138,382	278,906	66,322	345,229	–206,847	5,663	3.319
Kalimantan	EP	174,024	351,120	0.46	0.10	115,871	251,680	39,448	291,127	–175,256	4,818	2.824
Bali and Nusa Tenggara	EP	174,024	351,120	0.51	0.12	129,134	272,476	56,901	329,377	–200,243	5,519	3.235
Java	EP	174,024	351,120	0.56	0.13	142,397	343,672	59,866	403,538	–261,141	6,092	3.571
Off Java	EP	174,024	351,120	0.50	0.11	126,692	265,710	56,643	322,354	–195,662	5,550	3.253
Indonesia	EP	174,024	351,120	0.52	0.12	132,972	299,128	58,063	357,191	–224,219	5,842	3.425
Hybrid												
Central Java	EP	174,024	351,120	0.93	0.21	236,106	414,824	127,462	542,286	–306,180	5,586	3.275
East Java	EP	174,024	351,120	0.93	0.21	236,106	422,350	131,951	554,301	–318,195	5,933	3.478
Java	EP	174,024	351,120	0.93	0.21	236,106	412,501	125,774	538,275	–302,169	5,470	3.206
Indonesia	EP	174,024	351,120	0.93	0.21	236,106	414,854	127,116	541,971	–305,865	5,569	3.264

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: IRT is interregional trade, IS is import substitution, and EP is export promotion. Numbers may not add to totals due to rounding.

Table 38—Break-even yield and border prices in soybean production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Actual Yield	Break-even Yield	Actual Border Price, c.i.f Adjusted	Break-even Border Price c.i.f Adjusted	Break-even Border Price f.o.b. Source
		(metric ton/hectare)			(US$/metric ton)	
Traditional						
Central Java	IRT	1.019	1.576	144.81	213.60	169.77
East Java	IRT	1.060	1.730	144.81	220.54	176.71
Bali and Nusa Tenggara	IRT	0.875	1.081	164.33	198.27	128.42
Java	IRT	0.964	1.621	144.81	228.41	184.58
Off Java	IRT	0.858	1.063	164.33	198.69	128.84
Indonesia	IRT	0.903	1.330	151.32	212.67	160.17
Improved						
Central Java	IRT	1.600	2.059	144.81	180.85	137.02
East Java	IRT	1.600	2.214	144.81	190.75	146.92
Java	IRT	1.600	2.083	144.81	181.83	138.00
Indonesia	IRT	1.600	1.964	151.32	180.83	128.33
Traditional						
West Java	IS	0.813	1.414	146.60	248.65	202.44
Central Java	IS	1.019	1.476	144.81	205.02	161.19
East Java	IS	1.060	1.552	144.81	206.74	162.91
Sumatera	IS	0.833	1.227	147.87	211.80	163.89
Sulawesi	IS	0.939	1.194	150.69	187.21	135.54
Kalimantan	IS	0.785	0.944	157.12	186.77	126.53
Bali and Nusa Tenggara	IS	0.875	1.037	164.33	192.15	122.30
Java	IS	0.964	1.470	145.41	216.46	171.84
Off Java	IS	0.858	1.080	155.00	191.60	134.18
Indonesia	IS	0.903	1.242	150.89	203.11	151.18
Improved						
Central Java	IS	1.600	1.927	144.81	172.27	128.44
East Java	IS	1.600	1.985	144.81	176.95	133.12
Java	IS	1.600	1.889	145.41	169.88	125.26
Indonesia	IS	1.600	1.835	150.89	171.27	119.34
Traditional						
West Java	EP	0.813	2.052	115.31	260.25	260.25
Central Java	EP	1.019	2.071	115.31	214.15	214.15
East Java	EP	1.060	2.183	115.31	215.88	215.88
Sumatera	EP	0.833	1.784	115.31	221.48	221.48
Sulawesi	EP	0.939	1.803	115.31	197.37	197.37
Kalimantan	EP	0.785	1.468	115.31	197.27	197.27
Bali and Nusa Tenggara	EP	0.875	1.707	115.31	201.97	201.97
Java	EP	0.964	2.088	115.31	226.41	226.41
Off Java	EP	0.858	1.664	115.31	201.64	201.64
Indonesia	EP	0.903	1.849	115.31	213.11	213.11
Improved						
Central Java	EP	1.600	2.705	115.31	181.41	181.41
East Java	EP	1.600	2.793	115.31	186.09	186.09
Java	EP	1.600	2.684	115.31	179.84	179.84
Indonesia	EP	1.600	2.731	115.31	181.27	181.27

