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The Inflation–Devaluation–Inflation Hypothesis in Nicaragua

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This article employs a computable general equilibrium model for Sandinista Nicaragua to argue that a foreign exchange constrained economy does not necessarily fall prey to the inflation–devaluation–inflation vicious cycle characteristic of more mature Keynesian economies. It is seen that when the economy is shocked by a devaluation, prices do not rise proportionately. Output increases and the distribution of income can actually improve. These results support Sandinista policy of raising wages along with devaluation, a policy widely criticised as counterproductive. When the model is structured to account for the combined effects of Sandinista policies, however, including rising government expenditure and multiple effective exchange rates, a host of macroeconomic problems experienced by the regime arise. Stagflation sets in, income distribution deteriorates and the incentives for export production seriously diminish.

INTRODUCTION

After February 1988 Sandinista Nicaragua underwent a series of highly contractionary, policy-induced shocks.[1] As of 1989, maxi-devaluations undertaken since 1985 were insufficient to restore the real exchange rate of 1980. Toward the end of the regime, devaluations of 10 to 20 per cent per week to ten days were needed to keep pace with the inflation [*Taylor et al., 1989*].[2] It had become the conventional wisdom among country economists that these devaluations induced an 'inflation–devaluation–inflation' (IDI) vicious cycle [*Medal, 1988; Arguello and Mayorga, 1988*].

The IMF has supported Nicaragua's drastic austerity programme, reserving criticism only for the wage increases which accompanied the largest devaluations [*IMF, 1988*]. According to the orthodoxy, wage increases both undermine nominal devaluation and have little or no effect upon the real wage. Sandinista policy which sought to protect the incomes of workers through nominal wage increases would therefore be self-defeating and only serve to accelerate the IDI spiral.

In the theoretical literature, however, there is general agreement that the effects of devaluation on the trade balance, level of activity and price level depend upon the structural characteristics of the economy [*Bird, 1983*].

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This article examines the IDI hypothesis in the context of a more complex computable general equilibrium (CGE) model, tailored to the structural rigidities of the Nicaraguan economy under Sandinista rule.[3] It is seen that properly specified, the model does *not* show a pronounced tendency toward an IDI cycle. Moreover, while wage increases following a devaluation do lead to some inflation, there is improvement in the distribution of income even when the foreign exchange saving brought about by the devaluation is used to repay debt or accumulate reserves rather than increase employment. When devaluation with a wage increase is combined with rising nominal government expenditure and a multiple exchange rate system, the progressive effects of the policy quickly diminish.

The article's organisation runs as follows: the following section describes the structure of the CGE and its adjustment mechanisms. The formal specification of the model is not undertaken here, but is deferred to an appendix. The third section discusses various simulations. To understand how the model works, an increase in foreign exchange availability with no other changes is first considered. Then to examine the IDI hypothesis, a variety of simulations are run including a devaluation and nominal wage increase. Finally, the model is made increasingly realistic by introducing some of the features of Sandinista policies and it is seen that the rationale for currency depreciation *cum* wage increases is seriously undermined. A final section draws some general conclusions from the study.

TABLE 1

GOODS, PROCESSES AND SOCIAL GLASSES IN THE MODEL

Goods/Processes	Social Classes
AGRICULTURAL	
1. Export Agriculture	1. Agricultural Capitalists
Capitalist	2. Urban Capitalists
APP	3. Agricultural Workers
Peasant	4. Urban Workers
2. Domestic Agriculture	5. Peasants
Capitalist	6. Petty Capitalists
APP	
Peasant	
3. Agricultural Processing	
Capitalist	
APP	
URBAN	
4. Petroleum	
5. Basic Goods	
6. Nonbasic Goods	
7. Commerce	

THE MODEL

The model describes the production and consumption of seven commodities listed in Table 1. The base Social Accounting Matrix (SAM), to which the model is calibrated, is presented in Appendix 1.[4] As indicated in the table below, there are three alternative processes for agroexports and domestic agriculture: a capitalist process, a process operated by the state or *Area de Propriedad del Pueblo* (APP) and a *campesino* or peasant process.[5] Agricultural processing is also disaggregated into capitalist and APP In all, the seven goods are produced by the 12 processes shown in the table. Production technologies are all linear and there is no 'capital' other than produced means of production.

