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A structuralist macromodel for post-revolutionary Nicaragua

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1. Introduction

Nicaragua is fundamentally an agrarian economy. Its structure is dualistic (deJanvry, 1981) in the sense that it has a traditional sector which produces basic wage goods (corn, beans and rice) and a modern export sector devoted to cotton, coffee, sugar, beef, shrimps and bananas.[1] The character of the economy is the result of years of pursuing an export-led growth strategy designed primarily to concentrate agricultural resources and the income accruing thereto in the hands of a small agrarian oligarchy. There is no industrial bourgeoisie. With the exception of mining, bananas and petrochemicals, foreign capital has not been prominent. Before the revolution of 1978–79, there was a large, displaced rural proletariat and the distribution of income was one of the worst in Latin America. Now, owing to the CIA-financed war, the agrarian reform and the organisation of agricultural cooperatives and state farms, agricultural labour has become more scarce and expensive. Nevertheless, the bulging informal sector and pervasive urban underemployment suggest that Nicaragua is still properly categorised as a labour-surplus economy.

Total income lost during the struggle to overthrow the Somoza dictatorship has been estimated at $2 billion, approximately equal to GDP in 1981 (World Bank, 1981). Capital flight during and immediately after the revolution was massive as was the outflow of technicians, managers and other white-collar workers. In the immediate aftermath, agricultural output collapsed and is only now regaining prewar levels. In addition to the devastation of the war, the spring of 1982 brought 100-year floods which ravaged crops, bridges, roads and housing. United Nations estimates of the total loss exceed the damage done during the insurrection (CEPAL, 1982).

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[1]The descriptive material for this paper is drawn largely from CIERA (1983, 1984, 1985), Barraclough (1982), INIES–CRIES (1984), CEPAL (1982), Collins (1982), Deere and Marchetti (1981), Deere (1981 and 1982), Deere *et al.* (1984), Fitzgerald (1981), Weinert (1981), EIU (1982), IHC (1982) and World Bank (1981).

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The principal limitation on further accumulation through agricultural exports now appears to be political. The government argues that supply elasticities in the private export sector are weak due to heavy decapitalisation. Coffee growers have abandoned trees to the blight, machinery (often purchased with government credit) has been over-invoiced and then liquidated and more than 200,000 head of cattle have been rustled across the Honduran border (Collins, 1982). The evidence is uneven and anecdotal at best, but it is clear that decapitalisation is a major weapon available to the private sector. The situation is sufficiently critical for worker-peasant organisations to agitate for stricter penalties to reduce the rate at which the capital base of the *haciendas* and cattle ranches is being dissipated.

As a small, dependent economy, the options currently available to Nicaragua are, to say the least, limited. Since the revolution, Nicaragua has paid for less than half of its imports with exports and it is widely agreed that, if the Sandinista National Liberation Front (FSLN) is to maintain a degree of political autonomy, current account deficits must be brought under control. The regime is not hamstrung by allegiance to principles of the free market or any other ideology and has consequently approached its problems very creatively. The government has sought first to maintain a viable capitalist agro-export sector, it has made available ample credit at negative real interest rates to capitalist growers and provided generous guarantee prices while insuring producers against unfavourable fluctuations in world commodity prices. Taxes on agro-exporters are generally lower than under Somoza and, in 1982, a system of multiple exchange rates favouring export agriculture was introduced. The Sandinistas have experimented with various programmes under which growers can obtain part of their export earnings in dollars but have not been able fully to meet their obligations owing to the severe foreign exchange shortage. In February 1985, the currency was again devalued and support prices increased. The system of export producer incentives was reinstated, allowing large growers access to foreign exchange in proportion to the change in the level of exports. Many intermediate inputs for agriculture are subsidised, such as fertilisers, pesticides and improved seeds, as is agricultural machinery.

But what the Sandinistas cannot do in the effort to promote export agriculture is rescind its promise to the rural proletariat to enforce the minimum wage.[1] In part because the agricultural export sector depends crucially upon large supplies of mobile and cheap labour, agro-exporters are, on balance, opposed to the regime. They constantly question the Sandinistas commitment to a 'mixed market economy' and have been slow to restore prewar acreage levels. Cotton production in the 81/82 growing season declined to a low of 64·5 thousand metric tons from its 1977 level of 121 thousand metric tons (CIERA, 1983). The area cultivated in 1983–84 has been estimated at only 53% of the pre-evolutionary maximum (though 75% of the 1969–77 mean). Sugar, coffee and tobacco have remained on trend, while sesame and bananas have shown substantial growth (World Bank, 1981; CIERA, 1983).

In order to combat decapitalisation, the FSLN has set up a system of agricultural enterprises, known as the *Area de Propiedad del Pueblo* (Area of People's Property) or APP. There was in fact no real choice in this matter in that during the latter stages of the

[1]Average rural wages rose by approximately 60% immediately after the revolution. The Sandinista government has generally collapsed the differential between the highest and lowest paid workers; the Minister of Agricultural Development, for instance, is paid only 8 times the lowest-paid permanent farm worker. This ratio was 78:1 under Somoza.

revolution, militant *campesinos* (peasants) began expropriating plantations on their own initiative. Most of the expropriations were of the property of the Somoza dynasty, highly mechanised holdings organised for large-scale production. Although these enterprises are potentially the most efficient in the country, they were a drain on fiscal resources until their capital bases were refurbished in 1983. The growth of the APP has been impressive: in 1980, despite massive state investment in infrastructure, the APP produced only 14% of the value of agricultural production. By the 1984/85 crop cycle, however, the figure had risen to 36% (CIERA, 1985).

The objective of this paper is to weave together these and other features of the post-revolutionary Nicaraguan economy into a structuralist computable general equlibrium model.[1] In particular, we shall be concerned with a range of policy options available to the Sandinistas in light of the political disaffection of the class which is its principal engine of accumulation. There are a number of ways the Sandinistas can manage this crisis and we shall examine the probable implications in each of several strategies for exports, output, inflation, exployment and the distribution of income. The scenarios studied include (i) an expansion in output of the APP; (ii) an increase in foreign credits, and (iii) a devaluation. Two variants of the final simulation are considered: one in which the devalution is accompanied by a reduction in the exogenously given level of real foreign savings and a second in which nominal wages also rise as a reaction to the devaluation-induced inflation.

The results of the simulations show that devaluation of the cordoba is an expansionary strategy, favouring workers and *campesinos* in the redistribution of income. The reasons are strightforward. The model employed here takes the agricultural sectors to be supply constrained with industrial output determined by a foreign exchange constraint on intermediate goods. Devaluation then increases profits for export agriculture which stimulates output and exports (at a politically determined elasticity) and in turn allows non-agricultural sectors to expand. Although the terms of trade turn in favour of agriculture, thereby increasing the cost of food, workers and peasants are nevertheless better off with higher employment and lower non-agricultural prices. A similar result is achieved through foreign borrowing or an increase in the output of the APP, which uses less intermediate imports per unit of output. It is seen that if devaluation coupled with a reduction in the level of foreign savings triggers a wage-price inflationary spiral, the net effect is stagflationary with the distribution of income shifting to the disadvantage of the popular classes.