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: IRT is interregional trade, IS is import substitution, and EP is export promotion.

Cassava Production

For several years, dried cassava has been one of the major commodity exports of Indonesia. In recent years, the domestic demand for cassava starch in foods has increased rapidly in Indonesia, partly contributing to Indonesia's failure to meet its quota for cassava exports to the European Community. The other main reason is the shift in cultivation from cassava to rice and other crops such as soybeans and corn in some regions due to the relative financial profitability of these crops. In addition, area targeting has been pursued by Indonesia as a mechanism to induce farmers to plant soybeans and sugar. The traditional cassava production system in Indonesia is basically low technology. Farm yields are relatively low—about 9-11 tons per hectare—and material inputs such as fertilizer are not extensively used (Table 39). Often, cassava is intercropped with other upland crops such as corn, peanuts, and bananas. For the improved cassava production technology, yields are higher, averaging 22 tons per hectare of fresh cassava. Fertilizer and other material input costs are three times those of the low-technology cassava.

Cassava is sold as fresh cassava root and as *gaplek* (dried cassava). Some roots are processed into cassava starch, which is used in industry in making plywood and textiles and as an ingredient in cooking *krupuk*, a snack food with high income elasticity throughout Indonesia (Falcon et al. 1984). The European Community, the major importer of dried cassava, is a restricted market, and Thailand and Indonesia export dried cassava on a quota basis. However, as noted earlier, Indonesia has not fulfilled the quota in recent years due to high and rapidly growing domestic demand.

Financial Profitability

Net financial farm incomes appear high for cassava, ranging from Rp 96,071 to Rp 376,920 per hectare for traditional technology and Rp 384,134 to Rp 651,548 per hectare for the improved technology production systems (Table 39). However, it takes more than a year to grow cassava; therefore, if these net farm incomes are translated into monthly incomes, they are generally lower than the net farm incomes generated from short-season crops such as rice, soybeans, and corn.

Economic Performance

As would be expected, given Indonesia's profitable exports of cassava to the European Community, the DRC estimates indicate that at the 1986 border price of US$102.90 per ton (f.o.b.) of dried cassava, Indonesia has a comparative advantage in continuing cassava production for export. The estimated RCRs range from 0.40 to 0.50 (Table 40).

Indonesia can maintain this comparative advantage, given the current border prices and cost structure, as long as the yield can be sustained at 3.55 tons per hectare for traditional technology and 7.72 tons per hectare for improved technology. Competitiveness relative to yields is illustrated in Figure 25. Given the current cassava production technology and Indonesia's cost of production, the minimum border price that can sustain Indonesia's comparative advantage in cassava exports ranges from US$45-US$56 per ton (f.o.b.) (Table 41).