Six social classes of the model are listed in the right-hand side of Table 1. Capitalists are disaggregated into agricultural and urban. In the agricultural sectors, workers and peasants are divided on grounds of access to the means of production. Peasants have land but workers are landless and derive their income from selling their wage labour only. Peasants are distinguished from agricultural capitalists by the size of landholdings, with the cut-off at 35 hectares. This means that both the 'rich' and 'middle' peasants are for the purposes of the model considered peasants. Finally, both urban marginals of the informal sector, as well as small proprietors, or what Medal [*1988*] and others refer to as the *burguesía de delantal* (or 'apron' bourgeoisie) are classified as 'petty capitalists'. This class is an amalgam of various social elements and is difficult to characterise in their savings and consumption behaviour. The category consists basically of lower- to middle-class individuals struggling to make a living in the streets producing, selling and reselling commodities. As a class of petty commodity producers, they have little access to the formal channels of foreign exchange allocation and credit, yet petty capitalists of the informal sector manage to survive in the harsh environment.

Workers' income is determined by the given wage and fixed labour coefficients while petty-capitalists' income is taken as a constant fraction of total value added. Both peasants' and capitalists' income is determined as a residual once other costs are deducted. Taxes less subsidies are charged at the rate implicit in the base SAM. Only the APP is assumed to save directly, a reasonable assumption given the tightly-knit structure of ownership in the Nicaraguan economy.[6] Non-competitive imports of firms are linearly related to gross value of production.

Consumption is linear in expenditure with marginal propensities equal to the average propensities in the base SAM [*Taylor, 1979: Appendix 6*]. Capitalists, large and small, save while workers and peasants do not. Savings propensities are calibrated to the base SAM and direct taxes are linearly proportional to incomes as are non-competitive imports.

Adjustment Mechanisms

Export agriculture: In the first market it is assumed that the price is given by a guarantee price converted at some politically determined exchange rate, an assumption which reflects Sandinista policy toward agroexporters. Supply is

elastic with respect to the ratio of price to costs of production. In the short run, this elasticity is zero, but simulations are considered in which there is sufficient time to allow the capitalist process to respond to the incentive of higher profits.[7] The export price elasticity is set at 1.18, consistent with limited econometric evidence in the revolutionary period [*Taylor, et al., 1989: 37*]. With price given, exports move to clear the first market.

For realism, it is assumed that only part of the difference between domestic demand and supply of agroexports is exported directly. A constant fraction of the excess supply is delivered to the agricultural processing sectors as raw material and is therefore exported indirectly. The fraction of agroexports processed in the country is in part a policy variable but it also depends upon the level of installed processing capacity.

Clearly, one of the most critical parameters of the model is the supply response of the large agroexporters, who in 1988 controlled 42 per cent of the land sown to agroexports [*IHC, 1988: 33*]. After 1982, the government tried to increase agroexporter profits, but only with limited success. The effectiveness of any system of incentives was limited by the extreme uncertainty perceived by the private sector. Certainly, the real exchange rate was radically overvalued, especially during the 1986–87 period and the effect on the allocation of land between exportables and importables was impressive. In the immediate pre-revolutionary period, approximately 49 per cent of total acreage was devoted to exports, while by 1988, the figure had dropped to 36.2 per cent.[8]

Domestic agriculture: With three-fourths of the land sown to domestic agriculture in the hands of cooperatives and small and medium producers, supply in this sector was less dependent upon political agendas than in agroexports. In the short run, supply was still inelastic; but simulations are considered in which the elasticity is twice that of agroexports. As above, it is assumed that only capitalist producers respond to the price incentive. With demand determined endogenously and exports given, price in this market is flexible. A floor is imposed on the price of domestic agriculture, however, such that profits cannot be negative in order to avoid nonsensical results from the model computations. A large contraction in aggregate demand will therefore convert domestic agriculture from a flex- to a fix-price market.

Agricultural processing: Price in the third market is assumed to be set by the state using costs in the capitalist process as the guideline. The quantity supplied is determined by the intermediate deliveries from the agroexport sector as described above. Domestic demand is endogenously determined and exports are assumed to adjust to clear the market. Exports did in fact fall when domestic consumption of cotton seed or meat rose and the model is designed to reflect this.

Petroleum: Petroleum imports plagued the reconstruction effort since immediately after the revolution when the world price of oil more than doubled. Imported crude rose as high as 40 per cent of the total import bill. Earlier on, Mexico and Venezuela supplied Nicaragua with oil on

concessional terms and in later years, the Soviet Union and Eastern Bloc have provided Nicaragua with the bulk of its crude. Since July 1982, gasoline for private use was rationed in an effort to limit domestic consumption and protect low-income consumers. But by 1988, rationing was no longer effective since the price had risen sufficiently to render the rationing cards superfluous. Thereafter. fuel was sold at the market-clearing price and, thus, petroleum's price in the model is flexible. Demand adjusts to supply which is given by the foreign exchange allocated to petroleum purchases. As in the domestic agriculture sector, however, the price of petroleum is bounded from below by a zero-profit price.