The paper is organised as follows: section 2 discusses the disaggregation of productive sectors, social classes and the general structure of the economy. Included in this section are a guide to the data base and equations of the model as well as an intuitive explanation of the model's macroadjustment mechanism. The results of numerical simulations are presented in the third section and a final section draws some conclusions from the results. Table 3 presents balanced Social Accounting Matrices (SAMs) used for the simulations.[2]

[1]The basic reference for structuralist macromodels is Taylor (1983); for computable general equilibrium models see Taylor (1979); Dervis *et al.* (1982); Taylor and Lysy (1979), and Chichilnisky and Taylor (1980). Similar models have been constructed for Mexico (see Gibson, Lustig and Taylor, 1985), Brazil (Taylor *et al.*, 1980), Nigeria (Taylor, 1983), and Korea (Adelman and Robinson, 1977), as well as a host of other countries.

[2]Full balanced SAMs resulting from the simulations are available on request from the author.

Table 1. *Commodities, processes and social classes in the model*

Commodities	Processes	Classes
1 Export agriculture	(1) Capitalist (2) *Campesino* (3) APP	1 Agricultural capitalists 2 Urban capitalists 3 Agricultural workers 4 Urban workers 5 *Campesinos*
2 Domestic agriculture	(4) Capitalist (5) *Campesino* (6) APP	
3 Petroleum	(7)	
4 Agricultural processing	(8) Capitalist (9) APP	
5 Basic industry	(10)	
6 Non-basic industry	(11)	

2. Structural character of the Nicaraguan Economy

Though World Bank data places only 46·4% of the Nicaraguan labour force in 'agriculture' (73% of value added is in 'industry and services'), Nicaragua is far more agrarian than this number reveals. First, agriculture earns virtually all the foreign currency the country does not borrow. In 1980 coffee, cotton, beef, sugar and shrimps accounted for 70% of the value of exports, and for 1984 the figure is estimated at 82%. Roughly a fourth of GDP in 'industry' is actually agricultural processing which makes up more than 90% of agricultural exports.

Given the strategic importance of agriculture, the productive sectors were disaggregated according to the pattern of Table 1. There are six commodities and eleven processes by which these commodities are produced. The social structure is divided into five major classes, as shown. Export agriculture is subdivided into capitalist, *campesino* and the APP. The latter consists largely of the more than 2000 farms and ranches confiscated immediately after the revolution. In export agriculture, capitalist farms account for about half the GDP while *campesinos* and the APP each produce approximately a quarter. For domestic agriculture, *campesinos* produce more than 60% of GDP with the remainder split between capitalists and the APP.

The additional detail of the multiple processes is necessary given that the conditions of production vary widely among capitalist, peasant and the APP. Capitalist farms are large, modern and constrained primarily by foreign exchange (although the reduction in the reserve army of landless peasants has meant a shortage of wage labour in peak periods). Peasant farms are, of course, much smaller: 200,000 peasants on farms less than 14 hectares accounted for 14% of cultivable land in 1981. Originally the Sandinistas believed that the main barrier to self-sufficiency in basic grains were credit policies oriented toward Nicaragua's 'comparative advantage' in cotton, coffee, sugar, and

beef.[1] Since 1980, the government increased credit available to the small farmers who produce 60% of the nation's basic staples by more than sevenfold (CIERA, 1983). The programme of 'spilling credit on the countryside', however, brought a number of unanticipated consequences: the principal beneficiaries were the rural bourgeoisie, the prices of whose scarce animals, seeds, tools and equipment rose in the rush to sow the land. Though the credit programme was established to aid small farmers and agricultural collectives, subsequent studies have shown that large farmers, with the help of local bank officers, managed to capture a significant quantity of credit destined for *campesinos*. Deere *et al.* (1984) argue the net result was an 'explosion of peasant indebtedness with only mixed results in terms of basic grain production'. It is now believed that the limited availability of consumer goods in the countryside, rather than a shortage of credit, is the principal barrier to better peasant supply response.

The APP is potentially the most productive agricultural sector inasmuch as it consists of the expansive and highly mechanised plantations previously owned by the Somoza family and its associates. Yet productivity in the APP is the key issue now faced by the Sandinistas. Production in the APP is not undertaken strictly according to the principle of profitability: many units continuously show losses. In regard to foreign exchange costs per unit of output, however, the APP is slightly more efficient than its capitalist counterpart. Table 2 shows Nicaragua's foreign dependence and is computed from the data of Table 3, the base Social Accounting Matrix for 1981. The top panel of Table 2 lists noncompetitive imports excluding petroleum as well as petroleum intermediate imports by productive sector. Rows 4 and 5 indicate that the ratio of total imports to the gross value of production is lower for the APP than for capitalist agriculture, both export and domestic. Peasant agriculture is, as one would expect, the least foreign exchange intensive.

With the exception of a small amount of hydroelectric power and peasant dependence upon a rapidly depleting forestry reserve (wood still accounts for 30% of Nicaragua's total energy consumption), Nicaragua's demand for energy is satisfied entirely by imported fossil fuels. Although distribution is controlled by the government, the petroleum refinery is still in private hands. In 1981, imported crude accounted for about a fifth of total imports. The majority of petroleum products are used as intermediate goods and consequently the price of oil on the world market can substantially affect the domestic level of economic activity through the foreign exchange constraint. In 1982, the government began rationing petrol to private consumers. Some segments of the population have undoubtedly suffered as a result, but for the majority, rationing for private use is largely irrelevant.[2]

In the agricultural processing sector, the APP accounts for approximately a third of

[1]Food production per capita rose between 1969–71 and 1978, but as the Economist Intelligence Unit observed: '[it] should not be taken to mean that Nicaraguans ate better on average. Calorie intake averaged 2465 per day in 1969–71, 2404 in 1974–76 and 2368 in 1977–79. Protein consumption averaged 72·7 grams per day in 1969–71, 67·1 in 1974–76 and 66·1 in 1977–79. The explanation lies in the export orientation of prerevolutionary Nicaraguan agriculture. The growth in exports of bananas, beef and sugar in the 1970s was striking' (EIU, 1982, p. 12).

[2]In an interview, Wanceslao Aburto, factory worker and Coordinator of the Sandinista Defense Committee was asked how the people of his district had reacted to the rationing of petrol: 'Look, this question of petrol really doesn't affect us at all because we have never had a car, not even a motorcycle. Our only means of transport has been the buses and for that we need to make sure that we have one cordoba to pay the fare, nothing else. As long as there is petrol for the buses to take us to work, then we don't have to worry' (IHC, 1982).