Table 39—Summary of financial costs and returns of cassava production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Yield		Price of Output		Current Inputs	Labor Costs	Land Rent	Capital and Other Costs	Total Production Costs	Processing or Marketing Costs	Net Financial Profit		
		Tuber	*Gaplek*	Farmgate (Tuber)	Wholesale (*Gaplek*)							Total Costs	Farm-gate	Whole-sale
		(kilogram/hectare)		(Rp/kilogram)						(Rp/hectare)				
Traditional														
West Java	EP	11,400	4,560	33	125	15,249	111,588	125,708	20,861	280,129	167,001	447,130	96,071	122,870
Central Java	EP	11,275	4,510	36	140	21,926	65,492	125,708	13,656	230,361	160,660	391,021	175,539	240,379
East Java	EP	11,100	4,440	38	137	20,709	70,611	125,708	13,755	235,290	164,471	399,761	186,510	208,519
Sumatera	EP	9,855	3,942	45	156	8,036	81,077	48,694	15,975	157,665	159,190	316,855	285,810	298,097
Sulawesi	EP	9,995	3,998	49	178	3,641	57,721	48,694	16,864	134,068	188,278	322,346	355,687	389,298
Kalimantan	EP	10,457	4,183	53	180	3,768	102,602	48,694	20,903	177,301	159,761	337,062	376,920	415,878
Bali and Nusa Tenggara	EP	9,656	3,862	47	159	3,391	115,716	48,694	16,619	191,729	168,627	360,356	262,103	253,702
Java	EP	11,258	4,503	36	134	19,346	82,564	125,708	16,097	248,651	164,043	412,694	152,884	190,708
Off Java	EP	9,991	3,996	49	168	4,708	89,279	48,694	17,590	165,190	169,163	334,353	319,373	337,974
Indonesia	EP	10,534	4,214	43	154	11,006	86,401	81,700	16,953	200,987	167,730	368,717	251,975	278,433
Improved														
Central Java	EP	22,000	8,800	36	140	46,033	210,734	125,708	20,100	407,866	313,482	721,349	384,134	510,651
East Java	EP	22,000	8,800	38	137	43,874	210,734	125,708	20,114	405,154	325,978	731,132	430,846	474,468
Sumatera	EP	22,000	8,800	45	156	45,776	210,734	48,694	22,101	338,452	355,370	693,823	651,548	678,977
Java	EP	22,000	8,800	36	134	45,654	210,734	125,708	20,191	407,295	320,581	727,876	377,372	451,324
Off Java	EP	22,000	8,800	49	168	45,648	210,734	48,694	22,086	338,309	372,530	710,840	728,691	769,760
Indonesia	EP	22,000	8,800	43	154	45,752	210,734	100,037	20,835	384,412	350,266	734,678	561,588	616,751

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: EP is export promotion. *Gaplek* is dried cassava chips.

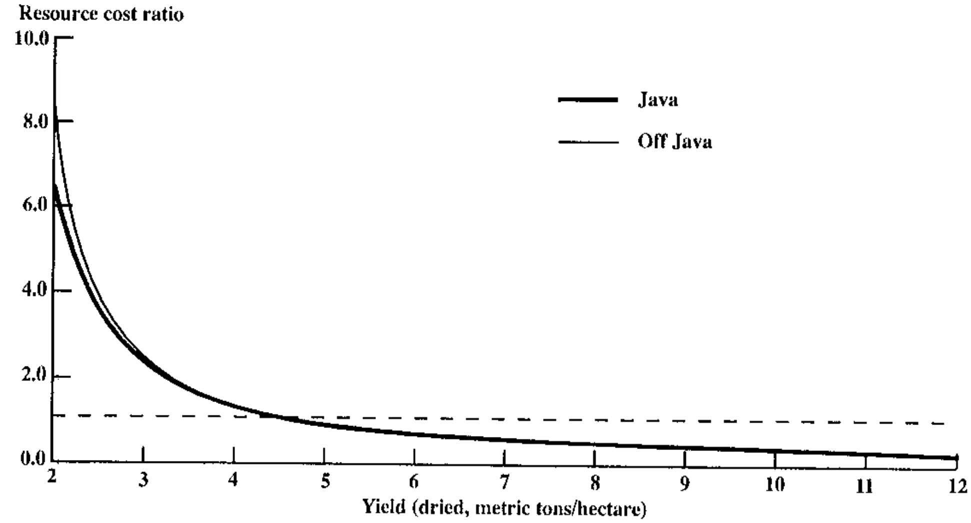
Table 40—Summary of economic efficiency in cassava production, by technology, region, and trade regime, 1986