Basic goods: The industrial goods sector is disaggregated into two: a *basic* goods sector with foreign exchange requirements administered by the government and a *non-basic* goods sector for which there is no priority foreign exchange allocation. Basic goods are fix-price commodities with their prices administered and defined in the model in the same way as agricultural processing. The Sandinistas had not been completely successful in controlling the prices of basics and upbraided 'speculators' who hoarded goods waiting for higher prices. Included in this sector are consumer goods deemed necessities by the government: matches, salt, etc., as well as some essential intermediate goods such as fertiliser and pesticides. The market for basics is essentially Keynesian in nature. Demand is met by an infinitely elastic supply, guaranteed by the government's foreign exchange allocation process.

Non-basic goods: The second part of the industrial sector, non-basics, serves as a buffer, along with petroleum, for the remaining income-expenditure balances in the economy. The supply of non-basics is determined by the allocation of foreign exchange to these two sectors and their input–output coefficients for non-competitive intermediate imports. In the simulations to follow, it is assumed that new foreign exchange is allocated to petroleum and non-basics in proportion to the use in the base SAM. A flexible price clears the market for nonbasics, but the price is not permitted to fall to the point that profits turn negative. The treatment of non-basics and petroleum in the model insures that the aggregate quantity of foreign savings remains constant.[9]

Commerce: Commerce is conceived as a separate good which forms a composite with the remaining goods, all measured in producer prices. The 'price' of commercial services is then properly considered a price like any other and here it is taken as determined by costs plus a fixed mark-up. The commercial input–output coefficients are functions of commercial margins, fixed 'physical' mark-ups, multiplied by the quantities of each of the other inputs. The commercial expenditure for the elements of final demand are determined in the same way. The fix-price commerce market is cleared by way of quantity adjustment.

HOW THE MODEL WORKS

To see how the model works, consider first a ten per cent exogenous increase in foreign savings. Table 2 confirms that additional foreign borrowing increases output by 4.7 per cent and causes the GDP deflator to fall by five per cent The additional foreign resources are devoted to imports of noncompetitive intermediates for petroleum and nonbasics and the subsequent rise in output puts downward pressure on their flexible prices. The petroleum price falls by 12 per cent and reaches its zero-profit lower limit. Its supply curve becomes flat and consequently it does not use all the foreign exchange allocated to the sector.[10] The fall in prices depreciates the real exchange rate by 2 4 per cent, stimulating the production of agroexports and food[11]. With supply response in both agricultural sectors, one could reasonably expect more exports, yet exports fall by 2.4 per cent. The increment in production is consumed domestically rather than exported due to the new employment and the large proportion of agricultural processing in workers' consumption (see Appendix 1).

The lower right-hand side of Table 2 shows the percentage change in the share of total income and the change in real income deflated by the consumer price index for each class (which uses base-SAM consumption as weights). In terms of shares, agricultural capitalists, workers and peasants all improve as foreign exchange availability increases Urban capitalists lose the most with a decline of 2.5 percentage points. Together with the loss sustained by petty capitalists this more than outweighs the gain by agricultural capitalists. The share of income accruing to workers and peasants increases and thus the rise in the availability of dollars is progressive in its effects on the distribution of income. Note that if capitalists were more responsive to the depreciation in the real exchange rate, exports would rise above the base level and the terms of trade would favour the agroexporters even more.[12] It is precisely this 'virtuous cycle' the Sandinistas wanted to set in motion with their *concertación* (harmony) initiative toward the end of their rule. While the simulation illustrates how crucial additional foreign savings will be to any future recovery, sustained growth will clearly depend upon the response of the private sector. The simulation confirms that without their support, an increase in foreign borrowing will simply cause exports to fall and deepen the crisis.