Table 2. *Nicaragua's export-import dependence (1981)*

	Export agriculture			Domestic agriculture			Petrol	Agric. Process		Basic industry	Non-basic industry	Total
	Capital	*Campesino*	APP	Capital	*Campesino*	APP		Capital	APP			
1 Imports	499	164	232	173	114	119	1638	423	227	1046	477	5113
2 Petroleum	72	2	43	45	6	23	65	152	84	424	74	990
3 Gross value of production	2321	979	1169	671	1625	484	1782	6105	3179	9225	10361	37902
ratios												
4 1/3	0·21	0·17	0·20	0·26	0·07	0·25	0·92	0·07	0·07	0·11	0·05	0·13
5 (1+2)/3	0·25	0·17	0·24	0·32	0·07	0·29	0·96	0·09	0·10	0·16	0·05	0·16

Commodities	Exports				Imports				Ratios	
	1 Direct exports	2 % of total	3 Direct + indirect exports	4 % of total	5 Direct imports	6 % of total	7 Direct + indirect imports	8 % of total	1/5	3/7
1 Export agriculture	359	9	1275	19	895	18	1318	19	0·40	0·97
2 Domestic agriculture	–341	–8	283	4	406	8	604	9	–0·84	0·47
3 Petroleum	93	2	266	4	1638	32	1726	25	0·06	0·15
4 Agricultural processing	3717	91	3802	58	650	13	1159	17	5·72	3·28
5 Basic industry	0	0	480	7	1046	20	1350	20	0·00	0·36
6 Non-basic industry	243	6	495	7	477	9	680	10	0·51	0·73
Total	4071	100	6601	100	5112	100	6837	100		

Source: Author's calculations from the Social Accounting Matrix. Millions of 1981 Cordobas; exchange rate = 10 Cordobas/US $.

Note: Direct + indirect imports = $M(I-A)^{-1}$. Direct + indirect exports = $(I-A)^{-1}E$. M = imports; E = exports; A = input/output matrix.

GDP. Value added per worker in agricultural processing is more than twice as high as in agriculture as a whole, and direct and indirect foreign exchange costs per unit of output are less than half those in export agriculture. The last column of the second panel of Table 2 computes the ratio of direct plus indirect exports to direct plus indirect imports. There it is seen that agricultural processing is the main net foreign exchange earning sector of the economy. Export agriculture on its own almost breaks even with a direct plus indirect export/import ratio of 0·97. Note that although direct exports of domestic agriculture are negative, −341, the indirect effects of domestic agriculture are of obvious importance in earning foreign exchange since the total figure amounts to 4% of the total direct plus indirect exports. In contrast to agricultural production, APP agricultural processing plants appear to be slightly more foreign-exchange intensive than private ones. APP processing plants are also less profitable (see Table 3), presumably owing to higher wage and infrastructural costs.

The remaining nonagricultural sectors of the economy are broadly classified as 'industry' in sectors 10 and 11. The industries grouped in sector 10 are 'basic' in the sense that they consist of essential consumer and producer goods as defined by government policy. These include agricultural chemicals and some industrial textiles, light consumer goods, salt, matches, etc., but not clothing or consumer durables. Foreign exchange needs for the production of basics are given higher priority and their prices are regulated. Non basic industry is made up of the rest of industry, construction, services, finance, and commerce. Table 2 shows the industrial sectors to be large net users of foreign exchange, along with petroleum and domestic agriculture. Industry as a whole earns foreign exchange indirectly (direct net exports are 6% of the total *vs* 14% for direct plus indirect), but the ratio of direct plus indirect exports to direct plus indirect imports is substantially less than one for basic industry (0·36) although higher for nonbasic industry (0·73).

2.1 Data base

The data for the model is shown in Table 3, a 1981 SAM in millions of current cordoba (exchange rate = 10 $ U.S.).[1] The model can be thought of as providing behavioural relationships connecting various submatrices of the SAM and these relationships will be described in sections 1·2–2·5 below. The base SAM is not available in previously published form but was constructed by an interministerial team from The Ministry of Agriculture (MIDINRA) and its research affiliate (CIERA), the Central Bank (BCN) and the Planning Ministry (MIPLAN) using a variety of published and unpublished data.

[1]For a basic reference for Social Accounting Matrices see Pyatt and Roe (1977); see also Taylor (1979). The data sources for the Nicaraguan Social Accounting Matrix are virtually all from previously unpublished working documents from various government ministries. For the agricultural productive sectors, cost sheets from the Banco National para el Desarrollo were used for the technologies and gross value of production from internal documents from MIDINRA and CIERA. The non-agricultural data is an aggregation of a computerised survey from the Ministry of Industry. The tertiary technologies come from MIPLAN and data for noncompetitive imports and exports is from the Ministerio de Comecio Exterior. The government accounts are from unpublished documents in the Ministry of Finance and the consumption matrix is constructed from internal documents of CIERA and Instituto Nacional de Estadisticas y Censos. Monetary data is from the Central Bank and World Bank (1981).

Table 3. *Base SAM–1981 (millions of 1981 cordobas)*

	Export agriculture			Domestic agriculture			Petrol	Agric. process		Basic Industry	Non-basic Industry	Total
	Capital	*Campesino*	APP	Capital	*Campesino*	APP		Capital	APP			
Export agriculture	18	3	8	0	0	0	0	1250	969	0	0	2248
Domestic agriculture	0	0	0	31	126	20	0	833	646	0	0	1657
Petroleum	72	2	43	45	5	23	65	151	84	424	74	989
Agric. processing	133	108	50	1	15	1	0	0	0	0	0	308
Basic industry	562	154	257	56	104	59	30	159	85	617	917	3000
Non-basic industry	0	0	0	0	0	0	5	182	74	1819	1080	3160
Total domestic	785	267	358	133	250	104	101	2576	1858	2860	2071	11363
Imports	499	164	232	173	114	119	1638	423	227	1046	477	5113
Total	1284	431	590	306	365	223	1739	2999	2086	3906	2548	16475
Value added by class												
Agric. capital	301			221								523
Urban capital							34	1206		2805	4184	8239
Agric. workers	736	177	365	144	208	68						1699
Urban workers							9	843	533	1735	2060	5180
Campesinos		371			1052							1423
Private value added	1038	548	365	365	1260	68	43	2049	533	4539	6254	17063
Indirect tax	0	0	0	0	0	0	0	1058	142	780	1559	3539
Direct tax												
APP profits			213			193			419			826
Subsidy	0			0			0	0		0	0	0
Net tax	0	0	213	0	0	193	0	1058	561	780	1559	4364
Savings												
Total	2321	979	1169	671	1625	484	1782	6105	3179	9225	10361	37902