Technology/Region	Trade Regime	Border Price		Yield	Gross Economic Returns	Economic Costs			Net Economic Profit	Domestic Resource Cost	Resource Cost Ratio
		In US$	In Rp			Domestic	Foreign	Total			
		(US$/mt)	(Rp/mt)	(mt/hectare)		(Rp/hectare)				(Rp/US$)	
Traditional											
West Java	EP	102.90	150,543	4.560	686,475	364,451	58,892	423,343	263,132	850	0.498
Central Java	EP	102.90	150,543	4.510	678,948	310,958	58,790	369,748	309,200	734	0.430
East Java	EP	102.90	150,543	4.440	668,410	315,273	63,341	378,614	289,796	762	0.447
Sumatera	EP	102.90	150,543	3.942	593,439	249,964	50,452	300,416	293,023	673	0.395
Sulawesi	EP	102.90	150,543	3.998	601,870	236,964	58,383	295,346	306,524	638	0.374
Kalimantan	EP	102.90	150,543	4.183	629,720	276,185	46,299	322,484	307,236	693	0.406
Bali and Nusa Tenggara	EP	102.90	150,543	3.862	581,396	286,398	50,921	337,319	244,077	790	0.463
Java	EP	102.90	150,543	4.503	677,894	329,907	60,214	390,121	287,773	781	0.458
Off Java	EP	102.90	150,543	3.996	601,569	262,516	51,611	314,126	287,443	698	0.409
Indonesia	EP	102.90	150,543	4.214	634,387	292,048	55,694	347,742	286,645	738	0.433
Improved											
Central Java	EP	102.90	150,543	8.800	1,324,776	575,410	147,350	722,759	602,017	715	0.419
East Java	EP	102.90	150,543	8.800	1,324,776	583,499	152,989	736,488	588,288	729	0.427
Sumatera	EP	102.90	150,543	8.800	1,324,776	533,498	163,555	697,053	627,723	672	0.394
Java	EP	102.90	150,543	8.800	1,324,776	577,078	149,183	726,261	598,515	718	0.421
Off Java	EP	102.90	150,543	8.800	1,324,776	543,806	170,961	714,767	610,009	690	0.404
Indonesia	EP	102.90	150,543	8.800	1,324,776	573,183	161,568	734,752	590,024	721	0.423

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Note: EP is export promotion. mt is metric ton.

Figure 25—Sensitivity of resource cost ratio (RCR) values to changes in yields of improved cassava, under an export promotion trade regime, Java and off Java, 1986



Notes: On Java, the actual yield is 8.8 metric tons per hectare and the RCR is 0.421. Off Java, the actual yield is also 8.8 metric tons per hectare and the RCR is 0.404.

Table 41—Break-even yield and border prices in cassava production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Actual Yield	Break-even Yield	Actual f.o.b. Price	Break-even f.o.b. Price
		(metric ton/hectare)		(US$/metric ton)	
Traditional					
West Java	EP	11.400	4.850	102.90	55.68
Central Java	EP	11.275	3.975	102.90	49.33
East Java	EP	11.100	4.120	102.90	51.38
Sumatera	EP	9.855	2.840	102.90	45.92
Sulawesi	EP	9.995	2.368	102.90	44.73
Kalimantan	EP	10.457	3.173	102.90	46.27
Bali and Nusa Tenggara	EP	9.656	3.430	102.90	52.48
Java	EP	11.258	4.305	102.90	52.09
Off Java	EP	9.991	2.958	102.90	47.34
Indonesia	EP	10.534	3.558	102.90	49.66
Improved					
Central Java	EP	22.000	7.875	102.90	49.78
East Java	EP	22.000	7.998	102.90	50.75
Sumatera	EP	22.000	6.978	102.90	48.24
Java	EP	22.000	7.865	102.90	50.03
Off-Java	EP	22.000	7.118	102.90	49.50
Indonesia	EP	22.000	7.720	102.90	50.73

Sources: Basic data from Indonesia, CBS (Central Bureau of Statistics), *Statistical Yearbook of Indonesia* (Jakarta: CBS, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Note: EP is export promotion.

