WORKING PAPER 01.02

EFFECTS OF AGRICULTURAL POLICY REFORM IN INDONESIA ON ITS FOOD SECURITY AND ENVIRONMENT

Erwidodo, Glynn Wittwer and Randy Stringer

November 2001

A joint research project on

Linkages Between Indonesia's Agricultural Production, Trade and the Environment
funded by the Australian Centre for International Agricultural Research,

between

CASER (Bogor) • CIES (Adelaide) • CSIS (Jakarta) • RSPAS (ANU, Canberra)

Lead institution: CIES • University of Adelaide • Adelaide • SA 5005 • Australia
Telephone (61 8) 8303 4712 • Facsimile (61 8) 8223 1460 • email: cies@economics.adelaide.edu.au
Homepage: http://www.adelaide.edu.au/cies/

CASER/CSIS/CIES/ANU
joint research project on

Policy analysis of linkages between Indonesia's agricultural production, trade and environment

Rapid economic growth in Indonesia has been accompanied by significant structural changes, including for its agricultural sector and its unique natural environment. Recently questions have been raised about the impact of Indonesia's agricultural, industrial, trade and environmental policies on sustainable rural development. The nature of interactions between the economic activities of different sectors and the environment are such that an intersectoral, system-wide perspective is essential for assessing them. An international perspective also is needed to assess the impact on Indonesia of major shocks abroad, such as the implementation of the Uruguay Round agreements, APEC initiatives, or reforms in former centrally planned economies. There is increasing pressure on supporters of liberal trade to demonstrate that trade reforms at home or abroad affecting countries such as Indonesia will not add to global environmental problems (e.g., deforestation, reduced biodiversity). Again, this requires system-wide quantitative models of the economy and ecology, because typically there are both positive and negative effects at work, so the sign of the net effects ultimately has to be determined empirically.

To begin to address these issues, the Australian Centre for International Agricultural Research (ACIAR) has generously provided funds for a collaborative 3-year project (to mid-1999) involving the University of Adelaide's Centre for International Economic Studies (CIES) as the lead institution, Bogor's Centre for Agro-Socioeconomic Research (CASER) which is affiliated with the Ministry of Agriculture, Jakarta's independent Centre for Strategic and International Studies (CSIS), and the Economics Division of the Research School of Pacific and Asian Studies (RSPAS) at the Australian National University in Canberra. Being based on Indonesia with its rich diversity of environmental resources (and on which there are relatively good data) and its rapid economic growth, the project could also serve as a prototype for similar studies of other developing countries in Southeast Asia and elsewhere.

The key objective of the project is to assess the production, consumption, trade, income distributional, regional, environmental, and welfare effects of structural and policy changes at home and abroad particularly as they will or could affect Indonesia's agricultural sector over the next 5-10 years. Among other things, the analysis will focus both on the effects of economic changes on the environment, and on the impacts on Indonesia's agricultural production and trade of resource and environmental policy changes. The implications of regional and multilateral trade liberalization initiatives and Indonesia's ongoing unilateral trade reforms will be analysed, along with other potential domestic policy changes and significant external shocks such as the entry of China and Taiwan into the World Trade Organization. The analysis will draw on and adapt computable general equilibrium (CGE) models such as the national INDOGEM Model (built as part of an earlier ACIAR project) and the global GTAP Model.

The project is being undertaken in close collaboration with the Indonesian Ministry of Agriculture and ministries involved in trade, planning, and the environment. A Research Advisory Committee has been established to encourage close collaboration of representatives from those and other ministries.

ACIAR INDONESIA RESEARCH PROJECT

WORKING PAPER 01.02

EFFECTS OF AGRICUTURAL POLICY REFORM IN INDONESIA ON ITS FOOD SECURITY AND ENVIRONMENT

Erwidodo, Glynn Wittwer and Randy Stringer

Deputy Director
Center for Agro-Socioeconomic Research
Bogor, Indonesia

Research Fellow
Centre of Policy Studies
Monash University
Melbourne, Australia

Formerly Deputy Director
Centre for International Economic Studies
Adelaide University, Australia

November 2001

The ongoing socioeconomic crisis enveloping Indonesia has dramatically reversed decades of rapid economic growth, steady progress in poverty reduction, and substantial improvements in food security.[1] Before the crisis, Indonesia was frequently cited as one of the highest performing Asian economies with per capita GDP growth in the top 10 percent of all developing countries. Since the crisis began in August 1997, however, the rupiah's value dropped by as much as 80 percent before a partial recovery. In 1998, inflation soared to an estimated 100 percent; and GDP fell by an estimated 14 percent in 1998 (World Bank, 1998). Indonesia's poor are especially vulnerable to the falling incomes, increasing prices and rising unemployment and underemployment brought on by these crisis-induced events. World Bank simulations suggest a 12 percent decline in real GDP in 1998 would add some 9 million people to the more than 20 million living in poverty before the crisis began (World Bank, 1998).

Indonesia's capacity to address the crisis initially was complicated by forest fires, drought, floods and a sharp decline in crude oil prices. During 1997, one million hectares of forest fires in Kalimantan and Sumatra damaged ecosystems, destroyed crops, disrupted transport and tourism, increased the incidence of respiratory problems and strained Indonesia's relations with neighbouring Singapore and Malaysia (Solahuddin, 1998). Estimates of the economic damage to Indonesia's logging and timber industries (excluding environmental and health costs) are set at more than US$900 million (Tay, 1998). One estimate of the 1997 fire's impact on increased health care costs and foregone tourism income for Indonesia, Malaysia and Singapore is US$1.4 billion (Tay, 1998).

A prolonged drought throughout 1997/98 reduced export crop production and, more importantly for the country's food security objectives, contributed to a large drop in paddy production. Initial estimates suggest that the 1998 paddy crop is nearly 10 percent below the 1996 production level (FA0, 1998; CBS, 1999). The drought's impact has been worse in the islands of the country's east, which is drier and contains a higher proportion of low-income households than Java.

Around one-third of the country's population spend 69 percent or more of their total expenditures on food (SUSENAS, 1996). Thus, the collapsing demand, rising unemployment, falling food production, increasing food prices and rapidly expanding numbers of malnourished has stressed the fundamental role agriculture must play in revitalizing the economy. The agricultural sector's potential to contribute has been greatly enhanced by

---

[1]There were four key microeconomic causes of Indonesia's crisis: the rapid build up of private debt; well-recognised flaws in the banking system; inadequate governance; and the timing of the crisis in relation to political events (World Bank, 1998).

crisis-induced policy reforms that have removed many of the long-standing disincentives facing producers, traders and processors. This dramatically changed policy environment provides an important foundation for a partial re-agriculturalisation of the economy.

One purpose of this paper is to provide insights into how agriculture can contribute to overcoming the negative consequences of the crisis in the medium-term period. A computable general equilibrium (CGE) model of Indonesia, WAYANG, is used to model the consequences of a real devaluation, a productivity decline and a loss of the country's endowment of productive factors. WAYANG is a single-country, 65-sector CGE model of the Indonesian economy.[2] The analysis focuses on medium-term shifts in production across industries to provide some indication of expected output changes arising from one key crisis-related impact: a real devaluation of the rupiah.