Table 3 Continued

	Consumption						Govt	Exports	Invest	Inventory	Total Invest	Total Final Demand	Gross Value Product
	Agric. capital	Urban capital	Agric. workers	Urban workers	*Campesino*	Total							
Export agriculture	17	132	535	757	418	1859	3	359	0	0	0	2221	4469
Domestic agriculture	6	142	370	729	218	1464	0	–341	0	0	0	1124	2780
Petroleum	16	358	0	43	15	432	128	93	0	140	140	793	1782
Agric. processing	59	1341	339	2876	331	4946	112	3717	0	202	202	8977	9284
Basic industry	77	1214	191	1349	196	3028	913	0	2082	202	2284	6225	9225
Non-basic industry	99	2398	262	1438	176	4373	1458	243	1127	0	1127	7201	10361
Total domestic	273	5585	1696	7192	1355	16102	2615	4071	3209	543	3752	26540	37902
Imports	30	667	172	727	135	1731	129		2095		2095	3955	9067
Total	303	6253	1868	7919	1489	17833	2743	4071	5304	543	5847	30494	46970
Value added by class													
Agric. capital													523
Urban capital													8239
Agric. workers													1699
Urban workers							3012						8191
Campesinos													1423
Private value added							3012						20074
Indirect tax													
Direct tax	36	562	0	0	0	597							
APP profits													
Subsidy	2	42	169	510	67	791							
Net tax	33	519	–169	–510	–67	–194							4171
Savings	186	1466	0	782	0	2435	–1584	4997					5847
Total	523	8239	1699	8191	1423	20074	4171	9067			5847		

2.2 Adjustment mechanisms

Since supply response in export agriculture depends as much on political as on economic considerations, complex maximising models are even less justifiable than usual. Output of this sector is therefore taken as a simple function of the ratio of the international price converted at the official exchange rate to cost of production:

$$x_1 = \bar{x}_1 \{p_1/[(1+\tau_1)(\sum_{i=1}^{7} p_i a_{i1} + w_1 l_1)]\}^a \quad (1)$$

where x_1 is a given constant, p_1 is the international price of terms in cordobas a is the supply response elasticity (fixed at one for the simulations) and the term in square brackets is cost of production. τ is the tax rate net of subsidies, p_i are the prices of the six domestic commodities plus non competitive intermediate imports, a_{ij} is the input of the ith commodity into the jth process, w is the wage rate and l is the direct labour coefficient.

In what follows, q_i ($i=1,2,...,6$) are the total supplies of each of the six commodities and x_i ($i=1,2,...,11$) represent the gross outputs of the eleven processes of Table 1. For the processes producing agricultural exports, we have:

$$q_1 = x_1 + \bar{x}_2 + \bar{x}_3 \quad (2)$$

Outputs $\bar{x}_2$ and $\bar{x}_3$ of the *campesinos* and APP are taken as given, assuming no response to price incentives. This is probably a better description of the APP than of the *campesinos*, since output decisions of the former are largely administrative.

Exports in the first three sectors are determined residually after domestic demand is subtracted from total supply. Not all of this residual is directly exported, however. A given fraction of the surplus over domestic final consumption requirements is sold as an intermediate product to the agricultural processing sectors, private and APP. The quantity of raw materials available for processing determines x_8, the output of the capitalist agricultural processing sector. The APP is assumed to have first claim on agricultural raw material based on an exogenously specified level of output, $\bar{x}_9$ while sector 8 receives the residual for its input requirements. Exports of sectors 8 and 9 are also determined residually, after domestic demand has been subtracted from total supply. The price for these sectors is the international price converted at the official exchange rate.

The supply of processed agricultural goods can then be written:

$$q_4 = x_8 + \bar{x}_9 \quad (3)$$

where:

$$x_8 = (k/a_{18})(q_1 - \sum_{\substack{j=1 \\ j\neq 8}}^{11} a_{1j}x_j - \sum_{j=1}^{5} c_{1j} - z_1 - g_1/p_1) \quad (4)$$

Here the c_{ij}'s are the consumption of good i by class j, and z_i is the given level of total real investment (including inventories) g_i is the given level of government spending which is assumed to be fixed in nominal terms (see section 2.3). k is the given proportion of the surplus over domestic demand purchased by sector 8. k probably depends upon the relative profitability of selling to the government export clearing house versus the internal market, but is taken as a policy variable here.

Output of agricultural processing is assumed to be limited by the supply of raw materials and the level of home consumption. The model thus reflects the indirect power

agro-export capital has over the majority of foreign-exchange earning capacity of the country.

Supply in the three domestic agricultural sectors is determined by the level of output in the peasant sector with given outputs of the capitalist and APP processes. It is assumed that *campesinos* respond to the incentive of better terms of trade for *basic* industrial commodities; the output of domestic agriculture is then written as:

$$q_2 = \bar{x}_4 + x_5 + \bar{x}_6 \tag{5}$$

with

$$x_5 = \bar{x}_5 (p_2/p_5)^{\beta} \tag{6}$$

Here $\bar{x}_5$ is given constant and β is the elasticity of supply response and equal to one for the simulations, $\bar{x}_4$ and $\bar{x}_6$, the outputs of the capitalists and APP processes, are fixed by assumption.

The price for the domestic agricultural good is set by government policy, approximately by capitalist-sector cost with a fixed mark-up, π

$$p_2 = (1+\pi_4)(1+\tau_4)\left(\sum_{i=1}^{7} p_i a_{i4} + w_4 l_4\right) \tag{7}$$

This price scheme enables capitalist producers of domestic agricultural products to earn a constant real rate of profit. The remaining sellers of this product receive a 'rent' which is determined by the relative efficiencies of their processes with respect to the capitalist process. Obviously, this rent may in some cases be negative, Equations (5), (6) and (7) serve to determine price and quantity supplied in domestic agriculture. Imports are assumed to fill any gap between supply and quantity demanded.

The structure of the petroleum market is particularly simple. Output is taken to be demand constrained and the price level is given by the international price converted at the official exchange rate. It is for simplicity that this market is taken to be demand determined, rather than rationed as it actually is.

Output in the Nicaraguan basic industrial sector is limited by the quantity of real foreign exchange allocated to it by the government for the purchase of imported intermediate goods, capital equipment and raw materials. The foreign exchange allocated to non-basic industrial production is determined as a residual after all other non-competitive imports are deducted from the sum of net exports and foreign savings. In this way, a constant level of real foreign savings is imposed as a constraint on the model.[1]

For simplicity, the level of output of basics is determined in this model by the quantity demanded; i.e., the government is assumed to acquiesce to the effective demand for basic industrial goods.[2] p_5 the price of industrial basics, is determined by

[1] In the SAM, nominal foreign savings vary with devaluation since, by convention, net exports are given in real terms while noncompetitive imports are shown in nominal terms.