Sugar Production

The data base for sugar is drawn from input-output data for Java and off Java, which were provided by the staff of the Center for Agro Economic Research (CAER). A CAER paper (Hutabarat et al. 1986) discusses the strategies and policy issues related to expansion of sugar production in Indonesia. The net profitability per hectare of sugar is shown in Table 42. Calculations for Java and off Java made at the ex-factory level indicate that Java had a net financial profit of Rp 1.4 million per season—slightly higher than off Java. On a per hectare basis, financial profits appear to be high, but sugar's effective profitability per hectare per month is low in comparison with other crops such as rice and soybeans. Sugar is produced over a season of 15-17 months, compared with 3-4 months for rice and corn.

Net economic profits in sugar production for both Java and off Java are negative (Table 43). Also, sugar is not an efficient import substitute. The RCRs—1.86 for Java and 1.33 off Java—imply a comparative disadvantage. However, sugar off Java is significantly more efficient than on Java, lending support to government policies that aim to shift sugar production off Java. Given the production costs of sugar in 1986, yields for refined sugar would have to increase from 4.6 to 6.3 tons per hectare to make it competitive as an import substitute (Table 44).

Table 42—Summary of financial costs and returns of sugar production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Yield	Output Price	Current Inputs	Labor Costs	Land Rent	Capital and Other Costs	Total Production Costs	Processing/ Marketing Costs	Total Costs	Net Financial Profit
		(metric ton/ hectare)	(Rp/kilogram)				(Rp/hectare)				
Traditional											
Java	IS	6.30	621	481,792	387,720	393,145	265,783	1,528,440	936,186	2,464,626	1,447,674
Off Java	IS	4.60	636	164,782	26,111	180,453	497,325	868,672	692,830	1,561,503	1,364,097

Sources: Basic data are from Indonesia, Ministry of Agriculture, Directorate General of Estate Crops, *Estate Crop Statistics of Indonesia* (Jakarta: Ministry of Agriculture, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: IS is import substitution. Numbers may not add to totals due to rounding.

Table 43—Summary of economic efficiency in sugar production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Border Price		Yield	Gross Economic Returns	Economic Costs			Net Economic Profit	Domestic Resource Cost	Resource Cost Ratio
		In US$	In Rp			Domestic	Foreign	Total			
		(US$/ metric ton)	(Rp/ metric ton)	(metric ton/ hectare)			(Rp/hectare)			(Rp/US$)	
Traditional											
Java	IS	202.80	296,696	6.30	1,869,187	1,972,589	958,988	2,931,577	−1,062,390	3,171	1.86
Off Java	IS	204.40	299,037	4.60	1,375,571	1,002,810	726,526	1,729,336	−353,765	2,260	1.33

Sources: Basic data are from Indonesia, Ministry of Agriculture, Directorate General of Estate Crops, *Estate Crop Statistics of Indonesia* (Jakarta: Ministry of Agriculture, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Notes: IS is import substitution. Numbers may not add to totals due to rounding.

Table 44—Break-even yield and border prices in sugar production, by technology, region, and trade regime, 1986

Technology/ Region	Trade Regime	Actual Yield	Break-even Yield	Actual Border Price, c.i.f. Adjusted	Break-even Border Price, c.i.f. Adjusted
		(metric ton/hectare)		(US$/metric ton)	
Traditional					
Java	IS	6.30	11.11	202.80	287.60
Off Java	IS	4.60	5.92	204.40	235.75

Sources: Basic data are from Indonesia, Ministry of Agriculture, Directorate General of Estate Crops, *Estate Crop Statistics of Indonesia* (Jakarta: Ministry of Agriculture, various years); World Bank, *Commodity Price and Price Projections* (Washington, D.C.: World Bank, various years).

