TMD DISCUSSION PAPER NO. 52

Structural Adjustment, Agriculture, and Deforestation in the Sumatera Regional Economy

Nu Nu San
Hans Löfgren
and
Sherman Robinson
International Food Policy Research Institute

Trade and Macroeconomics Division
International Food Policy Research Institute
2033 K Street, N.W.
Washington, D.C. 20006 U.S.A.

March, 2000

Structural Adjustment, Agriculture, and Deforestation in the Sumatera Regional Economy

Nu Nu San
Hans Löfgren
and
Sherman Robinson

ABSTRACT

The Asian financial crisis led to a major devaluation of the Indonesian exchange rate, macro instability, and the need for a “structural adjustment” program. The real devaluation affects prices throughout the economy and has a major impact on growth, production, deforestation, and income distribution in the Sumatera region. This paper uses computable general equilibrium (CGE) models —a national model and a regional model of Sumatera— that focus on agriculture to explore the impact of a real devaluation on the economy of Sumatera. The model incorporates commodity and factor market linkages between Sumatera, the rest of Indonesia, and the world (through commodity trade). Simulations are conducted for the short and medium run under alternative scenarios of macro adjustment.

Structural adjustment causes Sumatera's economy to contract in both the short and medium run. Devaluation leads to increases in the prices of tradable goods. Regional exports increase, mainly from the non-agricultural sectors, and imports decline. The agricultural terms of trade (agricultural prices relative to non-agricultural prices) decline because agriculture has a small share in both regional and national exports. Food crops, except for rice and sugar, decline while tree crops increase. Deforestation is likely to increase because demand for forestry products increases, both as final products and as intermediate goods for the wood processing industry, both of which are sold on international markets. We analyze a possible policy response of imposing an export tax of 5-20 percent on processed wood to discourage further deforestation in the region. The results show that the proposed export tax reduces production of raw timber and processed wood, but at the cost of lowering exports and hence making the macro adjustment more difficult.

Given the current situation, it is impossible to predict exactly how the resolution of the current macro crisis will unfold. We model two alternative macro adjustment scenarios that should bracket the likely response of the Sumatera region to the devaluation and structural adjustment program. In the first, we assume that regional investment is a proportion of regional aggregate income (or regional absorption), and that the adjustment burden is shared proportionately between aggregate consumption and investment. In the second, regional savings and investment are assumed to fall more, as the region’s trade balance is forced to improve dramatically to reflect the large required changes in the national trade balance. Under the first adjustment scenario, a devaluation benefits large farm households in the rural area and urban high income households who are involved in the production of tradable goods, while both rural poor and urban poor households lose. When investment falls more, all farm households and urban high income households benefit, but poor urban households lose more because the decline in investment hurts unskilled urban labor, especially in construction.

Table of contents

1. INTRODUCTION

Over the last decades, a large share of Sumatera's primary forest has been lost due to commercial logging, infrastructure development, large-scale immigration, natural population growth, and rapid growth of the plantation sector. Although this development pattern has generated much needed income for poor immigrants and parts of the native population, it is not environmentally sustainable. Macroeconomic, trade, and sectoral policies have been instrumental in guiding the nature and distribution of agricultural growth. However, current understanding of the impact of different policies on natural resources is still limited. The main objective of this study is to analyze the impact of a structural adjustment program —in particular, devaluation of the real exchange rate, as has occurred as a result of the Asian financial crisis— on production, land use, deforestation, and income distribution in the Sumatera region of Indonesia.

For this analysis, we have developed an agriculture-focused computable general equilibrium (CGE) model of the Sumatera region with a detailed treatment of land use, labor markets, and the household sector. The model allows us to simulate the effect of changes in policies and other exogenous conditions. Each simulation provides a full set of regional economic indicators, including household incomes; prices, supplies, and demands for factors and commodities; and macroeconomic data (*inter alia*, gross domestic product (GDP) and its breakdown, absorption, exports, and imports).

2. BACKGROUND

Sumatera is the second largest among the thousands of islands that make up Indonesia. It contains 20% of Indonesia's population and 25% of its GDP (18% of GDP if oil is excluded). In large parts of Sumatera, primary forests are being modified by selective logging or are being cleared and replaced by plantations (rubber, oil palm, and coffee) or by slash-and-burn cultivation. The land area devoted to estate crops, especially oil palm, coffee, and rubber, has expanded significantly over the past two decades: 117 percent for oil palm, 200 percent for coffee, and 90 percent for rubber plantations. Government policy plays a key role in determining land transformations. Sectoral policies directly affect forest-related activities. The government awards and supervises existing logging concessions, approves and provides investment incentives for plantation expansion, and is the driving force behind the transmigration efforts.

During 1997-98, Indonesia experienced the worst financial crisis in three decades. The Rupiah devalued against the U.S. dollar by as much as 75 percent initially. This crisis affected every aspect of the nation's economy. The extent of the impact depends partially on economic structure, and partly on the policies implemented during the time of crisis. Therefore, understanding the relationship between macro policy variables and economic indicators would help policy makers in implementing effective programs to improve economic performance.

Against this background, the objectives of this paper are: (1) to explore the impact of devaluation on production, income distribution, and deforestation in Sumatera; and (2) to analyze the impact of an export-tax policy aimed at reducing deforestation. In the process, we develop a research framework that can be used to analyze the effects of a broader set of structural adjustment programs on Sumatera's economy.

3. A CGE MODEL OF SUMATERA

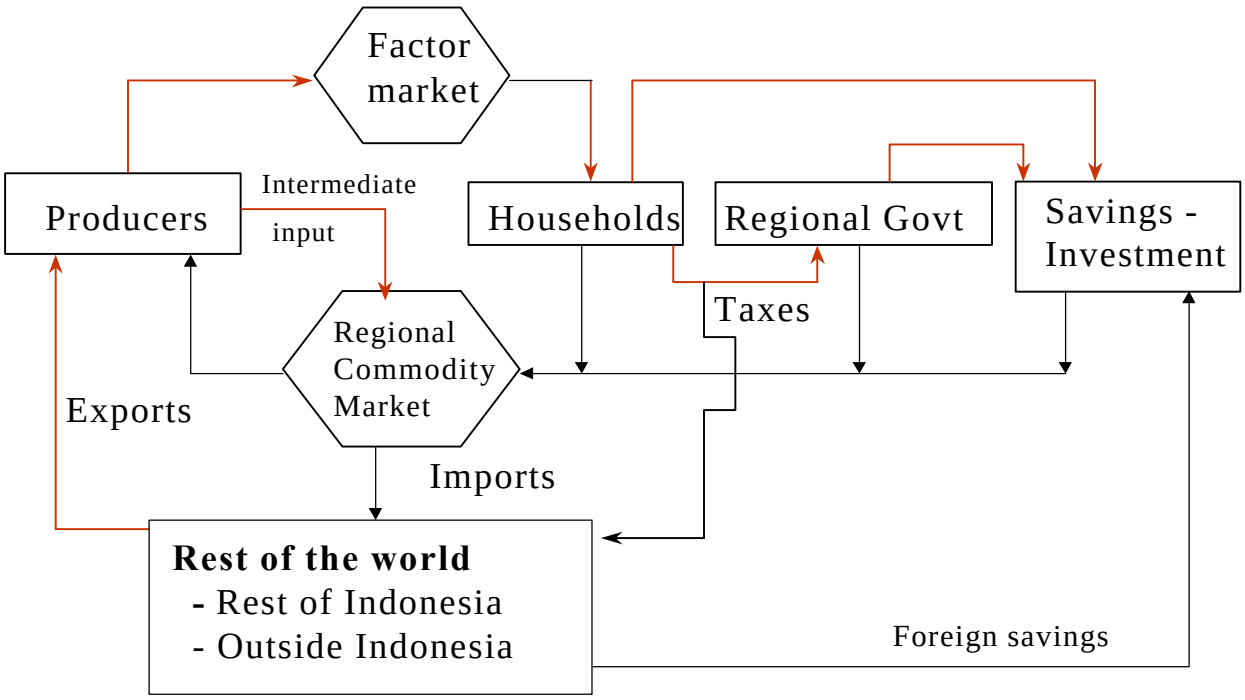
The CGE modeling framework is applied at the regional level with modifications that capture key institutional features and policy mechanisms that are specific to Sumatera. The structure of the model draws most directly on Hanson, Kilkenny, and Robinson (1990), Hazell and Ramasamy (1991), Robinson and Gehlhar (1995), Löfgren (1995), and Löfgren, Robinson, and Nygaard (1998). For detailed descriptions of the Sumatera regional model, see San, Löfgren, and Robinson (1999).