This paper is organised into five sections. An overview of how the socio-economic crisis has impacted on the agricultural sector is followed by details the agriculture-related policy responses induced by the crisis. The modelling scenarios and results are then discussed, before finishing with some concluding comments.

Crisis-related impacts on rural communities and agriculture

Among the on-going concerns facing agricultural policymakers is what the devaluation means for food security and what can be done to minimize the negative consequences for both food production and access to food. The devaluation's direct and indirect impacts on food consumers and producers work in opposing directions. For example, while agricultural wages represent an important cost component for food production, they are also the primary income source for many households. In part, the crisis shocks should encourage food production since drops in real wages reduce food production costs, which would provide incentives to boost production. For wage-dependent landless workers, however, falling incomes reduce food demand, counteracting the production-enhancing effects of lower production costs. Likewise, as the price of export crops increase relative to non-exported food crops, producers will shift land, labour and other inputs towards the more-profitable opportunities.

It is ironic that in Indonesia, agricultural households tend to be more vulnerable to food insecurity than urban residents. Before the crisis, the average per capita expenditure of agricultural households was about 57 percent higher than the poverty line (World Bank, 1998). In contrast,

---

[2] The model, detailed in Wittwer (1999) and summarised in Appendix 1 of this volume, is adapted from an earlier version developed at ANU by Peter Warr and associates, and ORANI-G.

average per capita expenditure among households in both manufacturing and construction was more than twice the poverty line. Unskilled agricultural wages have fallen in real terms as urban workers whose jobs have been lost in construction, manufacturing, and import-dependent food processing activities migrated back to the countryside to look for work.

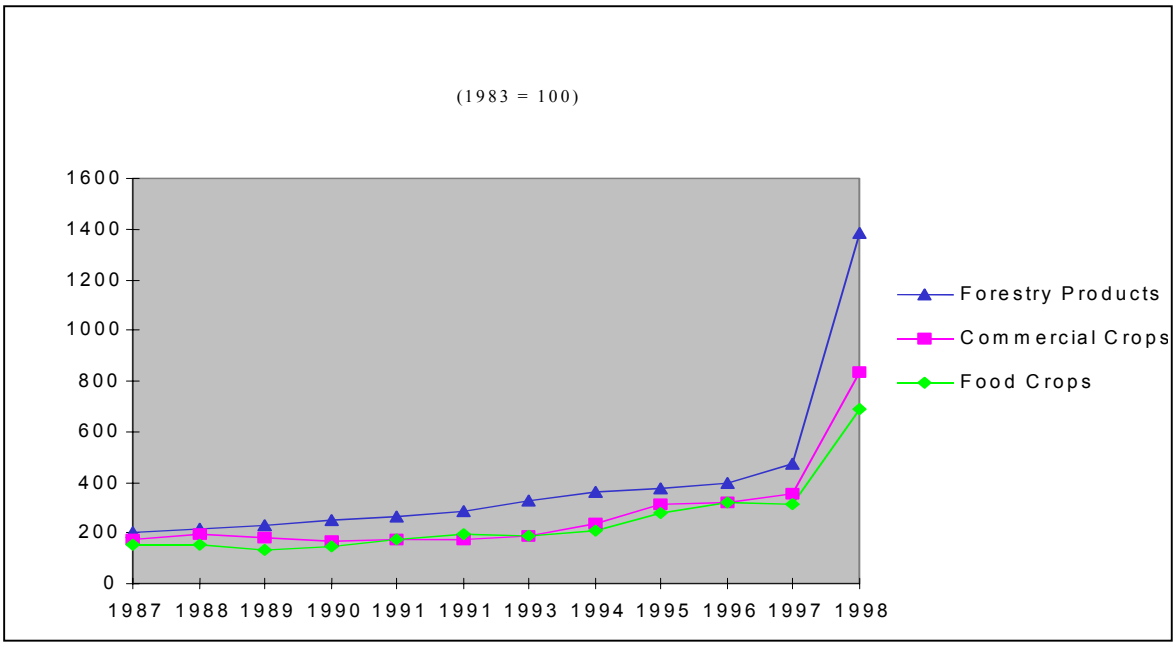
Empirical evidence demonstrates that this influx of labour into the countryside is placing downward pressure on agricultural wages. Table 9.1 presents evidence of real wage declines in Indonesia during the period of January 1997 to January 1998. As expected, regions closest to Jakarta, Central and East Java saw the largest declines (12 percent and 13 percent, respectively).

Table 9.1: Changes in real wages for weeding in selected provinces of Indonesia, 1997-98

Province	12 Month Change Jan 97 to Jan 98	6 Month Change July 97 to Jan 98
West Java	-6.8	-10.0
Central Java	-12.1	-13.4
East Java	-13.1	-11.2
West Sumatra	-5.2	-5.0
South Sulawesi	-8.0	-5.7
West Nusa Tenggara	-8.2	-12.0

Source: World Bank (1998b).he devaluation provides increased opportunities for expanding traditional exports crops (cocoa beans, coffee, tea and fishery and forestry products), as well as exports of fruits and vegetables (See Figure 9.1). As prices of vegetables increase relative to rice prices, producers tend to substitute vegetables for rice production. Table 9.2 highlights the trend in relative output prices. The price ratio of paddy to agricultural wages changed significantly compared with the price ratio of vegetables to agricultural wages between August 1997 and June 1998. As the relative output prices of these two commodities continued to diverge, policymakers attempting to control rice.prices through generalised subsidies found it increasingly difficult to compensate rice producers via input subsidies.

Figure 9.1: Wholesale price indices for export commodity groups, Indonesia, 1987 to 1998



The increasing food prices and falling real input costs stimulate production and agricultural income, but reduce the real income, effective demand and food security situation of landless agricultural workers and consumers who depend on the market for their food supplies. For agricultural workers, declining real wages harm their ability to feed their families, to school their children, and to provide adequate health care. These are especially important concerns for Indonesia where 11 million rice producers cultivate less than 0.35 hectares and an estimated 7 million rural households are landless (Tabor, Dillon and Sawit, 1998).

Figure 9.2 provides data showing just how much faster food prices rose relative to the average wage. The partial equilibrium impact on income of a 40 percent rise in the real price of rice (the estimated price rise if trade were liberalised at prices prevailing in late 1998) is simulated in Table 9.3. The income losses range from 7.5 percent to 14 percent. Income declines of this proportion for the poorest one-third of the country's population have serious implications for the country's food security objectives. On the other hand, what is not taken into account in the simulations presented in Table 9.3, is that rice producers gain from the real price rise.

Table 9.2 Increase in the price of paddy and vegetables relative to wages, various regions of Indonesia, 1997-98

Province	August 1997 to June 1998 (% change)	
	Paddy	Vegetables
West Java	35	79
Central Java	30	44
Yogyakarta	54	156
East Java	31	89
North Sumatra	9	86
South Sulawesi	32	23

Source: Authors' calculations based on BPS (1998).