Note: IS is import substitution.

8

CONCLUSIONS

The effects of government pricing, trade, and exchange rate policies on domestic agricultural incentives and comparative advantage are examined in this report for rice, corn, cassava, soybeans, and sugar. The measures used to assess economic incentives include direct, indirect, and total NPRs and EPRs for commodity- and technology-specific production enterprises. The regional costs of production of the five crops are analyzed in both financial and economic terms. In addition to production costs, the costs of processing, marketing, transporting, and distributing the crops under three trade scenarios (import substitution, interregional trade, and export promotion) are also incorporated in the analysis of comparative advantage. The domestic resource cost (DRC), which is the ratio of the domestic cost of production and the difference between the border price of output and foreign tradable input costs, is the method used.

The estimated equilibrium exchange rate permits decomposition of the direct, indirect, and total nominal and effective protection rates by commodity. When the rupiah was overvalued 16.6 percent in 1985/86, the indirect effect of trade and exchange rate policy was −16 percent. Broad summaries of key results are presented in Tables 45 and 46.

Rice

The analysis indicates that Indonesia has a comparative advantage in rice production compared with imports. This is partly due to the relatively productive rice technology that has been developed in Indonesia and partly to the natural protection afforded by freight and distribution costs from the major rice exporting countries. However, Indonesia does not have comparative advantage as a rice exporter. The problems associated with the thin world rice trade, grain quality, and the long gestation effects of investments related to market development for rice exports indicate that Indonesia should not pursue public investments keyed to a policy of sustained rice exports.

The basic strategy for rice should be to maintain balanced growth in domestic production and demand at long-term world prices. Sustained divergences from a balanced growth path may have particularly large costs in the case of rice because Indonesia is a major actor (or potential actor) in the world rice market. Large shortfalls in production relative to domestic demand growth, which generate large import demand, drive up the world price of rice and impose further economic costs. If production outstrips demand growth, the main strategies are accumulation of expensive stocks or subsidized disposal of surpluses on the export markets.

To implement this strategy, domestic wholesale and farm prices should be adjusted relative to the long-term movements in the world price of rice. Attempts to insulate domestic prices from world price movements prove costly in the long run. Maintaining low domestic prices to protect consumers would be a disincentive to production and likely to require substantial government subsidy expenditures on imported rice. Attempts to

Table 45—Indicators of incentive, financial, and economic performance of foodcrops, import substitution regime, 1986

Indicator	Rice	Corn		Soybeans		Sugar
	Irrigated	Open-Pollinated	Hybrid	Traditional	Improved	Average
Java						
Financial profit (Rp/hectare)[a]						
Farm	363,829	39,973	139,187	151,904	418,762	...
Wholesale	472,130	19,237	100,501	211,701	518,010	1,447,674
Economic profit (Rp/hectare)						
Wholesale	212,878	50,161	163,743	−125,816	−77,326	−1,062,390
Domestic resource cost (Rp/US$)	1,025	1,170	959	2,458	1,866	3,171
Resource cost ratio	0.60	0.69	0.56	1.60	1.23	1.86
Effective protection rate (EPR_T, percent)	0	−17	−19	148	170	194
Off Java						
Financial profit (Rp/hectare)[a]						
Farm	297,202	111,126	330,229	175,853	...	...
Wholesale	401,043	98,853	301,127	229,014	...	1,364,097
Economic profit (Rp/hectare)						
Wholesale	97,936	77,959	323,005	−58,995	...	−353,765
Domestic resource cost (Rp/US$)	1,196	962	790	1,949	...	2,260
Resource cost ratio	0.70	0.56	0.46	1.29	...	1.33
Effective protection rate (EPR, percent)	10	0	2	132	...	199
Indonesia						
Financial profit (Rp/hectare)[a]						
Farm	323,501	84,263	234,453	165,041	405,518	...
Wholesale	430,196	68,636	201,243	221,018	504,702	...
Economic profit (Rp/hectare)						
Wholesale	141,164	66,255	190,445	−87,316	−63,787	...
Domestic resource cost (Rp/US$)	1,121	1,055	897	2,169	1,778	...
Resource cost ratio	0.66	0.62	0.53	1.43	1.18	...
Effective protection rate (EPR_T, percent)	6	−7	−6	138	156	...