3.1. MODEL STRUCTURE

The basic framework of the Sumatera regional CGE model is summarized in the circular flow diagram shown in Figure 1. Producers, consumers, and government are principal agents, while their activities are associated with commodity and factor markets. In terms of behavior, it is assumed that producers maximize profits subject to prices and technologies (specified by a nested CES value-added function, and Leontief intermediate input coefficients), while consumers maximize utility subject to budget constraints and prices. Equilibrium is characterized by prices, quantities, and payment flows at which market quantities supplied and demanded are equal within the framework of competitive markets. Factors are finely disaggregated and their mobility is limited; any given land, labor, and capital category can only be used by a few activities.[1] Factors utilization is fixed at base levels with flexible market-clearing wages or rents, while intersectoral allocation is endogenously determined.

[1]For example, arable land can only be used by food crop production activities.

Figure 1. Circular Flow of Payments in Computable General Equilibrium (CGE) Model of Sumatera



With a few important exceptions, there is a one-to-one mapping between activities (the producing sectors) and commodities (the outputs produced). The exceptions are for rubber and oil palm production activities, where the two types of technologies (estate and smallholder) produce the same commodity.

Factor incomes generated by the production activities are divided among institutions (households and the rest of the world) in fixed factor-specific shares. In addition to factor income, households receive transfers (remittances) from the rest of the world. Total household income is used to pay taxes, save, and consume.

Regional government revenue includes direct taxes and indirect taxes collected from

domestic activities. All taxes are *ad valorem*. Local government consumption is a fixed share of total absorption. The rest of the world supplies imports and demands exports. Sumatera is treated like a "small country" in the sense that the export demands and import supplies that it faces are infinitely elastic at prevailing prices. It is important to note that, in this regional context, exports and imports refer to trade with the rest of the world as defined from Sumatera's perspective, i.e., including the rest of Indonesia and the world outside Indonesia's borders.

The Armington assumption is used to capture the choice between imports and domestic output under imperfect substitutability: to the extent that a commodity is imported, all domestic demands — household and government consumption, investment demand, and intermediate demands — are for a composite commodity, which is a mix between imports and domestic output. This demand is determined by the assumption that domestic demanders minimize cost subject to imperfect substitutability, captured by a CES aggregation function. Similarly, the allocation of domestic output between exports and domestic sales is determined by the assumption that domestic producers maximize profits subject to imperfect transformability between these two alternatives, expressed by a constant-elasticity-of-transformation (CET) function. These assumptions — imperfect substitutability and transformability — give the domestic (regional) price system a certain degree of independence from export and import prices and dampen export and import responses to changes in the producer environment. As a special feature, our model extends the Armington assumption to regional outputs produced by different activities: these are treated as imperfect substitutes in demand in a manner that parallels the treatment of imports and outputs of domestic origin. The result is that activities that face higher production costs and charge a higher price than their competitors lose some market share without

being forced to go out of business.

The macro system constraints (or macro closure) determine the manner in which the aggregate accounts for the local government, the rest of the world, and savings-investment are brought into balance. At the time of writing, it is impossible to predict exactly how the resolution of the current macro crisis will unfold, and how the adjustment burden will affect the macro accounts of the Sumatera region. We model two alternative macro adjustment scenarios that should bracket the likely response of the Sumatera region to the devaluation and structural adjustment program. In the first, which can be seen as a "balanced" macro adjustment, we assume that regional investment and regional government consumption are fixed proportions of regional aggregate demand (or regional absorption, which equals regional GDP plus imports minus exports). The regional savings rate (from household income) is assumed to adjust to achieve savings-investment balance. In this case, the adjustment burden of the macro shock due to the devaluation is shared proportionately among aggregate consumption, government consumption, and investment.

In the second macro adjustment scenario, regional investment is assumed to be determined by regional savings, and there is no adjustment in the regional private savings rate as a result of the macro shock. In this "savings driven" macro closure, more of the adjustment burden falls on aggregate investment, especially as the region's trade balance is forced to improve dramatically to reflect the large required changes in the national trade balance (i.e., from Sumatera's perspective a reduction in foreign savings), which significantly lowers regional aggregate demand. These two macro scenarios have different implications for the sectoral structure of demand, as well as the distribution of income, as the regional economy adjusts to the macro shocks. We present results

under both macro adjustment scenarios, which give an idea of the range of adjustments that can be expected. Some empirical conclusions, discussed below, are robust in that the qualitative results are the same under either adjustment scenario.

3.2. MODEL DATABASE

The model is calibrated so as to replicate the 1990 regional Sumatera SAM that was constructed specifically for this study. The starting point for our SAM is the Sumatera part of Indonesia's 1990 intra-regional input-output table (BAPPNAS and JICA, 1995), and Indonesia's 1990 national SAM (BPS, 1994). In order to further disaggregate agriculture and the household sector, these tables were complemented by data from several other sources. The Sumatera SAM incorporates 24 production activities, 22 commodities, 15 factors of production, and 7 household types. A cross entropy approach was used to balance the SAM (Robinson, Cattaneo, and El-Said 1998).[2]

3.3. STRUCTURE OF INDONESIA'S NATIONAL ECONOMY

Table 1 presents the 1990 Indonesian economy with reference to sectoral value added, output, trade, and trade ratios. The share of agriculture value-added is 24 percent, of which 15 percent is from food crops, 3 percent from plantation crops, 2 percent from livestock, and 2 percent each from forestry and fishery sectors. Among the non-agriculture sectors, oil production alone has a significant 11 percent share in total value-added.

[2]The current SAM is preliminary and will be refined in the near future.

Table 1. Structure of Indonesia s Economy, 1990.

	Sectoral composition (%)					Ratios (%)	
	Value Added (VA)	Output (X)	Domestic supply (Q)	Exports (E)	Imports (M)	Exports/ output (E/X)	Imports / domestic supply (M/Q)
Agriculture	**24.1**	**19.0**	**19.5**	**3.2**	**2.0**	-	-
Food crops							
Rice	7.7	8.2	7.8	0.0	0.0	0.0	0.0
Soybeans	0.6	0.3	0.4	0.0	0.5	0.0	8.9
Maize	0.8	0.4	0.4	0.1	0.0	1.0	0.1
Cassava	1.0	0.5	0.6	0.0	0.0	0.0	0.0
Fruits and vegetables	4.0	2.1	2.5	0.0	0.2	0.1	0.6
Other	1.0	0.6	0.7	0.3	0.6	3.9	5.4
Total	15.1	12.2	12.3	0.4	1.4		
Other agriculture							
Rubber	0.3	0.2	0.2	0.1	0.0	4.1	0.1
Sugarcane	0.4	0.3	0.3	0.0	0.0	0.0	0.0
Coconut	0.6	0.3	0.3	0.0	0.0	0.2	0.0
Palm oil	0.4	0.3	0.2	0.6	0.0	17.5	0.0
Other	1.5	0.9	0.8	1.3	0.2	11.4	1.6
Total	3.2	2.1	1.8	2.0	0.2		
Livestock	2.4	2.4	2.5	0.1	0.1	0.2	0.2
Forestry	1.5	1.0	1.2	0.2	0.3	1.3	1.6
Fishery	1.9	1.3	1.6	0.6	0.0	3.6	0.0
Non-agriculture	**75.9**	**81.0**	**80.5**	**96.8**	**98.0**	**16.7**	**14.7**
Oil	10.9	6.8	3.5	22.9	4.5	27.7	8.0
Mining	2.0	1.5	1.4	2.9	0.8	15.4	3.8
Food processing	3.6	6.3	6.4	7.5	2.5	9.7	2.5
Furniture	1.9	2.9	1.3	13.7	0.1	39.5	0.5
Textiles	2.3	3.7	2.9	10.5	4.6	23.5	9.9
Paper	0.7	0.9	1.0	0.6	1.1	5.5	6.8
Fertilizer	0.9	0.8	0.7	0.9	0.5	9.5	4.6
Chemical	0.8	1.6	3.6	1.6	14.1	8.3	24.4
Petroleum refinery	3.6	5.4	3.5	18.5	2.9	28.0	5.1
Cement	0.4	0.7	1.1	0.8	1.9	8.9	10.8
Steel	0.9	1.4	2.0	2.7	5.3	15.4	16.9
Other manufacturing	3.0	5.9	13.1	6.6	46.1	9.3	22.2
Construction	4.9	10.6	9.8	0.0	0.0	0.0	0.0
Electricity, gas, and water	0.7	1.2	1.1	0.0	0.0	0.0	0.0
Trade	12.0	9.3	8.3	0.4	0.6	0.3	0.4
Restaurants and hotels	3.1	4.1	3.7	2.0	2.0	4.0	3.4
Transportation and communication	5.5	5.4	5.1	1.6	2.3	2.4	2.9
Services	7.9	5.9	5.5	3.3	4.5	4.6	5.2
Public administration	7.8	5.2	5.1	0.5	3.3	0.8	4.1
Other services	2.9	1.4	1.4	0.0	0.9	0.2	3.9
Total	100.0	100.0	100.0	100.0	100.0		