Figure 9.2: Indices of farm household consumer prices, food prices, and agricultural wages, West Java, 1997-98

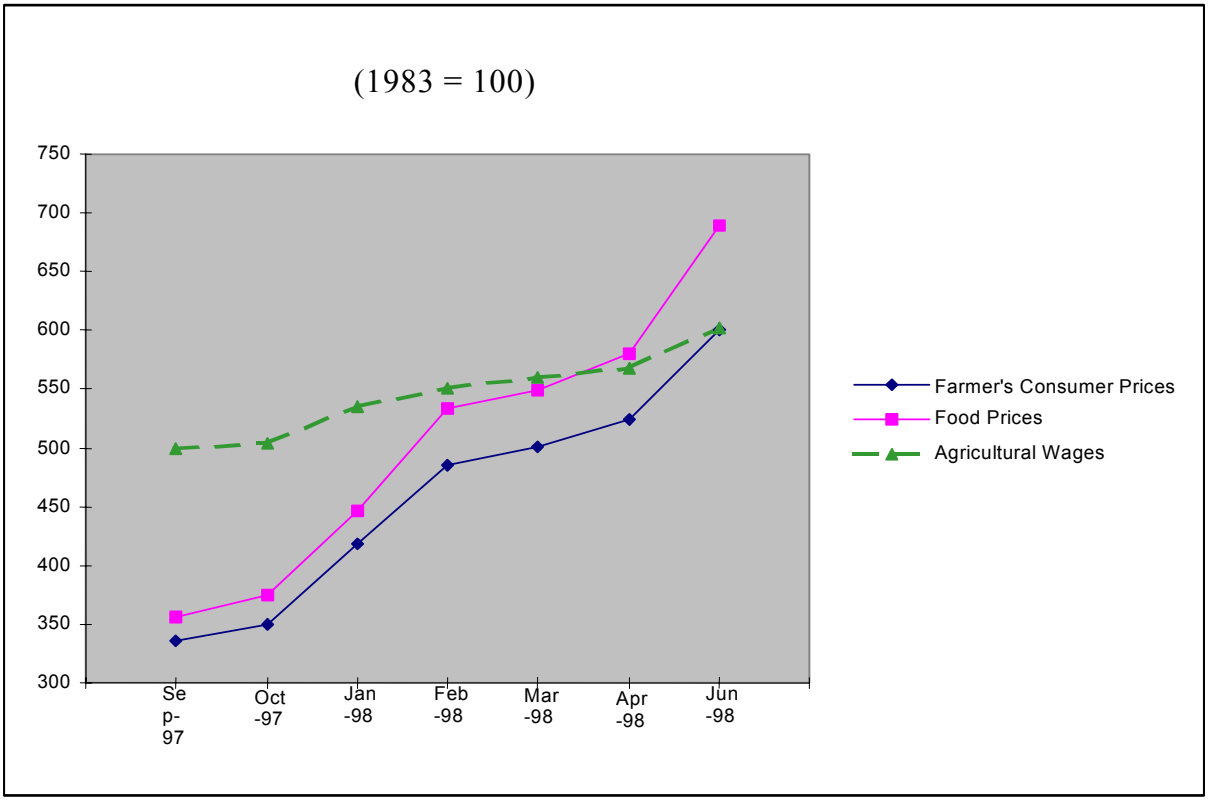


Table 9.3: Effects of a 40 percent real price rise for rice, Indonesia, 1998

Expenditure Group (1996 Rp/month)	Under 15000	15000-19999	20000-29999	30000-39999	40000-59999
Rice expenditure share	44%	34%	26%	21%	15%
Income elasticity	0.7	0.6	0.6	0.5	0.3
Compensated demand elasticity	-0.14	-0.14	-0.14	-0.14	-0.14
Price elasticity (Slutsky Equation)	-0.44	-0.34	-0.30	-0.25	-0.19
Kg purchased/mth before price rise	6.25	7.39	8.26	8.70	8.73
Price per kg before price rise	850	850	850	850	850
Real rice price rise (=40%)	1190	1190	1190	1190	1190
Kg purchased/mth after price rise	5.14	6.35	7.11	7.78	6.97
Food expenditure share	83%	72%	69%	66%	62%
Expenditure on food (Rupiahs/month)	10,095	13,475	18,305	23,384	31,100
Expenditure on cereals (Rupiahs/month)	6,467	7,115	7,705	7,998	8,377
Expenditure on rice (Rp/month)	5,315	6,280	7,024	7,392	7,418
Total monthly expenditure	12,210	18,676	26,537	35,463	49,896
Loss in consumer income	-14%	-12%	-9%	-8%	-6%

Source: SUSENAS, 1996 and authors' partial equilibrium calculations

The Ministry of Population's (BKKBN) estimates for May 1998 were that 16.7 percent of the households in Indonesia (some 34 million individuals) could be classified as badly impoverished -- households that were unable to satisfy their basic needs. Table 9.4 presents data on changes in poverty since 1976, including estimates of the growth in poor since the crisis. The Ministry of Food and Horticulture estimates that 40 percent could have been classified as food insecure. The highest absolute number of food insecure rural households are in Java.

Food insecurity and malnutrition have immediate consequences for those households effected. Chronic malnutrition blinds, otherwise debilitates and kills, reducing physical capacity, lowering productivity, stunting growth, and inhibiting learning. In the world's poorest regions and countries, one-third of deaths among children are due to malnutrition (Del Roso 1992). Decreased access to food and nutrition leads to declining learning capacity, school performance, and school attendance; to more school and work days lost to sickness; and to lower earnings, shorter work lives and a less productive work force.

Table 9.4: Incidence of poverty in Indonesia, 1976 to 1998[a]

	Millions			Percentage		
Year	Urban	Rural	Total	Urban	Rural	Total
1976	9.5	44.2	54.2	38.8	40.4	40.1
1980	9.4	32.8	42.3	29.0	28.4	28.6
1990	7.2	17.2	25.9	16.8	14.3	15.1
1996	10.0	15.3	22.5	9.7	12.3	11.3
1998 (est.)	15.0	32.0	53.0	20.0	30.0	26.0
1998 severely food insecure	9.6	24.3	32.0			

[a] 1976-1996 are BPS statistics while the 1998 values are estimated by Tabor et al.

Source: BPS (1998) and Tabor et al. (1998).

In a review of the crisis, Tabor, Dillon and Sawit (1998) argue that three events contributed to a significant increase in absolute poverty: a fall in average real incomes of 10 to 14 percent, a rise in urban unemployment (estimated to be as high as 15 million persons), and a rise in food prices facing the poor. Between January 1996 and May 1998, food prices rose 11 percent in real terms. Tabor et al. (1998) estimate that the crisis could have caused an increase of 8 million urban poor and 23 million rural poor; and there would be approximately 9.6 million urban and 24.3 million rural food-insecure individuals in mid-1998 (Table 9.4).