Note: Analysis of cassava as an import crop was not done; since it has comparative advantage as an export crop, it can be assumed to be highly competitive as an import substitute.

[a] Sugar has a 15-month production cycle and should be converted to 3.5 months equivalent to be comparable with other crops.

maintain high farm prices above equivalent world prices would also have high costs. This type of policy will either lead to a further squeeze on farm-to-wholesale price margins, forcing out private traders and leading to large buildups in government-held stocks or subsidized exports, or it will have a highly negative effect on consumer welfare if high domestic farm prices are passed on to consumers.

Alignment of rice prices with long-term world prices should also permit fertilizer subsidies to continue to be phased out. The government has used a substantial fertilizer subsidy as a key instrument for stimulating crop production, particularly rice. The rapid growth in fertilizer use, induced in part by the subsidy, together with adoption of modern varieties and massive investments in irrigation, has sharply increased the budgetary burden of the subsidy. There is also evidence that, in many areas of Java, low fertilizer prices have led to inefficient use of fertilizer, even overuse. Reduction or elimination of

Table 46—Indicators of incentive, financial, and economic performance of foodcrops, export promotion regime, 1986

	Rice	Corn		Soybeans		Cassava	
Indicator	Irrigated	Open Pollinated	Hybrid	Traditional	Improved	Traditional	Improved
Java							
Financial profit (Rp/hectare)[a]							
Farm	63,829	39,973	139,187	151,904	418,762	152,884	377,372
Wholesale	472,130	19,237	100,501	211,701	518,010	190,708	451,324
Economic profit (Rp/hectare)							
Wholesale	–65,934	–90,209	–98,143	–191,553	–186,433	287,773	598,515
Domestic resource cost (Rp/$)	1,671	2,523	2,058	3,627	2,910	781	718
Resource cost ratio	0.98	1.48	1.21	2.32	1.89	0.46	0.42
Effective Protection Rate (percent)	74	113	102	294	360	–35	–35
Off Java							
Financial profit (Rp/hectare)[a]							
Farm	297,202	111,126	330,229	175,853	...	319,373	728,691
Wholesale	401,043	98,853	301,127	229,014	...	337,974	769,760
Economic profit (Rp/hectare)							
Wholesale	–145,752	–45,988	–61,906	–133,678	...	287,443	610,009
Domestic resource cost (Rp/US$)	2,131	2,056	1,850	3,211	...	698	690
Resource cost ratio	1.25	1.21	1.09	2.06	...	0.41	0.40
Effective protection rate (percent)	123	146	186	312	...	–8	–6
Indonesia							
Financial profit (Rp/hectare)[a]							
Farm	323,501	84,263	234,453	165,041	405,518	251,975	561,588
Wholesale	430,196	68,636	201,243	221,018	504,702	278,433	616,751
Economic profit (Rp/hectare)							
Wholesale	–117,215	–65,593	–89,742	–158,620	–190,129	286,645	590,024
Domestic resource cost (Rp/US$)	1,923	2,277	2,017	3,408	2,949	738	721
Resource cost ratio	1.13	1.34	1.18	2.18	1.91	0.43	0.42
Effective protection rate (percent)	100	136	149	304	367	–20	–19

Note: Analysis of sugar was limited to the import substitute scenario. It is highly inefficient as an export crop.