Most of Indonesia's foreign trade is in manufacturing and mining. In terms of shares, oil, petroleum, furniture, and textiles account for 66 percent of total exports. Agriculture exports as a primary product is only 3 percent of total exports; however, the processed food sector accounts for nearly 8 percent of total exports. Among the imports, agricultural products only comprise 5 percent.

3.4. STRUCTURE OF THE SUMATERA REGIONAL ECONOMY

The SAM provides a detailed picture of the structure of Sumatera's economy in 1990. Table 2 reports the sectoral composition of output, value added, exports, imports, and labor income. In terms of regional GDP shares, mining (primarily petroleum and natural gas) is the major income earning sector (26%). Agriculture represents 20% of GDP, with rice as the most important subsector and 65% of employment.[3] The forestry and wood processing sectors combined provide 4% of regional value-added. As for labor income, the agriculture sector renders 30%, while the trade and transportation sector and services sector cover 50% of total labor income.

The data for Sumatera's "foreign" trade (i.e., its trade with the rest of Indonesia and other parts of the outside world) show that the island is self-sufficient in agricultural products and accounts for 6% of total exports, with 9% originating in the forestry and wood processing sectors. The mining, chemical and rubber, and trade and transportation sectors together

[3]The agricultural sector is also important as a source of intermediate products to non-agricultural sectors: oil palm is used for food processing, timber for wood processing, and rubber for the chemical and rubber industries.

Table 2. Structure of Sumatera's Economy, 1990.

	Sectoral Composition (Percent)					Ratios (Percent)		
	Value Added (VA)	Output (QA)	Domestic Supply (QQ)	Exports (QE)	Imports (QM)	Exports/ Output (QE/QX)	Imports/ Domestic Supply (QM/QQ)	Labor Income (%)
Agriculture	**19.9**	**16.2**	**25.9**	**6.1**	0.0	-		**28.9**
Food crops								
Rice	5.0	3.8	4.6	0.2	-	2.7	-	8.3
Soybeans	0.5	0.3	0.4	0.2	-	16.4	-	0.8
Cassava	0.6	0.4	0.4	0.3	-	22.5	-	1.0
Maize	0.4	0.3	0.3	-	-	17.8	-	0.6
Horticulture	2.6	1.9	2.3	0.1	-	5.2	-	4.3
Other	0.7	0.5	0.6	-	-	-	-	1.2
Non-food crop					-			
Rubber			0.9	-		-		
Estate	0.4	0.3	-	-	-	-	-	0.6
Smallholder	0.6	0.4	-	-	-	-	-	0.9
Palm oil			1.4	-	-	-	-	
Estate	1.3	1.0	-	-	-	-	-	2.1
Smallholder	0.2	0.2	-	-	-	-	-	0.4
Coffee	0.6	0.5	0.2	1.0	-	57.9	-	1.0
Sugar	0.2	0.2	0.2	-	-	-	-	0.4
Other estate	1.5	1.2	0.6	2.3	-	61.9	-	2.1
Livestock	1.4	2.0	2.4	-	-	-	-	1.6
Forestry	2.0	1.5	1.3	1.4	-	31.9	-	1.4
Fishery	1.9	1.8	2.1	0.5	-	11.1	-	2.4
Non-agriculture	**80.1**	**83.8**	**74.1**	**93.9**	**100.0**	**-**		**69.4**
Mining	25.8	19.1	9.0	40.0	-	59.7	-	5.1
Food processing	4.3	8.3	8.0	7.9	4.0	32.5	4.5	2.7
Other manufacturing	1.5	1.9	10.8	1.0	73.2	27.7	76.8	1.1
Wood processing	1.9	3.0	1.1	7.3	-	70.6	-	1.9
Chemical and rubber	9.2	15.1	10.5	21.6	-	40.2	-	5.8
Services	16.3	15.2	20.8	2.0	22.8	6.1	13.6	23.8
Construction	3.5	6.0	7.4	-	-	-	-	4.4
Trade and Transportation	17.6	15.2	14.4	12.2	-	22.7	-	26.4
Total	100.0	100.0	100.0	100.0	100.0	-	-	100.0

contribute 74% of Sumatera's exports. Manufactured goods account for 73% of total imports.

The data show that the agricultural production activities are relatively labor-intensive. While agricultural households receive income largely from labor and land, non-agricultural households mainly depend on labor income, supplemented by capital income. A significant amount of factor income (21 percent of total labor income, 19 percent of land income, and 46 percent capital income) is transferred to the rest of Indonesia and/or foreign countries.

4. SIMULATIONS

4.1. DEVALUATION IN A NATIONAL MODEL OF INDONESIA

Our starting point is a series of devaluation experiments conducted with a national CGE model of Indonesia.[4] Changes in composite prices of production and consumption in this national model are "transmitted" to Sumatera in the form of changes in regional import and export prices in the model of this region.

In both national and regional commodity markets, the producer composite price is defined as a weighted average of export and domestic goods prices (Equation a). The magnitude of its change due to devaluation depends on the export share in total output (data reported in Table 1 and 2), as well as the elasticity of transformation. Similarly, the consumption composite price is defined as the weighted average of import and domestic goods prices (Equation b). In this case, the change in price due to devaluation is influenced by the elasticity of substitution and the import share in total supply (data reported in Table 1 and 2).

$$PX_c = PD_c \cdot \frac{QD_c}{QX_c} + \overline{PE}_c \cdot \frac{QE_c}{QX_c} \qquad \text{(a)}$$

$$PQ_c = PD_c \cdot \frac{QD_c}{QQ_c} + \overline{PM}_c \cdot \frac{QM_c}{QQ_c} \qquad \text{(b)}$$

[4] For information on the economywide CGE model of Indonesia that was used for this part of the analysis, see Robinson, El-Said, and San (1998).

Table 3 presents relative changes in Sumatera export and import prices (national consumption and production composite prices) for national devaluations from 10 to 40 percent, simulated with the national model. These price changes are only relevant for commodities in which Sumatera has significant trade. On the import side, this applies to various non-primary commodities, including food processing, other manufacturing, chemical and rubber, and services. On the export side, the devaluation affects both agriculture and manufactured good sectors.

The impact of the devaluation on regional prices in Sumatera (evaluated via the national commodity market) are: relative regional export prices of food crops decline, those of tree crops and manufactured goods increase, and relative regional import prices of manufactured goods also increase. Consequently, consumer prices for manufactured goods increase relative to those of the primary good. From this point on, all prices in this discussion refer to prices in the regional commodity market.