[2] Alternative simulations were conducted under the assumption that the government decides how much of good 5 is to be imported and the available quantity is rationed according to pre-existing consumption patterns. If the level of imports remains constant, there is in general more movement in the price of non-basic goods and this causes the comparative statistics to be slightly more extreme than those reported below. But although the magnitude of the changes can be amplified by reducing the available quantity of basic goods (and dampened by increasing the quantity imported) the direction of the changes is not generally altered.

an equation similar to eqn (7) under the assumption that the regulated price bears some relationship to costs of production:

$$p_5=(1+\pi_{10})(1+\tau_{10})(\sum_{i=1}^{7} p_i a_{i10}+w_{10}l_{10}) \tag{8}$$

The output of non-basics is given by:

$$x_{11}=[\sum_{j=1}^{6} e_j+s_f-\sum_{j=1}^{10} a_{7j}x_j-\sum_{j=1}^{5} c_{7j}-z_7-g_7]/a_{711} \tag{9}$$

where e_j is net exports, of the jth commodity, and s_f is foreign savings. Recall that the seventh row of the SAM is non-competitive imports so that c_{7j} is imports of the jth social class, z_7 and g_7 are non-competitive imports for investment and government, respectively.
The balancing equations for each of the six goods take the form:

$$q_j=\sum_{i=1}^{11} a_{ji}x_i+\sum_{i=1}^{5} c_{ji}+z_j+g_j/p_j+e_j \qquad j=1,2,...,6 \tag{10}$$

The consumption functions employed are linear in expenditure including imports. If ε_j is total expenditure by the jth class and ψ_{ij} is the subsistence consumption of the ith good by the jth class, the consumers' expenditure system can be written:

$$c_{ij}=\psi_{ij}+(\mu_{ij}/p^{\star}_{ij})(\varepsilon_j-\sum_{i=1}^{7} p^{\star}_{ij}\psi_{ij}) \qquad \begin{matrix} i=1,2,...,7 \\ j=1,2,...,5 \end{matrix} \tag{11}$$

where the μ_{ij}'s are budget shares taken from the base SAM and $p^{\star}_{ij}$ is the price of consumption good i consumed by class j:

$$p^{\star}_{ij}=p_i-\sigma_{ij} \qquad \begin{matrix} i=1,2,...,7 \\ j=1,2,...,5 \end{matrix} \tag{12}$$

where σ_{ij} is the consumer subsidy on the ith good for the jth class.
Expenditures ε_j are given by:

$$\varepsilon_j=(1-s_j)(1-t_j)y_j \qquad j=1,2,...,5 \tag{13}$$

where y_j is total income, s_j is the savings rate and t_j is the direct tax rate.

Agricultural capitalists' income, y_1 is determined as a residual after taxes, labour and intermediate costs have been paid in processes 1 and 4:

$$y_1=[p_1-(1+\tau_1)(\sum_{i=1}^{7} p_j a_{j1}+\omega_1 l_1)]x_1+[p_2-(1+\tau_4)(\sum_{j=1}^{7} p_j a_{j4}+\omega_4 l_4)]x_4 \tag{14}$$

Income to industrial capitalists, y_2 accrues in sectors 7, 8, 10 and 11:

$$y_2=[p_3-(1+\tau_7)(\sum_{j=1}^{7} p_j a_{j7}+\omega_7 l_7)]x_7+[p_4-(1+\tau_8)(\sum_{j=1}^{7} p_j a_{j8}+\omega_8 l_8)]x_8+$$

$$[p_5-(1+\tau_{10})(\sum_{j=1}^{7} p_j a_{j10}+\omega_{10} l_{10})]x_{10}+[p_6-(1+\tau_{11})(\sum_{j=1}^{7} p_j a_{j11}+\omega_{11} l_{11})]x_{11} \tag{15}$$

The income of agricultural workers, y_3 and urban workers, y_4 is determined by:

$$y_3 = \sum_{j=1}^{5} \omega_j l_j x_j \tag{16}$$

$$y_4 = \sum_{j=6}^{11} \omega_j l_j x_j + \omega_g \tag{17}$$

where w_g is government wages.

It is assumed that APP profits accrue to general government revenues, although in reality there is no consolidated government account in the country. *Campesinos* earn profits in sectors 2 and 5, given by:

$$y_5 = [p_1 - (1+\tau_2)(\sum_{j=1}^{7} p_j a_{j2} + \omega_2 l_2)]x_2 + [p_2 - (1+\tau_5)(\sum_{j=1}^{7} p_j a_{j5} + \omega_5 l_5)]x_5 \tag{18}$$

2.3 Government accounts

As mentioned above, government expenditure in this model is taken as fixed in nominal terms to reflect the process by which nominally denominated expenditure targets can be eroded by inflation. Investment, on the other hand, is fixed in real terms as are exports of goods 3, 5 and 6. The government balance is written:

$$\sum_{i=1}^{7} g_i + \omega_g + s_g = \sum_{i=1}^{5} t_i y_i + \sum_{i=1}^{11} \left(\frac{\tau_i}{1+\tau_i}\right) p_i x_i + [p_1 - (\sum_{j=1}^{7} p_j a_{j3} + \omega_3 l_3)]x_3 +$$

$$[p_2 - (\sum_{j=1}^{7} p_j a_{j6} + \omega_6 l_6)]x_6 +$$

$$[p_4 - (\sum_{j=1}^{7} p_j a_{j9} + \omega_9 l_9)]x_9 - \sum_{i=1}^{6} (p_i - 1)e_i -$$

$$\sum_{i=1}^{7} \sum_{j=1}^{5} (p_i - p^*_{ij})c_{ij} \tag{19}$$

On the left-hand side is the sum of government expenditure, wages of government employees, and government savings. On the right is the sum of revenues including direct taxes, indirect taxes and government profits in processes 3, 6 and 9. The penultimate term is a government export subsidy to account for the fact that when domestic prices differ from international prices, it is the governmental trading agencies which must cover the difference. The last term takes account of government subsidies of consumer goods.

2.4 Monetary accounts

The monetary accounts in this model are rudimentary. The money supply is defined by the sum of assets:

money supply = credit to the government + credit to the private sector + foreign assets − non-monetary liabilities of the central bank

For the comparative static experiments that follow, government credit is determined by a base level plus the change in government savings. In addition, it is assumed that the government finances 75% of the nominal value of investment through monetary emissions. Credit to the private sector is endogenously determined by fixed coefficients multiplied by the gross value of output. There is assumed to be no change in the reserve level. Nonmonetary liabilities of the banking system consist of quasimoney and foreign and domestic borrowing. These items are held constant.