[a] Cassava has a 15-month production cycle and should be converted to 3.5 months equivalent, to be comparable with other crops.

the fertilizer subsidy should reduce these inefficiencies and achieve significant financial gains for the government.

Corn

With continuing growth in productivity, the corn subsector should continue to experience significant growth. Corn is economically efficient as an import substitute.

Improved and pest-resistant open-pollinated corn varieties have contributed to the strong growth in productivity. Hybrid corn technology has been introduced in Indonesia, but on a very limited scale. Compared with rice, corn has better potential as an export crop, depending on either continued rapid productivity growth or the recovery of world prices. To develop a significant export capability will require improvements in on-farm distribution of inputs, postharvest drying, and marketing, processing, and storage facilities in order to produce corn of export quality.

The analysis for corn and the other nonrice crops also lends cautious support to government plans for diversification through encouragement of expansion of crop production off Java. The generally higher yield levels on Java are largely offset by the lower levels of technology used off Java, so that the comparative advantage in production is slightly better off Java than on.

Soybeans

The DRC results indicate that high efficiency costs will be incurred in pursuing the rapid expansion of domestic soybean production. Vertical integration of domestic soybean production into processing for soybean meal and oil is not yet economically viable in Indonesia. The problem in domestic soybean production lies in the absence of a viable technology widely adapted to the agroclimatic conditions of Indonesia. This is reflected in the relatively low quality of domestic soybeans produced and the lack of incremental gains in on-farm yields of modern inputs applied. The high financial returns to domestic soybean production are due to the government targeting system and support prices, which are maintained by restricting imports. Given an already limited land frontier on Java, the expansion of soybean areas necessarily displaces the production of other crops like corn and cassava that are more economically efficient. Rather than subsidizing the spread of currently uncompetitive technology, a more appropriate policy to encourage soybean production would be continued investment in research and development of improved soybean varieties.

Sugar

Sugar was not economically efficient with 1986 production technology and prices. Without the system of area quotas, it is likely that there would be a significant shift of land out of sugarcane. Sugar production—both on and off Java—is economically inefficient compared with imports, but the off-Java region is more efficient than on Java. To the extent that domestic production of sugar remains a goal of the government, it would be more appropriate to continue to shift the sugar industry from Java to the outer islands.

Cassava

Cassava is an economically efficient export crop, which Indonesia can profitably exploit as a source of foreign exchange. Policies related to cassava production technology, resource conservation, and efficient distribution should be pursued more vigorously by Indonesia to take advantage of the economic profitability in cassava production. More rapid production growth in cassava will be required to meet growing domestic demand (and to achieve exportable surpluses if quotas to the European Community are retained).

In summary, Indonesia has pursued a set of policies that have been highly successful in promoting agricultural development. The key elements of the policy have included heavy investment in irrigation, research, extension, roads, and other rural infrastructure; maintenance of stable output prices for the major commodity, rice; and subsidies on major inputs, including irrigation, fertilizer, and pesticides. However, while successful in promoting agricultural growth, these policies (particularly output price support and input subsidies) have become increasingly costly as growth has proceeded. In recognition of these costs, the government has moved aggressively to reduce subsidies and protection of rice and corn, the largest food crops, in recent years. But high levels of protection have been maintained on sugar and soybeans in order to push diversification of cropping patterns. Promotion of a relatively inefficient crop, such as soybeans, through price protection, area quotas, and other policies, can impose high costs in production opportunities forgone for more efficient crops. A more appropriate strategy for diversification, which Indonesia has already followed for rice, corn, and cassava crops, allows producer incentives to be crop neutral and linked to long-run economic border prices. Although a crop targeting approach continues to be used for sugar and soybeans, the Indonesian government has mainly pursued balanced policies to facilitate diversification through phased trade liberalization, exchange rate adjustments, and investment in agricultural research to generate new technologies; expanded extension efforts to deliver appropriate technology to farmers, particularly for nonrice crops; and investment in rural infrastructure such as roads and communications to facilitate market development.

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