4.2. CURRENCY DEVALUATION

This simulation is implemented with two sets of alternative assumptions regarding the mobility of land and labor across production activities, and two macroeconomic adjustment scenarios: balanced adjustment and savings-driven adjustment. The two factor mobility scenarios reflect short and longer run effects, while the two macro adjustment scenarios should bracket the likely actual macro adjustment in Sumatera, given uncertainty about how the impact of the national macro crisis is being transmitted to the different regions of Indonesia.

Table 3. Real Devaluation in the National Model and Regional Sumatera Commodity Prices (% change).

Production Activities	Regional Export Prices with Rp. Devaluation in the National Model				Regional Import Prices with Rp. Devaluation in the National Model			
	10%	20%	30%	40%	10%	20%	30%	40%
Rice	2	1	-5	-5	-	-	-	-
Soybean	-2	-9	-20	-32	-	-	-	-
Cassava	-6	-17	-33	-50	-	-	-	-
Maize	-5	-15	-29	-42	-	-	-	-
Horticulture	-6	-17	-33	-49	-	-	-	-
Other food crop	-4	-12	-25	-38	-	-	-	-
Coffee	2	4	8	10	-	-	-	-
Other estate crop	2	5	7	10	-	-	-	-
Livestock	-5	-10	-15	-30	-	-	-	-
Forestry	13	26	33	35	-	-	-	-
Fishery	-1	-5	-10	-13	-	-	-	-
Mining	6	14	23	34	-	-	-	-
Food processing	5	10	15	20	0.4	1	3	5
Other manufacturing	5	10	17	25	6	12	18	24
Wood processing	6	14	22	30	-	-	-	-
Chemical and rubber	5	8	10	15	5	8	10	15
Services	3	8	13	17	4	8	12	16
Trade and transportation	3	7	15	20	-	-	-	-

4.2.1. Assumptions for Factor Markets

The first set of assumptions allows unemployment in the non-agriculture labor market, and limits the mobility of family labor in agriculture sectors, perennial land, capital in livestock and forestry sectors. The simulation with the second set of assumptions allows more factor mobility and hence adjustment possibilities. Results from the first set of assumptions embody assumptions of relatively *short-term adjustment with unemployment* in the non-agricultural labor market, and that of the second setting reflects a *medium-term, full-employment* adjustment scenario.

4.2.2. Macroeconomic Adjustment Scenarios

In the first macro adjustment scenario, the "balanced" adjustment, we assume that regional investment is a proportion of regional aggregate demand (or regional absorption), and that the adjustment burden is shared proportionately between aggregate consumption and investment. In the second, savings-driven adjustment, regional savings and investment end up falling more to reflect the large required changes in the national trade balance.

4.3. RESULTS: BALANCED MACRO ADJUSTMENT

4.3.1. Short-term, Unemployment Scenario

Increased export and import prices of manufactured goods encourage their production and discourage consumption. In the agricultural sectors, the decline in export prices for food crops weakens incentives for production except for the staple crops, rice and sugar, which have relatively low income elasticities of demand. In the tree crop sector, production of oil palm,

rubber, coffee, and other estate crops is encouraged by higher prices. At the micro level, demand shifts away from more expensive imports, boosting demand and prices of domestic output sold domestically. However, higher prices for manufactured goods lower real incomes, with the effect of dampening consumption demand throughout the economy. Table 4 reports the ultimate impact on commodity production. These results represent a short-run scenario, as most of the factors (except for agriculture paid labor, skilled, and unskilled labor), are limited in their ability to move across production sectors.

The results show that, except for rice and sugar, food crop production (soybean, cassava, maize, horticulture) declines. Non-food crop production (rubber, oil palm, coffee and other estate crop) increases. Livestock and fishery production decline as their price incentives are weakened. Deforestation is likely as more forestry products are demanded, both as final products and as intermediates for the wood processing industry, the latter reflecting a strong backward linkage from forestry to the wood processing industry.

In the factor markets, rents increase for factors associated with tradables, most strongly for capital and land used for tree crops. Secondary forestry land and monoculture tree crop land rents rise while grass land and arable land rents decline. In the labor market, real wages for agricultural labor decrease, but wages for clerical, production, and professional labor increase. Returns to capital in the food crop and livestock sectors decline, but are boosted in tree crops, manufacturing, and forestry.

Devaluation has a negative impact on low-income household groups in both rural and urban areas. The changes in real income for different households vary according to their main source of income and sectoral composition of consumption demand. Agricultural labor and small

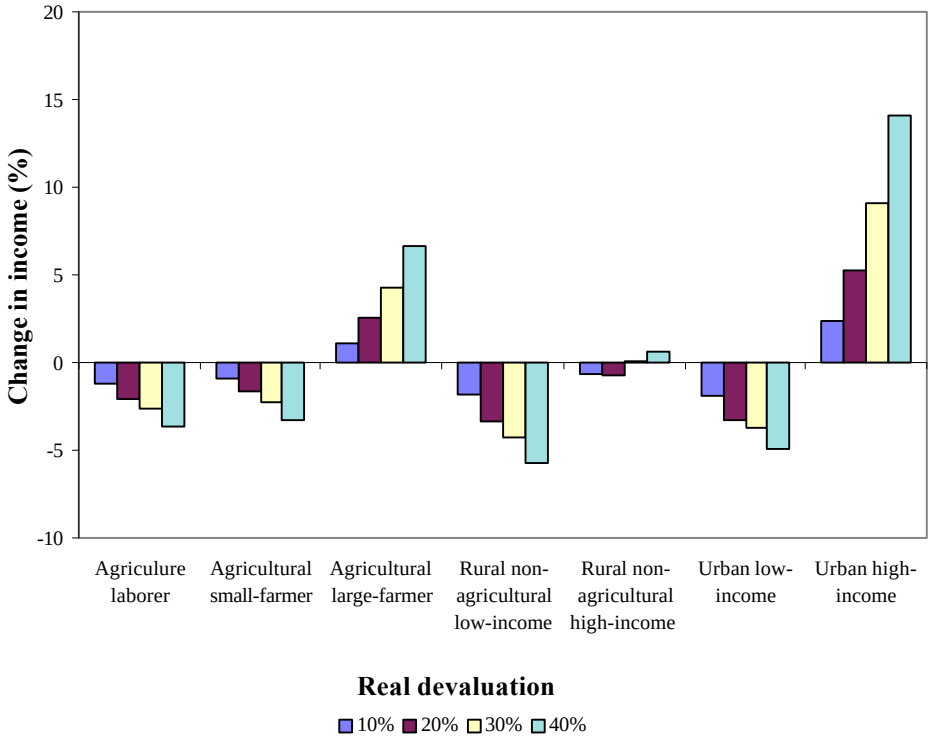
Table 4. Short-run, Unemployment Scenario: Real Devaluation and Production in Sumatera (% change).