The demand for money is textbook Keynesian with interest and income elasticities equal to $-0{\cdot}2$ and 2 respectively. A balancing 'interest rate' is computed but it does not feed back into the equations of the model. The monetary accounts function only as a feasibility check on the levels of government, foreign and private savings. Interest rates wildly out of line should be a cause for suspicion either with respect to the structure of the model or the underlying data base.

2.5 How the model works

Equations (1) to (19) constitute a system of 68 independent equations in 68 unknowns. The variables are the three quantities produced q_1, q_2 and q_4; six activity levels x_1, x_5, x_7, x_8, x_{10}, and x_{11}; three exports quantities e_1, e_2 and e_4; three prices p_2, p_5, p_6 and seven subsidised prices $p^{\star}_i$, five income and expenditure levels y_j and ε_i; 35 consumption levels, c_{ij}; and government savings s_g. The adjustment mechanism can be thought of as follows: in the first two markets, agricultural exports or imports fill the gap between domestic demand and supply.[1] Supply is elastic and depends upon the ratio of the producer price to costs in export agriculture and producer price to basic commodities in domestic agriculture. The supply curve in the third market, petroleum, is flat so that quantities adjust. In the fourth market, agricultural processing, supply is determined by that part of the first market's surplus over domestic demand channelled to it. Exports are again the balancing residual since the price is fixed. The fifth market, basic industrial goods, is like that of petroleum: supply adjusts to the quantity demanded. Foreign exchange available to the non-basic industrial sector is determined by the constraint that foreign savings remain constant. Output then depends on the intermediate import coefficient and a flexible price is assumed to clear the market.

To understand further how the model functions consider an exogenous increase in investment demand without other parameter changes. Upward pressure on the flexible price causes intermediate costs to rise for export agriculture and the level of both direct exports and deliveries to agricultural processing to fall. Consequently, foreign exchange earnings decline and subsequent reduction in the availability of imported non-basics puts further upward pressure on their prices.[2] The rise in the price of non-basics also

[1]The heuristic nature of this paragraph permits minor inaccuracies in the model's description. 'Domestic demand' as it is used here, for example, does not include intermediate sales from export agriculture to agricultural processing. Since some of the output of the latter sector is consumed domestically, rather than exported, it is not entirely correct to refer to the gap between domestic demand and supply as the exported surplus.

[2]The adjustment mechanism described in this way reveals a potential instability in the structure of the model. Consider a disequilibrium configuration in which there is excess supply for the nonbasic industrial good because the price is too high. Since agricultural export supply depends upon costs, which directly and indirectly include the non-basic industrial price, output in the first sector shrinks. Exports of both raw and processed agricultural goods decline and the supply of the non-basic industrial commodity *contracts*. This puts additional upward pressure on the price level with a possibly unstable outcome. Offsetting the contraction in non-basic industrial supply, however, are income effects from the reduction in output which, in this model, insure stability.

pushes up the prices of basics (through interindustry relations) thereby reducing peasant production of domestic agricultural goods. This increases imports of basic grains. Note that with fixed nominal wages there is forced savings as the increase in prices redistributes income toward higher-saving urban capitalists. The net effect is a reduction in the aggregate level of economic activity and a negative investment multiplier. It should be borne in mind however, that this outcome is a direct reflection of the foreign exchange limitation imposed upon the model. If the government expands foreign borrowing along with investment, it can achieve whatever multiplier it desires.

The limitations of the model largely derive from problems of data availability. No data exist on supply response elasticities or potential substitution between domestic and imported intermediates and so average changes in output, consumption, employment, and imports are used instead of marginal changes. Obviously, this will overestimate some changes and underestimate others. Moreover, in considering the results of the simulations, one should keep in mind the static nature of the model. What follows are comparative static exercises and not intended to represent full dynamic paths of adjustment.

3. Results

This section presents the results of numerical simulations of the model discussed above. The results are summarised in Table 4. Complete balanced SAMs for each simulation can be obtained on request from the author.

3.1 The decapitalisation of export agriculture

First, to assess the effects of decapitalisation in export agriculture, the constant term in eqn (1) was reduced until gross value of production in capitalist export agriculture fell by 10%. Table 4 shows this caused real GDP to contract by 4·9% and the deflator to rise by 8%. The contraction in employment in agriculture and industry is relatively balanced owing to the importance of export agriculture in generating the foreign exchange necessary to sustain industry. The second block of Table 4 shows the change in real income, relative to the base SAM, deflated by a class-specific consumer price index (weights are derived from the base consumption matrix). It is important to note that these data reflect the income of a class as a whole. In order to determine per capita changes for workers, the change in employment must be subtracted.[1] As a result of the reduction in output in the export agricultural sector, agricultural capitalists suffer the largest decline in their real income, −21·6%. Urban capitalist income, on the other hand, improves since the rise in the price of industrial commodities more than compensates for the contraction in output. Foreign exchange is scarce and urban capitalists, the majority of whom are merchants, capture the associated rents. The real income of workers and peasants declines by approximately 9%, owing to inflation and contraction in employment. Private savings rise as a result of the redistribution of income toward high-saving urban capitalists who increase their share of total income by more than four percentage points relative to the base SAM. Government savings rise by 17·3% since taxes rise and consumer subsidies (largely proportional to workers consumption of domestic agriculture) fall while, by assumption, government spending remains constant in nominal terms. Note also that exports fall as do imports of domestic agriculture. The contraction of the

[1] In all simulations, the *share* of each class in total income moved in the same direction as the change in real income, hence, data on income shares are not shown separately in Table 4.

Table 4. *Results of the simulations*

	Simulations					
	1	2	3	4	5	6
	10% Decapitalisation export agriculture	Recuperation by the APP	1% Increase in real foreign savings	1% Devaluation		
				Real foreign savings constant	2·5% Real foreign savings decrease	5 + 1% Nominal wages increase
Production and employment			% change from base SAM			
Real GDP	–4·9	0·2	0·8	2·0	0·0	–0·9
GDP deflator	8·0	–1·0	–2·0	–4·0	1·0	3·0
Agricultural employment	–5·1	0·0	0·4	1·2	0·1	–0·4
Urban employment	–5·4	0·2	0·9	2·2	0·0	–1·0
Growth in real income			% change from base SAM[a]			
Agricultural capitalists	–21·6	–3·1	4·5	12·8	1·5	–4·6
Urban capitalists	4·5	–0·8	–1·8	–3·7	0·7	1·6
Agricultural workers	9·1	0·4	1·4	2·7	–0·9	–1·5
Urban workers	–8·7	0·6	1·8	3·6	–1·1	–2·4
Campesinos	–8·7	0·8	2·2	5·1	–0·5	–2·5
Savings and investments			% change from base SAM[b]			
Private savings	6·2	–1·3	–2·2	–4·1	1·4	3·0
Government savings	17·3	–0·4	–6·3	–11·4	4·1	8·1
Foreign savings (real)	0·0	0·0	1·0	0·0	–2·5	–2·5