The highest estimate of poverty levels was that of the Ministry of Women's Affairs. This ministry classified 56 percent of the population, or around 113 million persons, as poor. In 1996, 22.5 million persons were classified as absolutely poor of which about 7.2 million were in urban area and 15.3 in rural area. Another 37 million were reported as "nearly poor". With falling real wages and shocks to food production, the great majority of these "nearly poor" households would have fallen below the poverty line. This implies that 50-55 million persons could be classified as absolutely poor, of which 38 million live in the rural areas.

These crisis-related impacts have long-term consequences for future income, agricultural productivity and aggregate production possibilities. Many households respond to negative economic shocks by pulling their children out of school. An estimated 17.5 million school age children (out of a total 53 million) in 1997 were reported to be out of school to earn an income (Tabor et al. 1998). Even with the planned abolition of school fees, these numbers would have risen as the increased opportunity cost of keeping children in school rose. Government estimates suggest that about 6 percent of primary school students and 13 percent of junior secondary school students were at risk of dropping out (approximately 1,650,000 and 1,100,000 students respectively), while an additional 400,000 primary

school graduates were expected to not continue their education (World Bank, 1998)[3].

The outlook for health is also sobering. The sharp exchange rate depreciation raised the prices of medicines, vaccines, contraceptives and other medical supplies. Drug prices increased two- to three-fold relative to when the crisis began. In some communities, health centres have had to close because of a lack of medicines.

Recent estimates suggest that primary, junior and secondary school drop-out rates rose rapidly. Government estimates presented in Table 9.5 show that drop-out rates more than doubled from 1997/98 to 1998/99. Evidence from the much smaller 1986/87 shock, however leads one to expect the overall impacts to be large. During that period enrolment rates fell from 62 percent to 52 percent at the junior secondary level and took a decade to recover. Virtually the entire decline was from poor households (Atinc and Walton 1998).

Table 9.5: The impact of the crisis on school enrolments in Indonesia, 1998-99

			Change 98/98 to 98/99	
	1997/98	1998/99	Absolute	Percentage
PRIMARY				
Enrolment (millions)	29.27	28.99	-0.28	-1%
Drop-outs (millions)	0.76	1.65	0.89	117%
Drop-out rate	2.6%	5.7%		119%
JUNIOR SECONDARY				
Enrolment (millions)	9.69	8.33	-1.36	-14%
Drop-outs (millions)	0.47	1.11	0.64	136%
Drop-out rate	5.1%	11.5%		126%

Source: World Bank (1998a).

The drop in enrolment levels raises serious medium- and long-term growth implications for Indonesia's economy. The development literature suggests strongly that basic education, skill development and institutional reforms are all necessary conditions for increasing productivity growth and taking advantage of the increased competition resulting from market liberalisation (Krueger, 1995; Rodrigo and Thorbecke, 1997; World Bank, 1998a). While measuring how much basic education actually contributes to

[3] As cited by Tabor et al. (1998), UNICEF estimates that 8 percent of the 30 million primary school children and 14 percent of the 10 million junior high school students droped out of school as a result of the economic crisis.

economic growth remains part of an ongoing empirical debate, few dispute the fundamental role played by education in the agricultural development process. Schooling and basic education foster agricultural innovations, enhance producers' abilities to reallocate resources in response to policy reforms and to adapt to fluctuating input and output prices, and promote the use of new technologies, including best practice resource management techniques (World Bank, 1998; Foster and Rosenzweig, 1993, 1995, 1996).

Crisis-induced agricultural policy responses

Crisis-induced policy responses impact directly and indirectly on producer and consumer price incentives, affecting competition in output, input and credit markets, and the use of natural resources and environmental services. Moreover, agricultural suppliers, producers, processors, and traders are influenced directly by the policy response and indirectly via how producers and consumers respond.

Among its many attempts to address the impacts of the drought and the economic crisis, Indonesia's policymakers worked with the international community to establish a series of appropriate policy responses. The Minister For Economy, Finance and Industry provided periodically a letter of intent to the Managing Director of the International Monetary Fund which included an outline of the government's policy reforms and specified the types and timing of the actions to be taken.

The macroeconomic, trade and agriculture policy reforms implemented in response to the crisis were wide ranging. Since September 1997, Indonesian policy-makers have taken steps to reduce tariffs on more than 500 food items to 5 percent. They have eliminated local content requirements for dairy products and dismantled export controls for plywood and wood products. The government has withdrawn BULOG's import and trading monopolies for wheat, wheat flour, garlic, sugar and soybeans, abolished the clove monopoly and reduced agricultural export taxes to 10 percent. Inter-provincial commodity trade restrictions have been eliminated. Other policy reforms include removing the export restriction on oil palm products, privatising plantations, estates and input suppliers, liquidating cooperatives and removing land use regulations restricting producer crop choices.

The September 1998 memorandum includes an annex outlining a strategy for Indonesian food subsidies and another annex outlining a seven-point strategy for rice. Important food and agricultural sector reforms include eliminating BULOG's monopoly on wheat, sugar and soybeans imports; suspending the VAT on rice and other essential commodities; eliminating wheat and sugar subsidies; phasing out soybean subsidies; removing export bans on wheat, soybeans and sugar; eliminating import subsidies and relevant import duties for soybean meal and fishmeal; and for the first time in 30 years, allowing private traders to import rice.

Unlike pre-crisis reforms that were often motivated by budgetary constraints, these price and trade reforms reflect the government's inability to enforce export bans and to hold down food prices in local markets. Illegal exports and trader markups forced the early implementation of these policies. Indeed, the government's price interventions have not been effective. From January to June 1998, BULOG raised procurement and market operation prices three times. Procurement prices for paddy were increased to Rp.600, then to Rp.700 and finally to Rp.1000 per kilogram in June. BULOG also attempted to lower rice prices for consumers by selling large quantities in the market at Rp.1750 to Rp.2000 per kilogram. Prices remained high, among other reasons, because the rice distribution system allowed speculators to buy subsidised rice and sell it at higher prices. In addition, large amount of rice were being exported illegally to neighbouring countries.[4] In an attempt to curb speculation, BULOG raised its reference price to between Rp.2000 and Rp.3500 per kilogram, depending on the quality of the rice.

Due to the lower than expected second rice harvest, panic hoarding, and sharp rises in rice prices, the targeted rice price program (covering 2 million people) was expanded to cover 7.5 million people by October, and potentially 15 million families by 1999. In addition, BULOG plans to increase substantially the quantity of rice released into the market at below market prices and maintained a high release level until the main harvest.