Production Activities	Base Values**	Rp. Devaluation in the National Model (Balanced Macro Adjustment)				Rp. Devaluation in the National Model (Savings Driven Closure)			
		10%	20%	30%	40%	10%	20%	30%	40%
Agriculture									
Food crop									
Rice	2610	0.4	0.8	1.2	1.7	0.3	0.7	1.0	1.3
Soybeans	279	-0.4	-2.0	-4.1	-6.4	-0.8	-2.4	-4.4	-5.9
Cassava	352	-1.6	-4.6	-8.1	-10.9	-2.4	-5.7	-8.9	-11.0
Maize	235	-1.5	-3.7	-6.0	-8.1	-1.4	-3.1	-4.8	-5.8
Horticulture	1336	-0.9	-1.8	-2.4	-3.3	-0.3	-0.5	-0.5	-0.3
Other food crop	392	-0.9	-1.8	-2.6	-3.6	-0.3	-0.6	-0.6	-0.6
Non-Food crop									
Estate rubber	223	1.0	1.0	0.7	1.0	1.2	1.4	1.5	1.7
Smallholder rubber	282	0.6	0.8	1.0	1.5	0.4	0.4	0.4	0.4
Estate oil palm	666	1.4	3.0	5.0	6.7	1.0	2.2	3.6	4.2
Smallholder oil palm	127	0.5	1.1	1.8	2.4	0.4	0.9	1.4	1.6
Coffee	353	0.5	1.1	2.1	2.8	0.1	0.3	0.8	0.9
Sugar	146	0.7	1.5	2.5	3.5	0.9	1.8	2.8	3.7
Other estate crop	817	0.7	1.7	2.6	4.0	0.1	0.5	0.6	1.0
Livestock	1391	-1.6	-3.0	-4.1	-6.1	-0.4	-0.5	-0.2	-0.2
Forestry	1045	2.2	4.5	6.0	7.0	1.7	3.4	4.4	4.6
Fishery	1301	-1.6	-3.4	-4.9	-6.6	-0.8	-1.6	-2.2	-2.5
Non-Agricultural Sector									
Mining (Petroleum)	12785	0.3	0.6	0.9	1.2	0.2	0.5	0.8	1.1
Food processing	5710	1.5	3.3	5.1	7.0	1.4	2.8	4.3	5.6
Other manufacturing	1334	-0.1	-0.1	0.4	0.5	-2.2	-4.8	-7.0	-10.8
Wood processing	2109	2.3	5.5	8.7	11.9	1.9	4.7	7.7	10.7
Chemical and rubber	10918	0.9	1.1	0.9	1.3	1.0	1.3	1.3	1.9
Services	10346	-3.5	-6.6	-9.0	-12.7	-2.5	-4.3	-5.2	-6.4
Construction	4084	-5.4	-10.4	-14.6	-19.8	-17.4	-34.2	-50.0	-69.2
Trade and transportation	10660	-2.1	-3.6	-3.9	-5.5	-3.3	-5.9	-6.9	-9.0

** Base values are in 1990 billion Rupiah

farm households, producing non-tradables, face a decline in real income due to lower labor income in the agriculture sector. Medium and large farm households and urban high-income households, producing tradables, benefit from the increase in capital income. Urban high-income households are among those who gain the most while rural non-farm are among the hardest hit (Figure 2).

Figure 2. Short-Run, Unemployment Scenario with Balanced Macro Adjustment: Real Devaluation and Disposable Household Incomes.



Changes in economy-wide indicators (compared to their base levels) are shown in Table 5. The decline in Sumatera's real GDP is 3.3 percent for a 40 percent devaluation. Household total consumption declines by 14 percent, by 6 percent in agricultural commodities,

Table 5. Balanced Macro Adjustment: Real devaluation and Sumatera s Macroeconomic Indicators (% change).

		Rp. Devaluation in the National Model (Short run-Unemployment scenario)				Rp. Devaluation in the National Model (Medium run-full Employment scenario)			
	Base Values*	10%	20%	30%	40%	10%	20%	30%	40%
Percent change in real :									
GDP	46.3	-0.9	-1.8	-2.3	-3.3	-0.2	-0.5	-1.1	-2.0
Private consumption	21.2	-3.9	-7.4	-10.1	-13.9	-6.6	-12.6	-18.0	-25.7
Investment	8.3	-6.1	-11.6	-16.4	-22.2	-9.5	-17.9	-25.1	-34.7
Government consumption	3.6	-4.1	-7.8	-11.0	-15.3	-8.2	-15.6	-22.2	-31.3
Exports	20.9	2.5	4.8	7.0	9.4	7.7	14.4	20.0	27.6
Imports	-7.8	-6.9	-13.0	-17.8	-23.8	-10.1	-18.6	-26.0	-35.4

* Base values are in 1990 trillion Rupiah

and 20 percent in non-agricultural commodities. Total investment declines by 22 percent while government consumption decreases by 15 percent. As expected, total imports decline while total exports increase, boosting the regional trade surplus. The agriculture terms of trade also declines with Rupiah devaluation, as the non-agriculture sectors dominate regional exports and imports.

4.3.2. Medium-Term, Full-Employment Scenario

Sectoral impacts for the medium-term, full-employment scenario are similar to those of short-term, unemployment scenario in both macro adjustments. The detailed results are not reported in this paper. In the agricultural sector, food crop production declines as tree crop production expands, with the exception of monoculture rubber, which is mainly replaced by oil palm. Higher demand for forestry and timber products would possibly induce further deforestation in the region. Returns to perennial and secondary forest land increase relative to all other land types. Changes in capital markets are parallel to that of the short-term scenario. In the labor market, the real wage deteriorates throughout the economy. At the household level, income distribution impacts are also parallel to those of the short-term scenario, with lesser impacts to all income groups. At the macro level, compared to the preceding scenario, the decline in real GDP is relatively mild (2 percent for a 40 percent devaluation). However, the decline in aggregate household consumption is deeper (24 percent for a 40 percent devaluation), aggregate imports decline by as much as 30 percent, and total exports go up by 28 percent. The agricultural terms of trade decline in the medium term, similar to the change in the short-term scenario.

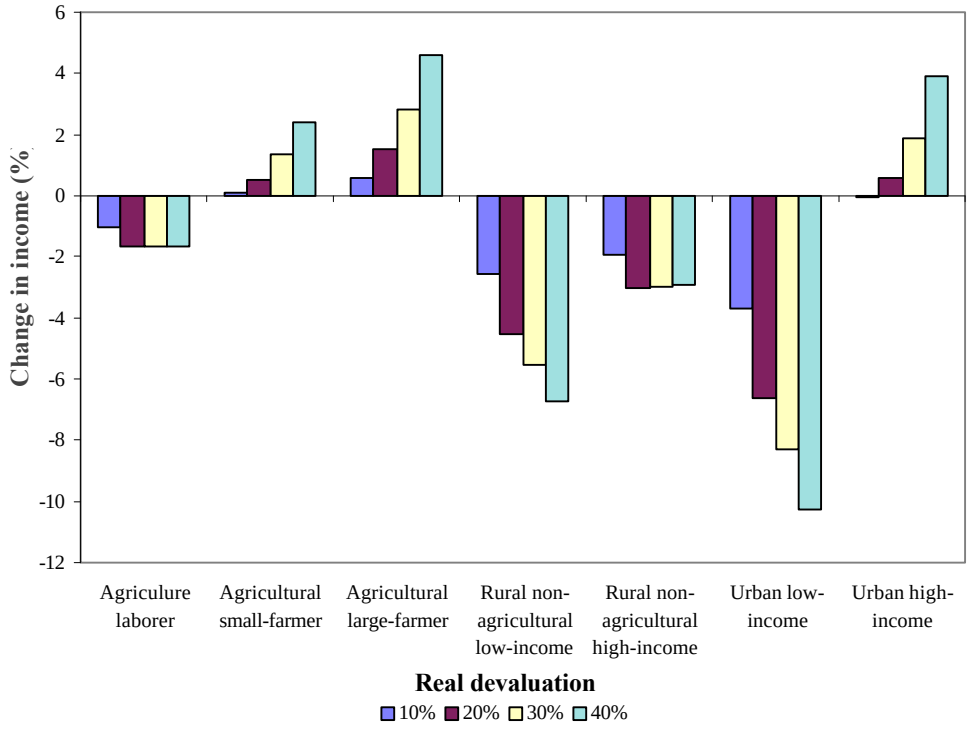
4.4. RESULTS: SAVINGS-DRIVEN MACRO ADJUSTMENT

4.4.1. Short-term, Unemployment Scenario

Compared to the balanced macro adjustment scenario, the savings-driven adjustment leads to similar structural changes in agriculture: tree crop production increases; food crop production falls; and deforestation is still a threat with increased production in the forestry and wood processing sectors. In the non-agricultural sectors, however, the impact is quite different because, under the savings-driven adjustment, regional investment falls much more than under the balanced adjustment. The result is that sectors producing capital goods (trade and transportation, other manufacturing, and construction) decline, despite higher export prices. Construction, in particular, is hit hard as the real devaluation reaches 40 percent (Table 4). In this case, regional investment falls by 81 percent from the base value.