Government			% change from base SAM[b]			
Expenditure	0·0	0·0	0·0	0·0	0·0	0·0
Indirect tax	4·2	–0·8	–1·9	–3·3	1·6	3·0
Direct tax	12·2	–1·7	–3·7	–7·4	2·0	4·9
Consumer subsidy	–19·5	1·1	3·9	6·7	–3·2	–6·7
Foreign			% change from base SAM[b]			
Exports	–4·3	–0·2	–1·2	0·4	3·2	2·8
Domestic ag imports	–62·2	0·6	5·6	7·6	–5·9	–13·8
Intermediate imports	–3·4	–0·1	0·2	1·8	1·2	0·7
Final imports	–1·1	–1·2	–1·2	–0·6	–0·1	0·1
Prices						
Export agriculture	1·00	1·00	1·00	1·01	1·01	1·01
Domestic agriculture	1·01	1·00	1·00	1·00	1·01	1·01
Petroleum	1·00	1·00	1·00	1·00	1·01	1·01
Agricultural processing	1·00	1·00	1·00	1·01	1·01	1·01
Basic industry	1·08	0·99	0·98	0·96	1·01	1·03
Nonbasic industry	1·22	0·98	0·95	0·89	1·02	1·07
Interest rate	19·0	10·0	9·0	8·0	10·0	12·0

Notes: [a]Change in class income deflated by consumer price index. [b]Values in nominal terms.

economy is evident in the reduction in intermediate imports while imports for final consumption remain virtually constant due to the redistribution of income.

Observe that the interest rate rises as the money supply contracts with output. The smaller government deficit puts less pressure on emissions as does the reduction in credit granted to the private sector for working capital.[1]

Table 4 documents the medium-term consequences of a capital strike in export agriculture. While it is clear that in terms of real income, agricultural capitalists stand to lose the most from a collapse in productive capacity, the assumption here is that the underlying motivation is political rather than economic. The simulation also illustrates one of the most difficult policy problems facing planners of Nicaragua's 'mixed' economy. With fixed exchange rates, and scarce foreign exchange, any contraction in the economy shifts the distribution of income toward urban capitalists who have the largest demand for imported luxury goods, the smallest supply elasticities and are most intensive users of imported intermediates.

3.2 Recuperation by the APP

The second column of Table 4 shows the results of increasing the output of APP export agriculture to make up for real output lost to decapitalisation in the capitalist sector. This scenario reflects an actual trend in the Nicaraguan economy. In the four agricultural cycles since the revolution, agro-exports of the APP have grown by approximately 40% per year while the sector as a whole has grown by an average annual rate of 28% (CIERA 1984). Peasant producers have also contributed to the growth in agro-exports, shifting their land from corn, beans and rice to cotton, coffee and sesame.

In this simulation, APP production is increased to the point where real output of export agriculture is the same as it was in the base SAM. Real GDP rises, as a result, by 0·2% and the GDP deflator falls by 1%. Table 4 shows that capitalists' incomes are reduced by switching output to the APP, while incomes of workers and peasants rise. The result hinges primarily on the lower import intensity of the APP process and the subsequent expansion of employment in the urban sectors as foreign exchange is freed.

The redistribution of income and deflation cause government savings to decline as tax revenues decrease and subsidies rise. Real foreign saving is fixed by assumption, but rises as a percentage of total savings owing to the fall in the price level. Again, owing to the redistribution of income, food imports predictably rise while imported consumer goods fall.

As a strategy for combating the foreign exchange shortage, increasing the participation of the APP appears to be a reasonably effective and progressive alternative. Moreover, a policy of placing resources in the hands of those who support the broader social objectives of the regime is unquestionably prudent in the longer run.

[1]The model suggests that the government deficit will rise with a more equal distribution of income but it should be noted that there is no room in the structure of equations for any further monetary feedback on the real side of the economy. The model is agnostic about the effects of an autonomous increase in the supply of money. In reality, increased liquidity would put upward pressure on prices which are free to rise, thereby worsening the profitability of the export sector and contracting output even further. A built-in stabiliser in the Nicaraguan economy is the fiscal structure in which tax revenues rise with inflation, thereby reducing the government deficit and money supply. A model which allows for monetary repercussions on the economy would clearly behave less radically than is suggested here.

3.3 Foreign borrowing

The contractionary effects of a capital strike in the export sector could also be offset by an increase in foreign savings. From Table 4, observe that a 1% increase in foreign borrowing causes a 0·8% increase in real economic activity and reduces the GDP deflator by 2%. The government deficit rises with output by 6·3% and private savings decline by 2·2% as foreign savings grow in real terms. The foreign exchange constraint affects industry most, so it is not surprising that urban employment grows more rapidly than agricultural employment.

The increase in foreign resources causes agricultural capitalists real income to rise by 4·5%. Part of this increase is due to the improvement in the agricultural terms of trade which reduces urban capital's income by 1·8%. Agricultural workers are also better off, but most of this gain is taken in the form of real wage increases rather than employment. Rising real incomes of urban workers are more equally divided between employment and an increase in real wages.

With more foreign savings, output rises and monetary emissions follow. The interest rate falls accordingly to 9% owing to the larger fiscal and foreign deficits as well as the expansion of credit granted to the private sector.

3.4 Devaluation with constant foreign savings

Early in 1985, the government devalued the cordoba from 10 to 28 per US dollar (the 'parallel' rate went from 28 to 50) and announced a new programme of incentives for export agriculture. In this simulation, we investigate the consequences of a much smaller devaluation of one per cent, without changing the level of real foreign savings. Under this set of assumptions, devaluation is expansionary with real GDP growth of 2%. The GDP deflator falls by 4% and urban employment grows by 2·2%. Devaluation appears to be similar to an increase in foreign borrowing in its impact on the distribution of savings: the nominal value of foreign savings rises, private savings decline by 4% and the government goes more deeply into debt.

Perhaps the most striking outcome of this simulation is the improvement in the real income of workers and peasants. *Campesino* income rises by 5·1% largely as a result of the improvement in the terms of trade between domestic agriculture and basic industrial goods. Both urban and agricultural workers are better off as a class and, taking into account the growth in employment, they are better off individually as well. The relative position of all classes improves at the expense of urban capitalists whose real income drops by 3·7%. Not surprisingly, export agricultural capital benefits the most from devaluation; real income increases by more than 12%.