Making the best use of agriculture to address poverty and food security

One of the most important short-term goals for improving food security in Indonesia was to utilise the poverty reduction potential of its agricultural sector. Periods of high agricultural growth rates are associated with falling rural poverty and increasing food security (Binswanger and von Braun 1991; Timmer 1992; Bell and Rich 1994; Johnson 1993). Strong agricultural growth leads to lower food prices (for urban consumers and rural net-food buyers), increased income generating opportunities for food producers and jobs for rural workers (thus reducing rural-urban migration, with positive consequences for real urban wage rates), and positive intersectoral spillover effects including migration, trade and enhanced

[4] More than 1900 tons of rice were seized at Sunda Kelapa harbour in North Jakarta as it was being prepared to be exported to Kuching, Malaysia. The rice was found in boats, containers, trucks, and warehouses at the harbour. The remaining 380 tons were seized from traders who tried to mixing low quality rice and good quality rice before selling it in open market to gain greater profit.

productivity (Lipton and Ravallion, 1995; Timmer 1992). In the past, Indonesia's rapid agricultural growth substantially reduced rural poverty, improved food security in both rural and urban sectors, and provided a significant demand-side stimulus for non-agricultural goods and services.

Much of this past progress in providing increased food availability in Indonesia has resulted primarily from increased domestic food production. Despite rapid industrialisation, Indonesia's cereal self-sufficiency ratio increased from 90 percent to 95 percent, with rice yields increasing from 3.3 kg/ha to 4.3 kg/ha during this period between 1979/81 to 1989/91. Martin and Warr (1993) conclude that technical change in Indonesia has been faster in agriculture than in the rest of the rest of the economy due to such programs as rice intensification (BIMAS, INMAS, INSUS), public investment in irrigation and in adaptive research and dissemination of modern varieties, and the subsidies for credit, fertilisers and pesticides.

Indonesia's rice self-sufficiency initiatives involved a range of food and agricultural policies aimed at boosting rice production. The government established public investment programs, import restrictions, procurement policies and price controls. Rice intensification provided irrigation, fertiliser, pesticides, HYV seeds, credit extension, technical assistance and related capital improvements. Irrigation alone is credited with contributing to around 50 percent of the growth in rice production through increased yields during the 1980s and early 1990s. In total, the rice area under HYVs increased by 75 percent since the late 1970s, bringing the new technology to 3.5 million hectares and 6 million farmers.

The subsidised inputs and credit, expanded marketing channels and extension services all contributed to sharp increases in fertiliser and pesticide use. Fertiliser subsidies kept the retail price 40 percent below its economic value and helped keep Indonesian farmgate prices among the lowest in Asia during the 1980s. Fertiliser applications increased by 500 percent in many areas, with applications rates more than twice those in the Philippines and three times those in Thailand (FAO, 1992). Subsidy programs maintained a prominent role throughout the 1980s. By 1987, the fertiliser subsidy alone consumed 35 percent of the government's expenditure on agriculture. The irrigation subsidy cost about US $110 per hectare. Together, rice-related subsidies for fertilisers, pesticides, HYV seeds, credit and irrigation amounted to more than US $1 billion per years in the late 1980s.

However, after three decades of steady gains in agricultural productivity, growth rates of food production began to lag. Annual rice yield growth in Indonesia has dropped from 5.2 percent in the 1971-83 period, to 3.1 percent in 1984-90, to less than 3 percent since. Warning signs include declining growth of arable and irrigated areas, and increasing competition for resources between agriculture and other sectors. The use of inputs such as fertiliser and pesticides has declined due to environmental and health

concerns. Falling world food prices have discouraged investment in agriculture, particularly agricultural research.

Indonesia's agricultural sector was growing relatively slowly even before the drought and economic crisis hit. The same trend of declining agricultural comparative advantage in the process of industrialisation experienced by structural changes in developing countries worldwide. The share of agricultural output in total production in developing countries as a group has declined from 29 percent in 1965 to 17 percent in 1990. In Indonesia, agriculture's share of GDP has fallen from 45 percent in the early 1970s to around 17 percent in the mid-1990s and is expected to be less than 10 percent by 2020 (Anderson and Pangestu, 1995).

Anderson and Pangestu (1995) examine how three sets of influences affected structural change in Indonesia's agricultural sector: external events, domestic macroeconomic and non-agricultural policies, and domestic food and agricultural policies. Their study suggests that while petroleum sector prices represent the most important external event influencing the country's economic growth pattern (both the boom period during the 1970s and the critical 60 percent drop in real oil prices between 1982-86), it has been the prudent, market-driven approach to macroeconomic management and the liberalisation of foreign trade and investment since 1985 which laid the foundation for the continuous rapid economic growth in all sectors.[5]

Modelling the aftermath of the Indonesian crisis

The gravity of the problems facing Indonesia makes modelling of crisis-related scenarios a task that is potentially trivialising. Nevertheless, modelling can provide insights into adjustments to external shocks. On this basis, we present the projections of a real devaluation of the rupiah here to gain some insights into effects on average income and its distribution.

WAYANG is a model of real activity, without a financial sector. Therefore, we are somewhat restricted in what we are able to model, as the devaluation of the rupiah was due to a collapse in the financial sector. We have explored two methods of ascribing a real devaluation to the model. In early attempts, we imposed a sharp decline in the Indonesia's terms of trade on the model to induce a real devaluation of approximately the magnitude that has been observed since 1998. But the reality is that, at least in 2000,

[5] While these polices and programs have been highly successful, Indonesia's economic success is also due to an abundant natural resource base. Oil, natural gas, coal, tin nickel and gold are all found in substantial amounts, along with one of the world's riches tropical commercial forests. With more than 13,000 islands, the county's marine area is six times larger than its land area. Together renewable and exhaustible primary resources contribute 40 percent of GDP. Primary sector exports account for 70 percent of total exports, with agriculture contributing about 50 percent of non-oil exports.

the terms of trade have improved relative to pre-crisis times due to the soaring price of crude oil and petroleum. And at no time was there any sharp deterioration in Indonesia's terms of trade, indicating the financial rather than terms-of-trade origins of the rupiah's decline. A recovery of the rupiah has not accompanied the improving terms of trade. This leads to an alternative method, to shock the balance of trade surplus within the model, in keeping with the theory that a real devaluation induces an increase in the international trade surplus. There are differences between the two approaches. The first allows us to depict the full magnitude of the observed real depreciation. But the second depicts more realistically the impact on the trade balance (imposed exogenously) and household consumption, while capturing only a fraction of the real depreciation. Available trade data indicate that the balance of trade surplus between 1997 and 2000 increased by around 10 percent of GDP. Within WAYANG, a shock of this magnitude induces a real depreciation of around 14 percent, perhaps only one half of the actual depreciation.

Table 9.6: Key closure choices in the WAYANG model of the Indonesian economy[a]

Variable capital (national)	X	Variable capital (industry)	N
National labour	X	Industry labour	N
National land	X	Industry land	X
Sector-specific capital (non-ag.)	X	Tariff rate	X
Aggregate investment	X	Various tax rates	X
Wage shifter	X	Change in budget deficit	X
Import prices	X	Technological change	X
Export prices	X	Current account deficit	X

X = exogenous; N = endogenous.

[a] Differences from Table 2 of the Wayang handbook (Wittwer 1999) are: x5tot, x2tot_i and delbudget are exogenous instead of f5tot2, omega and f1inc_tax.