There are also differences in the results for the factor markets. Under the savings-driven adjustment, the return to land increases for all land types, while in the balanced adjustment scenario only secondary forest land and monoculture land rent increase. Again, the collapse in investment increases the relative attractiveness of agricultural sectors. In the labor market, the real wage of non-agricultural labor declines. In the rural area, farm households benefit while all other non-farm households, both urban and rural, except the urban high-income household, are negatively affected by the devaluation (Figure 3). At the macro level (Table 6), the regional economy contracts as much as 5 percent with the 40 percent devaluation. Total exports increase only 9 percent, while total imports decline up to 41 percent. Household consumption initially declines; however, it finally improves with a 40 percent devaluation as export growth increases income.

Figure 3. Short-Run Unemployment Scenario with Savings-Driven Macro Adjustment: Real Devaluation and Disposable Household Incomes



4.4.2. Medium-Term, Full-Employment Scenario

We present results for this scenario with the savings-driven adjustment and devaluations of 10 to 30 percent. Results for the macroeconomic indicators parallel the results from the short-term scenario, with a lesser effect on GDP (Table 6). With more capacity to adjust, the regional economy is able to recover more effectively from the shock. In the medium run, the real wage response to a devaluation is similar to that of the short-run scenario. Urban low-income households and rural non-farm households who do not have access to land and capital are negatively affected by the devaluation.

Table 6. Savings Driven Closure: Real devaluation and Sumatera s Macroeconomic Indicators (% change)

		Rp. Devaluation in the National Model (Short run-Unemployment scenario)				Rp. Devaluation in the National Model (Medium run-full Employment scenario)			
	Base Values*	10%	20%	30%	40%	10%	20%	30%	40%
Percent change in real :									
GDP	46.3	-1.5	-2.8	-3.8	-5.1	-0.4	-1.1	-2.0	-
Private consumption	21.2	-0.9	-1.2	-0.6	0.2	0.2	0.7	1.7	-
Investment	8.3	-20.4	-40.2	-59.1	-81.9	-41.4	-81.4	118.1	-
Government consumption	3.6	-5.8	-11.0	-15.4	-20.5	-10.9	-21.4	-30.9	-
Exports	20.9	2.6	4.9	7.1	9.5	10.0	19.0	26.2	-
Imports	-7.8	-11.5	-21.8	-30.7	-40.9	-19.8	-38.0	-54.2	-

* Base values are in 1990 trillion Rupiah

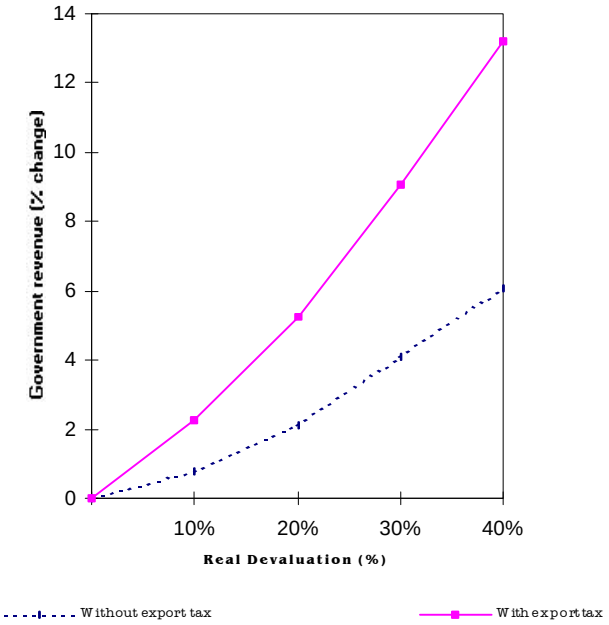
4.5. DEFORESTATION AND POLICY RESPONSE

Both short run and medium-run scenarios suggest that devaluation will place pressure on Sumatera's forest since processed wood, raw timber, and other forestry products support exports, both directly and indirectly (as intermediate inputs into manufactured exports). Historically, logging has paved the way for shifting cultivation and the establishment of plantation crops. To offset the effect of devaluation on deforestation, we consider a policy that would curtail the production of processed wood, discouraging deforestation. Already, Sumatera (and Indonesia) imposes a high export tax on logs and sawn timber, designed to encourage the export of plywood (which has a zero export tax).[5] This tax is likely to have increased the rate of forest exploitation in the past, since it provides strong incentives for substantial investments in plywood mills. We consider a simulation in which an export tax rate of 5 percent is imposed on processed wood (under the balanced adjustment scenario). The increase in the export tax discourages the production of raw timber and processed wood in both the short-run and medium-run scenarios. Government revenue increases by as much as 12 percent, depending on the size of the devaluation. The total value of aggregate exports declines by only 1 percent at most. The results are illustrated in Figure 4.

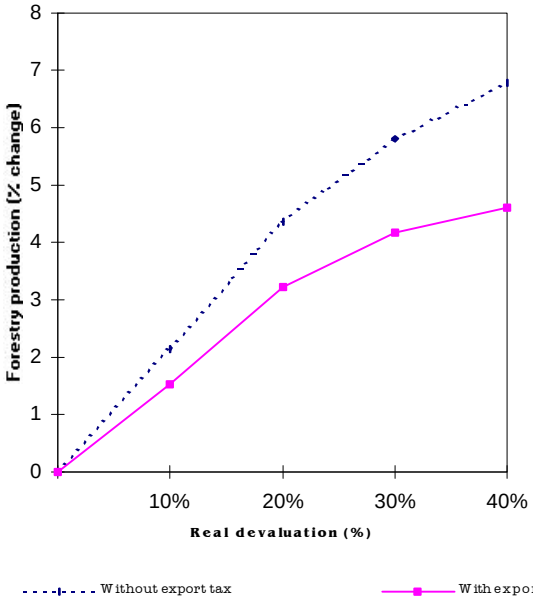
[5]In 1998, the government of Indonesia committed itself to reducing the export tax on logs and sawn timber to a maximum of 20 percent by the end of 1998, 15 percent by the end of 1999, and 10 percent by end of 2000 (IMF, 1998).

Figure 4. Short-Run, Unemployment Scenario with Balanced Macro Adjustment: Real Devaluation with and without Export Tax on Wood Processing.

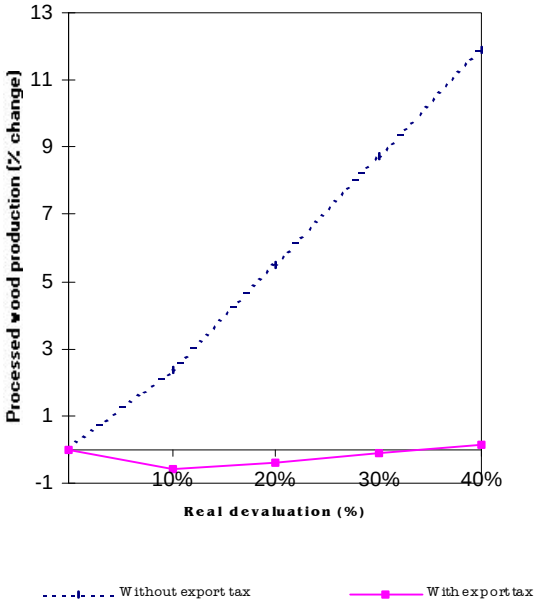
A. Government revenue



B. Forestry production



C. Processed wood production



5. CONCLUSION

This study analyzes the impact of structural adjustment, particularly devaluation of the exchange rate, on regional production, deforestation, factor markets, income distribution, exports, and imports in the short run and the medium run. Two alternative macro adjustment scenarios are considered, in which the burden of adjustment is shared differently between aggregate consumption and investment. Regardless of macro adjustment scenario, the regional economy contracts in both the short and medium run. Regional exports increase, mainly from non-agricultural sectors, and imports decline. The agricultural terms of trade decline due to the fact that agriculture has a small export share in both regional and national exports (3 percent and 6 percent, respectively).