Typically, devaluation tends to raise the nominal value of foreign savings, inasmuch as the level of exports is structurally determined at least in the short run. If the government does not move to prop up aggregate demand, a contraction from the excess of savings over investment can result. If, however, exports respond to higher profits, as assumed in this model, devaluation can be expansionary. Equations (1) and (6) predict that capitalists and *campesinos* respond to higher profits with postulated elasticities of $a=\beta=1$. Even if these elasticities are reduced to zero, the growth rate is still 1% and the rate of inflation slows by 3%. Distributional effects all move in the same direction, but with smaller magnitudes. The reason the economy expands even without supply response is that devaluation reduces the incomes of industrial capitalists whose consumption basket includes a relatively high proportion of petroleum and imported goods.

The reduction in imported fuel and consumer goods allows nonbasic industry to expand by 3% with favourable consequences for output, employment and inflation.

The potency of devaluation in this model is largely the result of changes in the distribution of income which reduce the demand for imported goods, coupled with the supply response in the agricultural sector. No other changes are assumed to take place, in particular, there is no change in the level of real foreign savings or in nominal wages. In the following simulations, we consider more complex and realistic variations of the devaluation scenario in which these variables do in fact adjust.

3.5 Devaluation with a reduction in foreign savings

Though the last simulation held constant the level of real foreign savings, one of the main objectives of devaluation is to reduce dependency on foreign sources of accumulation. From the third simulation above, it is clear that *reducing* foreign savings would move GDP in the same direction and stimulate inflation. In this section, we consider a devaluation accompanied by a reduction in foreign savings to the point that there is no real growth in GDP. The required reduction is approximately 2·5%.

From Table 4 it is seen that the result is slightly inflationary with income transferred from workers and peasants to the capitalist class, an outcome typical of real-world devaluation. The redistribution is evident both in the growth of real income by class, in which urban workers suffer the most, as well as in the growth of private savings. Government savings also rise by 4·2% owing to a rise in taxes and a fall in consumer subsidies. Total exports rise and imports of basic grains fall.

These last two simulations show that whether devaluation improves the incomes of the popular classes depends on the environment in which it is undertaken. If the devaluation is used to reduce foreign liabilities and the government deficit, the net effect is likely to be prejudicial to workers and peasants. On the other hand, if devaluation is used to stimulate exports with no change in foreign savings, then the impact on the income of popular classes will be favourable.

3.6 Devaluation with reduction in foreign savings and increase in nominal wages

In January 1985 the government introduced a new wage policy in which producers in the 'formal' agricultural and industrial sectors would receive the 'proper incentives' to reverse the flow of labour from the formal to the informal sector (*Barricada International* 10 January 1985). Although no official targets have been set, nominal wages are likely to rise by as much as 30% in 1985. The final simulation shows increases in nominal wages to be counterproductive and not the proper way to counteract detrimental effects on the distribution of income following from devaluation.

From Table 4 it is seen that a 1% increase in nominal wages simply shifts income to rent-earning industrial capital with the net effect of a contraction of almost 1% in GDP. The deflator also increases by 3%. Urban employment contracts by more than agricultural employment since the redistribution of income toward urban capital increases imports of petroleum and consumer goods, leaving less for industrial intermediates. Private and government savings move up together for reasons that are, by now, obvious: higher saving capitalists get larger real incomes and indirect taxes rise while consumer subsidies fall.

Workers, both rural and urban, are substantially worse off as a result of the increase in nominal wages inasmuch as inflation has eroded their real income and fewer workers are

employed. Real consumption of every good falls absolutely and imported food falls precipitously by 13·8%.

5. Conclusions

The model of this paper suggests that devaluation is probably an effective device to stimulate exports, output and employment in the heavily foreign-exchange constrained Nicaraguan economy. The simulations generally support recent policy initiatives in which the cordoba was devalued, agricultural support prices raised and the programme of export incentives revitalised. If the measures serve to relax the foreign exchange constraint under which the economy is currently operating, output will rise, inflation will abate and the distribution of income will probably improve. But if the government retires foreign debt at a rate that just maintains economic activity, workers and peasants will suffer the typical consequences of devaluation.

The simulations as a whole show improvement in real incomes of workers and peasants (both absolutely and as a share) when output increases. This result confirms the view that it is the popular classes who disproportionately bear the burden of foreign exchange shortage. Capitalists are better able to protect themselves; indeed, as has been seen, urban capital benefits from foreign exchanges scarcity. Consequently, efforts by the regime to reduce Nicaragua's dependency on foreign sources of accumulation is progressive, whether achieved by resisting export-sector decapitalisation, increasing the domestic content of production or shifting resources from importers to exporters through devaluation.

The final simulation confirms, however, that if a devaluation trips an inflationary wage-price spiral, workers and peasants are sure to be the ultimate victims. Nominal wage increases are not the way to protect real incomes in an economy dominated by dependence on foreign exchange. According to this model, attempts by the Sandinistas to redress inequality through nominal wage adjustment will be self-defeating.

Note that in all cases in which comparative static changes favour workers and peasants, the internal terms of trade for agriculture improve. Although the popular classes spend a larger fraction of their incomes on food than do nonworking classes, the impact on their real incomes is nevertheless positive. The Sandinistas have been persistent, although not always successful, in trying to turn the internal terms of trade in favour of agriculture and the model supports this policy direction. Moreover, note that in most simulations in which workers and *campesinos* are better off, so too are agricultural capitalists. This reflects a confluence of class interests between agrarian capital, workers and peasants, interests counterposed to those of rent-earning urban capital. Only in the case in which the APP increases its participation does the real of income of agricultural capital move in an opposite direction to that of workers and peasants.

The alternative to a popular alliance with agrarian capital is increasing the role of the state. In the second simulation above we saw that the foreign exchange constraint can be relaxed by an increase in exports or a decrease in the non-competitive import intensity of production. Though the model is, by design, pessimistic about import substitution within any given productive process, changing the mix of production such that the smaller producers and the APP are more prominent will have expansionary effects.

The advantages of the alternative of increasing state participation in the key foreign-exchange earning sectors of the economy are clear: although the growth rate is not as high nor the distribution of income as progressive as under an expansionary devaluation,

the government deficit is more manageable. The drawbacks of this approach, however, are political in nature and very difficult to weigh. Real private savings decrease more under this second scenario than with an expansionary devaluation. The World Bank has suggested that, in order for the economy to be truly 'mixed', private investment should be on the order of 10% of GDP (World Bank, 1981). If the political autonomy of the FSLN indeed depends in part upon maintaining a mixed economy and increasing the level of output of the APP is seen as undermining this goal, then this alternative may be less appealing.

The success of Sandinista development policies hinges essentially on their ability to control the foreign sector of the economy. By closing the capital market and controlling imports, the Sandinistas have been able to pursue a more autonomous development programme than is typically available to peripheral capitalist countries. In the end it is this relative autonomy rather than the percentage of GDP controlled by the state that challenges the traditional means of North-South domination. Consequently, the ultimate success or failure of Sandinista policies is more likely to depend on the nature of the reaction by the North, rather than on the inherent soundness of Sandinista economics.

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