Table 9.6 summarises the closures used in the simulation. The national stocks of both labour and mobile capital are exogenous, but endogenous at the industry level. That is, if an industry responds positively to a particular shock, it attracts labour and mobile capital from other industries. Since WAYANG usually simulates in a short- to medium-term time horizon, each non-agricultural industry includes specific capital as a factor of production.

On the expenditure side at the macroeconomic level, the government's budget balance remains exogenous, as does real government expenditure. Real investment also remains exogenous. This implies that the

only component of real absorption to vary with any shock is aggregate household consumption. In reality, we would expect real government spending to decline in the short term relative to a base case. We would also expect households, in response to the crisis at least in the short term, to sell off savings in response to declining incomes, in order to maintain consumption. The modelled closure implies the opposite in the medium term.[6] Clearly, a large increase in the balance of trade surplus will have a large negative impact on the only endogenous component of real absorption, household consumption, for a given level of economic activity. This implies that our measure of welfare, which depends only on real consumption, will be sharply negative.

The scenarios presented here assume a degree of adjustment within the Indonesian economy. As noted above, the Indonesian government has responded to the crisis by liberalising markets and by removing legislative restrictions on agricultural land use. Given the nature and extent of the crisis, a much longer period may be needed before agents respond fully to liberalisation and before market and social institutions begin operating effectively.

In this experiment, the economy experiences a real devaluation in the medium term. The rupiah in the early part of 1998 suffered from a classic overshoot, reaching a bottom of 15,000 to the US dollar. By late October 1998, its value had settled at around 7,500. In 2000, the rupiah followed many currencies in the world in depreciating markedly against the US dollar.

Given the potential array of influences, the model is used to predict which industries might win and which might lose from the real devaluation. The magnitude of the gain or loss to a particular industry from a real devaluation depends on a number of influences, including the export intensity of sales of the industry's output, the import intensity of production, overall cost changes, the fate of other industries intensive in purchases of the output of this industry, and the proportion of household sales in total sales.

We turn first to industry outcomes. To assist in explaining an industry's change in output, we apportion the change to the sum of three effects using Fan decomposition.[7] This explains total sales as the sum of the local market, import share and export effects. A pattern we might expect

---

[6] Consider the macroeconomic identity C + I + G = S + T + M. With the closure, G – T is exogenous and X – M increases. Since I is exogenous, this ensures that S, national savings, increases. That is, in the medium term, we would expect real investment to be funded increasingly by domestic savings following a real devaluation.

[7] Fan decomposition is named after Mr Fan Mingtai of the Beijing Institute of Quantitative and Technical Economics. This is explained in the WAYANG technical document (Wittwer 1999).

across all sectors in response to a large real devaluation is for household purchases to decline, due to falling household expenditures. But since imports are now more expensive than domestic substitutes for most commodities, we might expect domestic purchases to increase relative to imports. That is, domestic purchases of a particular commodity may increase or decline, with substitution of the domestic for the imported commodity.

In Table 9.7, we have separated all primary and manufactures sectors into "winners" and "losers" from the devaluation. We will explain the outcomes for several industries. First, note that real consumption declines for each household by between 14 percent (for "Urban3": the high income urban household) and 21 percent (for "Rural4": rural households in agriculture with more than 1 hectare of land). This means that the expenditure effect for each commodity will be negative, as there are no inferior goods in the model. In addition, the prices of all imports rise relative to CPI, although the price rises of many domestically-produced goods are less than CPI. Concerning domestic demand, some goods will have a negative price effect and some a positive effect, depending on whether the domestic-import composite consumer price rises or falls relative to CPI. Clearly, for goods with a high import weighting, the price effect will be negative. For all goods in all households, the negative expenditure effect dominates the outcomes, so that real consumption declines. But domestically-sourced household purchases of some goods increase. Among crop sectors that increase output in response to the devaluation, we discuss three: rubber, other estate crops and palm oil. For rubber, there are two sources of positive growth, as is evident in the local market and export columns in Table 9.7. The positive local market effect is due to sales as inputs to manufactured rubber and plastics, an industry that gains significantly with the devaluation. Direct exports of rubber also increase. Other estate crops suffer due to the expenditure effect, but a large export effect more than compensates for this, with a net gain in output.

Oil palm also has a positive local market contribution to output (5.5 percent, explaining all the output increase). This crop is an important input into manufactured oils & fats. As the latter manufacturing sector experiences a net increase in output due to the export contribution, this implies a positive local market sales effect for palm oil. Among other primary inputs, wood and other forest products also benefit from large local market contributions. This is due to purchases by bamboo & wood manufactures, which has a large increase in exports. The increase in output of other forest products is also due to a substantial increase in direct exports (9.5 percent out of total output of 20.2 percent). Coal & ores and sea fish are other primary industries to benefit.

Why do some crops lose from the real devaluation? Any commodity reliant on households for a large proportion of sales is likely to suffer a

substantial negative local market contribution, due to the negative expenditure effect. We project output declines in maize (53 percent of total sales are to households), cassava (74 percent) and vegetables and fruit (91 percent), because export expansion is not sufficient to compensate fully for reductions in local sales. Paddy rice is another loser from the devaluation, as the expenditure effect dominates the outcome. Among manufactures that gain from the real devaluation, food processing and bamboo & wood benefit from large export contributions to growth.

Table 9.7: Estimated effects of a real depreciation in Indonesia (percentage change from base case)

	Local Market	Import Share	Export	Total		Local Market	Import Share	Export	Total
Crops +					*Manufacturing +*				
Oth. Forestry	10.4	0.3	9.5	20.2	Nonfer. metals.	6.3	-1.8	20.3	24.8
Oth. Estate crops	-6.5	2.9	21.9	18.3	Oth manu.	7.8	3.7	12.4	23.9
					Bamboo/wood	-3.6	0.1	21.7	18.2
Rubber	11.1	0.5	2.6	14.3	Yarn	9.2	-0.1	8.4	17.5
Other crops	-5.5	19.3	0.0	13.8	Chemical	4.1	8.5	5.0	17.5
Fibre	13.4	0.3	0.1	13.8	Food proc.	-5.5	2.4	18.3	15.2
Tobacco	-10.0	8.3	10.6	8.9	Textiles	-1.7	2.5	12.7	13.5
Oth. Agri.	-4.2	0.7	11.6	8.0	Nonmetals	-0.6	6.6	6.2	12.2
Oil Palm	5.5	0.0	0.0	5.6	Manu paper	-1.7	8.0	5.7	12.0
Beans	-5.7	9.6	0.4	4.3	Metal prod.	-2.0	7.3	5.1	10.5
Tea	-4.8	3.8	4.2	3.2	Rubber & plastic	-1.0	1.7	9.5	10.2
Crops —					Basic iron	2.2	2.6	3.9	8.6
Coconut	-6.4	0.0	1.9	-4.5	Electrical	-2.6	-0.2	11.4	8.6
Maize	-8.8	0.2	1.5	-7.1	Petrol	-0.8	0.6	4.7	4.5
Coffee	-7.7	0.0	0.0	-7.7	Crude oil	2.6	-0.1	1.6	4.1
Cassava	-10.8	0.0	2.1	-8.6	Manu oils & fats	-8.6	2.0	9.7	3.2
Veg. & fruit	-11.8	1.1	0.2	-10.5	Transport equip	-4.9	0.8	6.7	2.5
Clove	-12.6	0.0	0.0	-12.5	Cement	-2.2	0.1	2.2	0.1
Paddy rice	-13.2	0.0	0.0	-13.2	*Manufacturing —*				
Oth. primary					Nonfer. metals.	-9.3	7.5	0.6	-1.2