The impact of the devaluation on the agricultural sectors is also similar, regardless of the macro adjustment scenario. In qualitative terms, most differences are also small between the short run and longer runs. Production of the food crop sector, except for rice and sugar, declines while that of the tree crop sector increases. Devaluation encourages deforestation, as forestry products support exports both as final products and as intermediate inputs into the wood processing industry. As for non-agricultural sectors, production in the mining, wood processing, food processing, and chemical and rubber sectors increases while the trade and transportation, services, and construction sectors decline. Under the savings-driven adjustment scenario, regional investment declines much more than under balanced macro adjustment, which leads to more severe shocks to sectors producing capital goods, especially construction. The two adjustment scenarios probably bracket the actual adjustment that Indonesia and Sumatera are making.

The two macro adjustment scenarios lead to slightly different income distribution patterns in response to the devaluation. With balanced macro adjustment, devaluation benefits only large farm households in the rural area and urban high-income households —all other households lose. In the savings-driven adjustment scenario, where investment falls more dramatically, all farm households gain, as agriculture gains generally compared to the urban sectors (although urban high-income households still gain). A free fall in capital investment brought out by the savings-driven adjustment scenario damages the construction sector significantly, which also hurts unskilled labor. The increase in exports, which favors urban sectors, is not enough to offset the loss from the decline in capital goods sectors.

In all adjustment scenarios, the results indicate that the devaluation will place pressure on regional forests. Tradable sectors gain from the devaluation, and forestry is linked, directly and indirectly, to exports. To discourage further deforestation in the region, we considered the impact of an export tax of 5-20 percent on processed wood products. The results show that the proposed export tax structure effectively offsets the increased demand for raw timber and processed wood generated by the devaluation, and significantly reduces the impact of the structural adjustment program on deforestation.

REFERENCES

Adelman, Irma and Sherman Robinson. 1989. "Income Distribution and Development". Chapter 19 in Hollis Chenery, and T.N. Srinivasan, eds. Handbook of Development Economics, Vol. II. Elsevier Science.

Adelman, Irma and Sherman Robinson. 1988. "Macroeconomic Adjustment and Income Distribution". Journal of Development Economics, Vol. 29, pp. 23-44.
Booth, Ann. 1988. Agricultural Development in Indonesia. Allen and Unwin Australia Pty Ltd.

Biro Pusat Statistik.1994. Sistem Neraca Social Ekonomi, Indonesia. 1990. Jakarta: Jilid I and II.

Badan Perencanaan Pembangunan Nasional (BAPPNAS) and Japanese International Cooperation Agency (JICA). 1995. Intra-regional Input-Output Table, Indonesia. 1990. Jakarta.

Brooke, Anthony, David Kendrick, and Alexander Meeraus. 1988. GAMS: A User's Guide. Redwood, California: The Scientific Press.

Dervis, Kemal, Jaime De Melo and Sherman Robinson. 1982. General Equilibrium Models for Development Policy. New York: Cambridge Press.

Devarajan, Shantayanan, Jeffery Lewis and Sherman Robinson. 1993. "External Shocks, Purchasing Power Parity, and the Equilibrium Real Exchange Rate." World Bank Economic Review, vol. 7. No. 1.

Hanson, Kenneth, Maureen Kilkenny, and Sherman Robinson. 1990. "The USDA/ERS Computable General Equilibrium Models of the United States." Staff Report No. AGES 9094, Economic Research Services. Washington, D.C. : U.S. Department of Agriculture.

Hazell, Peter and C. Ramasamy. 1991. The Green Revolution Reconsidered, The Impact of High-Yielding Rice Varieties in South India. The John Hopkins University Press. Baltimore.

Hill, Hal. eds.1991. Unity and Diversity, Regional Economic Development in Indonesia since 1970. Oxford University Press.

International Monetary Fund. Memo. 1998. Indonesia: Supplementary Memorandum of Economic and Financial Policies.

Isard, Walter, Iwan J. Azis, Matthew P. Drennan, Ronald E. Miller, Sidney Saltzman and Erik Thorbecke. 1998. Methods of Interregional and Regional Analysis. Regional Science Studies Series. Ashgate.

Löfgren, Hans. 1995. "Macro and Micro Effects of Subsidy Cuts: A Short-Run CGE Analysis

for Egypt," *Middle East Business and Economic Review*, Vol. 7, No. 2, pp. 18-39.

Löfgren, Hans, Sherman Robinson and David Nygaard. 1998. "Tiger or Turtle? Exploring Alternative Futures for Egypt to 2020," pp. 167-197 in Raed Safadi, ed., Opening Doors to the World: A New Trade Agenda for the Middle East. Cairo: American University in Cairo Press and International Development Research Center, in association with the Economic Research Forum, Cairo.

Robinson, Sherman. 1989. "Multisectoral Models," Chapter 18 in Hollis Chenery, and T.N. Srinivasan, eds. Handbook of Development Economics, Vol. II. Elsevier Science Publishers.

Robinson, Sherman, Andrea Cattaneo, and Moataz El-Said. 1998. Estimating a Social Accounting Matrix Using Cross Entropy Methods. Discussion Paper No. 33. Trade and Macroeconomics Division, International Food Policy Research Institute. Washington D.C.

Robinson, Sherman, and Clemen Gehlhar. 1998. Land, Water, and Agriculture in Egypt: The Economy-wide Impact of Policy Reform. Discussion Paper No. 1. Trade and Macroeconomics Division, International Food Policy Research Institute. Washington D.C.

Robinson, Sherman, Moataz El-Said and Nu Nu San. 1998. "Rice Policy, Trade and Exchange Rate Changes in Indonesia: A General Equilibrium Analysis," *Journal of Asian Economics*. Vol. 11, No.3, pp.393-423.

Robinson, Sherman. 1991. "Macroeconomics, Financial Variables, and Computable General Equilibrium Models." *World Development*. Vol. 19, No. 11, pp. 1509-1525.

San, Nu Nu, Hans Löfgren, Sherman Robinson. 1999. Indonesia: Structural Adjustment, Agriculture, and Deforestation in the Sumatera Regional Economy. Final Report for the International Center for Research in Agroforestry, Kenya.

Thorbecke, Erik. 1991. "Adjustment, Growth, and Income Distribution in Indonesia." *World Development*. Vol. 19, No. 11. pp 1595-1614.

IFPRI
Trade and Macroeconomics Division

LIST OF DISCUSSION PAPERS

No. 1 - "Land, Water, and Agriculture in Egypt: The Economywide Impact of Policy Reform" by Sherman Robinson and Clemen Gehlhar (January 1995)

No. 2 - "Price Competitiveness and Variability in Egyptian Cotton: Effects of Sectoral and Economywide Policies" by Romeo M. Bautista and Clemen Gehlhar (January 1995)

No. 3 - "International Trade, Regional Integration and Food Security in the Middle East" by Dean A. DeRosa (January 1995)

No. 4 - "The Green Revolution in a Macroeconomic Perspective: The Philippine Case" by Romeo M. Bautista (May 1995)

No. 5 - "Macro and Micro Effects of Subsidy Cuts: A Short-Run CGE Analysis for Egypt" by Hans Löfgren (May 1995)

No. 6 - "On the Production Economics of Cattle" by Yair Mundlak, He Huang and Edgardo Favaro (May 1995)

No. 7 - "The Cost of Managing with Less: Cutting Water Subsidies and Supplies in Egypt's Agriculture" by Hans Löfgren (July 1995, Revised April 1996)

No. 8 - "The Impact of the Mexican Crisis on Trade, Agriculture and Migration" by Sherman Robinson, Mary Burfisher and Karen Thierfelder (September 1995)

No. 9 - "The Trade-Wage Debate in a Model with Nontraded Goods: Making Room for Labor Economists in Trade Theory" by Sherman Robinson and Karen Thierfelder (Revised March 1996)

No. 10 - "Macroeconomic Adjustment and Agricultural Performance in Southern Africa: A Quantitative Overview" by Romeo M. Bautista (February 1996)

No. 11 - "Tiger or Turtle? Exploring Alternative Futures for Egypt to 2020" by Hans Löfgren, Sherman Robinson and David Nygaard (August 1996)

No. 12 - "Water and Land in South Africa: Economywide Impacts of Reform - A Case Study for the Olifants River" by Natasha Mukherjee (July 1996)

TMD Discussion Papers marked with an "" are MERRISA-related papers.
Copies can be obtained by calling, Maria Cohan at 202-862-5627 or e-mail m.cohan@cgiar.org