+									
Wood	11.2	0.5	0.2	11.9	Sugar cane	-2.8	0.0	0.0	-2.8
Coal & metal ores	5.1	0.2	5.4	10.7	Manu. Flour	-11.1	6.0	0.9	-4.2
Oth. Mining	-1.1	2.2	1.1	2.2	Manu. Oth food	-12.0	4.2	4.2	-3.6
Oth. primary					Fertiliser	-14.1	4.4	3.2	-6.5
Seafish	-8.7	0.0	4.6	-4.1	Beverages	-13.7	5.8	1.2	-6.6
Livestock	-19.4	0.1	0.4	-18.9	Cigarettes	-14.4	0.1	1.5	-12.8
Meat prod.	-22.6	0.7	0.0	-21.9	Milled rice	-13.9	0.2	0.5	-13.2
Poultry	-24.0	0.5	0.0	-23.5	Household	Aggregate consumption			
Regional		Output			Rural 1		-19.4		
Java/Bali		-0.4			Rural 2		-20.3		
Sumatra		0.4			Rural 3		-20.7		
Other		0.2			Rural 4		-20.9		
					Rural 5		-18.8		
					Rural 6		-15.3		
					Rural 7		-18.2		
					Urban 1		-16.4		
					Urban 2		-18.3		
					Urban 3		-14.2		

Source: Authors' WAYANG model projections.

There are several different reasons why some manufactures lose from the devaluation. Domestic household sales account for a large proportion of total sales of milled rice, flour, sugar, other food, cigarettes and beverages, so that they lose through the adverse expenditure effect. Fertiliser is treated within the model as a substitutable primary factor in agricultural production. Farmers therefore substitute out of fertiliser and into other primary inputs whose prices are less dependent on world markets.

As mentioned, all households suffer a decline in aggregate consumption, which is tied to household income in WAYANG's consumption function. Finally, we note that output in the Java/Bali region declines by 0.4 percent, while rising in Sumatra (0.4 percent) and the remaining islands (0.2 percent). Two of the crops gaining the most in percentage terms from the devaluation, rubber and other estate crops, are grown mostly in provinces other than in the Java/Bali region. Among the losing crop industries shown in Table 9.7, Java/Bali accounts for in excess of 50 percent of production of all but coffee and clove. The other primary

industries gaining from the depreciation are relatively small in Java/Bali. We assume in the database that Java/Bali accounts for 73 perc ent of service industry activity. Services, on a cost share weighted basis, suffer a decline in output of 2.0 percent due to the devaluation. In summary, the outer islands have the potential to increase economic activity as a consequence of the real devaluation.

As mentioned in the introduction, the Indonesian government (with World Bank support) is attempting to address the rapid deterioration of access to and provision of education in the wake of the crisis. But the problem is potentially so large that even with active measures, millions of future producers are likely to have dropped out of school. We could attempt to model a decline in productive capacity. On the other hand, it is possible that with a partial restoration of provision and participation in schooling, the progress made in previous decades in Indonesia in raising literacy levels will continue. In some regions, escalating civil unrest since the crisis started makes this unlikely for some time.

One of the disturbing aspects of the real depreciation is the rising cost of some essential imports. The difficulties Indonesia faces in maintaining health services with the spiralling cost of pharmaceutical items is outlined above. An important concern is whether the social effects of these increasing costs may be far greater than indicated by the model. On the other hand, the model is not a forecasting tool. Even if the real depreciation persists for a number of years, the international price of many pharmaceutical items may fall over time. Within the scenario, a real depreciation induces substitution of domestically-produced for imported goods. Potentially, the depreciation could encourage increased manufacturing of pharmaceutics within Indonesia. Alternatively, importers may turn increasingly to cheaper generic brands, thereby alleviating some of the pain of rising costs.

Since 1997, the crisis in Indonesian has resulted in capital flight, rising unemployment, civil disturbances, and the loss of social and market institutions. Modelling of these disruptions explicitly is beyond the scope of the WAYANG model. The depreciation exercise presumes that disruption is not so great as to prevent movement of some resources between industries in the medium-term. This partial movement alleviates some of the acute symptoms of the crisis. On the other hand, further mobility assumptions, in the longer term, would act to restore the economy to a growth path.

Conclusion

The depth and extent of the Indonesian economic crisis suggests that several years are required before the economy resumes its past growth rates. There appears to be a restoration of sorts under way in the new millennium, despite continuing civil unrest in some provinces. There is little doubt that international financial markets and investors will once more consider

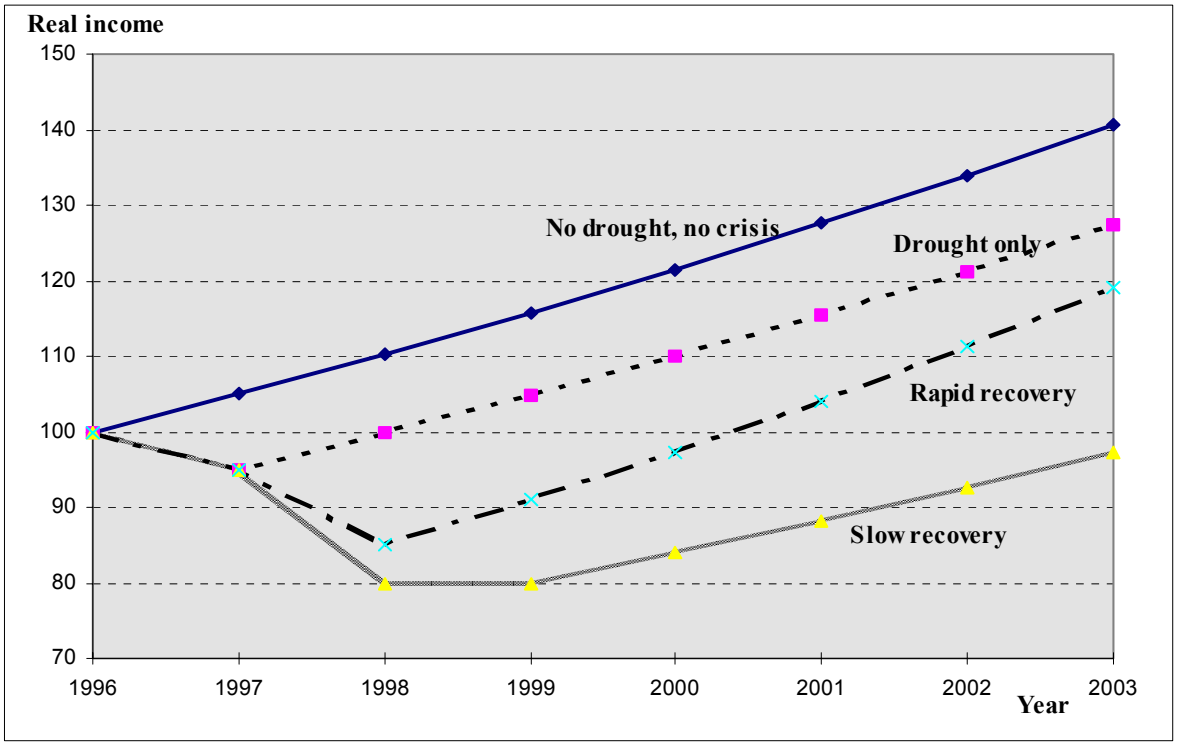
Indonesia favourably if peace can be negotiated in various trouble spots in the archipelago. Conversely, continuing strife until now appears to have hindered the recovery of the rupiah since its initial collapse.

Supposing the economy, in the absence of a crisis, had continued to grow at more than 5 percent a year. With the contractions in 1997 and 1998 alone, the crisis would have the effect, by 2003, of reducing national income by around 25 percent from the counter-factual with no crisis (Figure 9.3). The "slow recovery" path shown in Figure 9.3 indicates a more grave outcome, in which real income does not recover its 1996 level by 2003.

The modelling in this paper is an attempt to understand how and why the Indonesian economy has altered in the wake of the crisis. There are, however, several difficulties in using a comparative static approach to model elements of the crisis. For example, with the collapse of the rupiah has come inflation, as modelled. Inflation creates uncertainty. This in turn exacerbates a loss in investor confidence. Partial indexation of wages in Indonesia has the effect of increasing the share of income accruing to certain types of labour at the expense of other factors and, in an inflationary environment, can contribute to an increase in unemployment. As mentioned above, there is some evidence of falling wages in the agricultural sector. Indexed wages within manufactures would reduce the opportunities for such industries to take advantage of increased import substitution and export sales in response to the devaluation. Indexed wages have not been modelled in the scenario presented here.

It would appear that no Asian economy has escaped the crisis of the late 1990s, but Indonesia has suffered more than other nations. The drought of 1997 alone would have caused difficulties that might have lasted beyond a year or two. Even without the dramatic capital flight and loss of investor confidence that occurred in the wake of the drought, it is highly probable that the economy would still have contracted in 1997. The stylised 'no drought, no crisis' growth path shown in Figure 9.3 assumes away a natural event and implies a growth rate that, in 1997 at least, would not have been possible even had the most judicious of economic management been in place for some time. A more reasonable counter-factual from which to consider policy analysis is the 'drought only' growth path. The difference between the 'slow recovery' income and 'drought only' income by 2003 is around 30 percent, compared with around 10 percent between the 'rapid recovery' and 'drought only' scenarios.

Figure 9.3: Stylised growth scenarios for Indonesia in the wake of the crisis



References

Anderson, K. and M. Pangestu (1995), *Agricultural and Rural Development in Indonesia into the 21st Century*, CIES Seminar Paper 95-05, University of Adelaide.

Atinc, T. M. and M. Walton (1998), *Social Consequences of the East Asian Financial Crisis*, Washington, DC: World Bank.

Bell, C. and R. Rich (1994), 'Rural Poverty and Agricultural Performance in Post Independence India,' *0xford Bulletin of Economics and Statistics* 56(2): 141-33.

Binswanger, H.P. and J. von Braun (1991), 'Technological Change and Commercialization in Agriculture, The Effect on the Poor,' *World Bank Research Observer* 6(1): 57-80, January.

BPS (1998), *Indikator Ekonomi* (various issues), Jakarta: Badan Pusat Statistik (Cental Bureau of Statistics), Internet version.

Del Roso, H. (1992), 'Investing in Nutrition with World Bank Assistance,' Washington, DC: World Bank.

FAO (1992), *The State of Food and Agriculture,* Rome: Food and Agriculture Organization of the United Nations.

Foster, A. and M. Rosenzweig (1993), 'Information flows and discrimination in labour markets in rural areas in developing countries,' in *Proceedings of the World Bank Annual Conference on Development Economics 199*2, edited by L. Summers and S. Shah. Washington DC: World Bank.

Foster, A. and M. Rosenzweig (1995), 'Learning by doing and learning from others: human capital and technical change in agriculture,' *Journal of Political Economy* 103(6): 1176-1209.

Foster, A. and M. Rosenzweig (1996), 'Technical change and human capital returns in investments: evidence from the green revolution,' *American Economic Review* 86(4): 931-53.

Krueger, A. O. (1995), 'East Asian experience and endogenous growth theory', pp. 9-36 in *Growth Theories in Light of the Asian Experience*, edited by T. Ito and A. O. Krueger, Chicago: University of Chicago Press.

Lipton, M. and M. Ravallion (1995), 'Poverty and Policy,' in *Handbook of Development Economics Vol IIIB*, edited by J. Behrman and T.N. Srinivasan, Amsterdam: Elsevier.

Martin, W. and P.G. Warr (1993), 'Explaining the Relative Decline of Agriculture: A supply-Side Analysis for Indonesia', *World Bank Economic Review* 7(1): 381-401.

Rodrigo, G.C. and E. Thorbecke (1997), 'Sources of Growth: A reconsideration and general equilibrium application to Indonesia, ' *World Development* 25(10): 1609-1625.

Solahuddin, S. (1998), 'Agricultural Policy and Development in Indonesia.'' Keynote presentation at the International Seminar on Agricultural

Engineering and Technology Application in Developing Countries - Case Studies for Indonesia and Some African Countries, Bogor, 22 September.

Tabor, R.T., H.S. Dillon, and M.H. Sawit (1998), *Food Security on the Road to Economic Recovery*. Paper presented at the Indonesian Society of Agricultural Economics (PERHEPI) and The Center for Agricultural Policy Studies (CAPS), meeting, 26 June 1998.

Tay, S.S.C. (1998), 'What Should be Done About the Haze?' *The Indonesian Quarterly* 26(2): 99-117, March.

Timmer, P. (1992), 'Agriculture and Economic Development Revisited', *Agricultural Systems* 40: 21-58.

Wittwer, G. (1999), *WAYANG: A General Equilibrium Model Adapted for the Indonesian Economy*, (adapted from Horridge, M., B. Parmenter and K. Pearson, *ORANI-G: A General Equilibrium Model of the Australian Economy*), Adelaide: Centre for International Economic Studies (downloadable at http://www.adelaide.edu.au/cies/iwp9910.pdf

World Bank (1998a), *Indonesia Country Brief*, Washington DC: World Bank.

World Bank (1998b), *Indonesia in Crisis: A Macroeconomic Update*. The World Bank, Washington, DC.