IFPRI
Trade and Macroeconomics Division

No. 13 - "Agriculture and the New Industrial Revolution in Asia" by Romeo M. Bautista and Dean A. DeRosa (September 1996)

No. 14 - "Income and Equity Effects of Crop Productivity Growth Under Alternative Foreign Trade Regimes: A CGE Analysis for the Philippines" by Romeo M. Bautista and Sherman Robinson (September 1996)

No. 15 - "Southern Africa: Economic Structure, Trade, and Regional Integration" by Natasha Mukherjee and Sherman Robinson (October 1996)

No. 16 - "The 1990's Global Grain Situation and its Impact on the Food Security of Selected Developing Countries" by Mark Friedberg and Marcelle Thomas (February 1997)

No. 17 - "Rural Development in Morocco: Alternative Scenarios to the Year 2000" by Hans Löfgren, Rachid Doukkali, Hassan Serghini and Sherman Robinson (February 1997)

No. 18 - "Evaluating the Effects of Domestic Policies and External Factors on the Price Competitiveness of Indonesian Crops: Cassava, Soybean, Corn, and Sugarcane" by Romeo M. Bautista, Nu Nu San, Dewa Swastika, Sjaiful Bachri and Hermanto (June 1997)

No. 19 - "Rice Price Policies in Indonesia: A Computable General Equilibrium (CGE) Analysis" by Sherman Robinson, Moataz El-Said, Nu Nu San, Achmad Suryana, Hermanto, Dewa Swastika and Sjaiful Bahri (June 1997)

No. 20 - "The Mixed-Complementarity Approach to Specifying Agricultural Supply in Computable General Equilibrium Models" by Hans Löfgren and Sherman Robinson (August 1997)

No. 21 - "Estimating a Social Accounting Matrix Using Entropy Difference Methods" by Sherman Robinson and Moataz-El-Said (September 1997)

No. 22 - "Income Effects of Alternative Trade Policy Adjustments on Philippine Rural Households: A General Equilibrium Analysis" by Romeo M. Bautista and Marcelle Thomas (October 1997)

TMD Discussion Papers marked with an "" are MERRISA-related papers.
Copies can be obtained by calling, Maria Cohan at 202-862-5627 or e-mail m.cohan@cgiar.org

IFPRI
Trade and Macroeconomics Division

No. 23 - "South American Wheat Markets and MERCOSUR" by Eugenio Díaz-Bonilla (November 1997)

No. 24 - "Changes in Latin American Agricultural Markets" by Lucio Reca and Eugenio Díaz-Bonilla (November 1997)

No. 25* - "Policy Bias and Agriculture: Partial and General Equilibrium Measures" by Romeo M. Bautista, Sherman Robinson, Finn Tarp and Peter Wobst (May 1998)

No. 26 - "Estimating Income Mobility in Colombia Using Maximum Entropy Econometrics" by Samuel Morley, Sherman Robinson and Rebecca Harris (Revised February 1999)

No. 27 - "Rice Policy, Trade, and Exchange Rate Changes in Indonesia: A General Equilibrium Analysis" by Sherman Robinson, Moataz El-Said and Nu Nu San (June 1998)

No. 28* - "Social Accounting Matrices for Mozambique - 1994 and 1995" by Channing Arndt, Antonio Cruz, Henning Tarp Jensen, Sherman Robinson and Finn Tarp (July 1998)

No. 29* - "Agriculture and Macroeconomic Reforms in Zimbabwe: A Political-Economy Perspective" by Kay Muir-Leresche (August 1998)

No. 30* - "A 1992 Social Accounting Matrix (SAM) for Tanzania" by Peter Wobst (August 1998)

No. 31* - "Agricultural Growth Linkages in Zimbabwe: Income and Equity Effects" by Romeo M. Bautista and Marcelle Thomas (September 1998)

No. 32* - "Does Trade Liberalization Enhance Income Growth and Equity in Zimbabwe? The Role of Complementary Polices" by Romeo M.Bautista, Hans Lofgren and Marcelle Thomas (September 1998)

No. 33 - "Estimating a Social Accounting Matrix Using Cross Entropy Methods" by Sherman Robinson, Andrea Cattaneo and Moataz El-Said (October 1998)

No. 34 - "Trade Liberalization and Regional Integration: The Search for Large Numbers" by Sherman Robinson and Karen Thierfelder (January 1999)

TMD Discussion Papers marked with an "" are MERRISA-related papers.
Copies can be obtained by calling, Maria Cohan at 202-862-5627 or e-mail m.cohan@cgiar.org

IFPRI
Trade and Macroeconomics Division

No. 35 - "Spatial Networks in Multi-Region Computable General Equilibrium Models" by Hans Löfgren and Sherman Robinson (January 1999)

No. 36* - "A 1991 Social Accounting Matrix (SAM) for Zimbabwe" by Marcelle Thomas, and Romeo M. Bautista (January 1999)

No. 37 - To Trade or not to Trade: Non-Separable Farm Household Models in Partial and General Equilibrium" by Hans Löfgren and Sherman Robinson (January 1999)

No. 38 - "Trade Reform and the Poor in Morocco: A Rural-Urban General Equilibrium Analysis of Reduced Protection" by Hans Löfgren (January 1999)

No. 39 - " A Note on Taxes, Prices, Wages, and Welfare in General Equilibrium Models" by Sherman Robinson and Karen Thierfelder (January 1999)

No. 40 - "Parameter Estimation for a Computable General Equilibrium Model: A Maximum Entropy Approach" by Channing Arndt, Sherman Robinson and Finn Tarp (February 1999)

No. 41 - "Trade Liberalization and Complementary Domestic Policies: A Rural-Urban General Equilibrium Analysis of Morocco" by Hans Löfgren, Moataz El-Said and Sherman Robinson (April 1999)

No. 42 - "Alternative Industrial Development Paths for Indonesia: SAM and CGE Analysis" by Romeo M. Bautista, Sherman Robinson and Moataz El-Said (May 1999)

No. 43* - "Marketing Margins and Agricultural Technology in Mozambique" by Channing Arndt, Henning Tarp Jensen, Sherman Robinson and Finn Tarp (July 1999)

No. 44 - "The Distributional Impact of Macroeconomic Shocks in Mexico: Threshold Effects in a Multi-Region CGE Model" by Rebecca Lee Harris (July 1999)

No. 45 - "Economic Growth and Poverty Reduction in Indochina: Lessons From East Asia" by Romeo M. Bautista (September 1999)

No. 46* - "After the Negotiations: Assessing the Impact of Free Trade Agreements in Southern Africa" by Jeffrey D. Lewis, Sherman Robinson and Karen Thierfelder (September 1999)

TMD Discussion Papers marked with an "" are MERRISA-related papers.
Copies can be obtained by calling, Maria Cohan at 202-862-5627 or e-mail m.cohan@cgiar.org

IFPRI
Trade and Macroeconomics Division

No. 47* - "Impediments to Agricultural Growth in Zambia" by Rainer Wichern, Ulrich Hausner and Dennis K. Chiwele (September 1999)

No. 48 - "A General Equilibrium Analysis of Alternative Scenarios for Food Subsidy Reform in Egypt" by Hans Lofgren and Moataz El-Said (September 1999)

No. 49 - " A 1995 Social Accounting Matrix for Zambia" by Ulrich Hausner (September 1999)

No. 50 - "Reconciling Household Surveys and National Accounts Data Using a Cross Entropy Estimation Method" by Anne-Sophie Robilliard and Sherman Robinson (November 1999)

No. 51 - "Agriculture-Based Development: A SAM Perspective on Central Viet Nam" by Romeo M. Bautista (January 2000)

No. 52 - "Structural Adjustment, Agriculture, and Deforestation in the Sumatera Regional Economy" by Nu Nu San, Hans Löfgren, and Sherman Robinson (March 2000)

TMD Discussion Papers marked with an "" are MERRISA-related papers.
Copies can be obtained by calling, Maria Cohan at 202-862-5627 or e-mail m.cohan@cgiar.org