Devaluation

How then does nominal devaluation affect the model's aggregates and the distribution of income? Table 3 shows that for a ten per cent devaluation in the short run, that is with supply elasticities set equal to zero for both export and domestic agriculture, real GDP grows by 2.8 per cent. The petroleum price hits its fix-price minimum but the price of domestic agriculture and nonbasics remain flexible. The GDP deflator falls by 2.3 per cent.[13] The table confirms that nominal devaluation in a foreign exchange constrained model produces many of the same effects as an increase in foreign savings. The main difference is that, even without supply response, exports rise in this

TABLE 2
10% INCREASE IN FOREIGN SAVINGS --% CHANGE FROM BASE SAM

GDP	4.7	Real Exchange Rate	2.4
Deflator	-5.0	Government Deficit	1.9
Exports	-2.4	Foreign Savings	7.2

	Prices	Output		Share	Income
Export Ag.	0.0	1.7	Ag. Caps.	0.8	16.8
Domestic Ag.	1.8	3.1	Urban Caps.	-2.5	-10.6
Ag. Processing	-1.3	1.7	Ag. Workers	0.4	4.5
Petroleum	-12.0	6.6	Urban Workers	1.1	6.2
Basics	-4.9	4.6	Peasants	0.6	4.9
Nonbasics	-20.7	15.6	Petty Caps.	-0.4	1.8
Commerce	-3.9	3.9			

Source model computations

simulation due to expenditure switching away from agricultural processing, now more expensive due to the devaluation. Domestic agriculture bears much of the consequence of the shift in demand with its price increasing by 6.9 per cent. Observe that because of the fall in urban prices, the real exchange rate nevertheless depreciates by 6.3 per cent.

With fixed nominal investment and the rise in the nominal value of foreign savings brought on by the devaluation, at least one other component of nominal savings must fall. Government savings does indeed decline since government imports are now more expensive while the progressive redistribution of income exacerbates the decline in direct taxes. The rise in agricultural capitalists' income notwithstanding, personal savings also declines as both urban and petty capitalists' income fall. Urban capitalists' income depends upon the scarcity value of nonbasics relative to the cost of imported intermediates (now significantly diminished due to the increase in output of non-basics). The large decline in urban capitalists' income is due in part to the precipitous fall in the price of nonbasics and petroleum, the latter of which hits its fix-price floor. Petty capitalists and the informal sector are not hurt as badly since two-thirds of their income derives from commerce which actually increases its 'real' output along with the level of activity.

Agricultural and urban workers' real income decreases largely because the increase in peasant income puts demand pressure on the flexible domestic agricultural price. Peasants, like agricultural capitalists, are better off due to the real depreciation. The devaluation causes the costs and therefore the price of processed agricultural goods to rise. Together these two goods represent more than two-thirds of the wage basket for workers and peasants (see Appendix 1). With no supply response, urban employment does not rise sufficiently to offset the higher cost of food.[14] Even though income of

TABLE 3
10% DEVALUATION -- % CHANGE FROM BASE SAM

GDP	2.8	Real Exchange Rate	6.3
Deflator	-2.3	Government Deficit	6.7
Exports	7.0	Foreign Savings	-4.7

	Prices	Output		Share	Income
Export Ag.	10.0	0.0	Ag. Caps.	1.7	26.5
Domestic Ag.	6.9	0.0	Urban Caps.	-2.8	-15.8
Ag. Processing	6.0	0.4	Ag. Workers	0.1	-3.6
Petroleum	-5.4	0.1	Urban Workers	0.6	-0.2
Basics	-2.6	1.7	Peasants	1.7	8.5
Nonbasics	-21.3	14.9	Petty Caps.	-1.3	-5.1
Commerce	-3.6	1.6			

Source model computations

workers deflated by the CPI falls, devaluation is nevertheless progressive from the point of view of the share of total income accruing to workers and peasants, increasing from 44.3 per cent in the base SAM to 46.7 per cent.

The outcome of a devaluation is somewhat different, however, when the model is run with a Keynesian closure, that is, when the petroleum and non-basic prices are determined by a mark-up rather than adjusting to balance supply and demand. The results of a ten per cent devaluation are shown in Table 4. When supply elasticities are set equal to zero, the economy contracts by one per cent and prices increase by 1.6 per cent, consistent with the typical policy-makers' perception that devaluation is stagflationary. The table shows that under the Keynesian closure, devaluation is partially cancelled by the rise in fix-prices. A ten per cent increase in the price of foreign exchange generates an increase in other fix-prices of between one and 7.7 per cent. It is only because flexible agricultural prices fall by almost seven per cent, due to a fall in industrial employment by 1.7 per cent, that the deflator rises by only 1.6 per cent.[15] Because of the depreciation of the real exchange rate and fall in consumption, exports increase dramatically.

In both simulations, resources have been redistributed away from consumption and toward exports. The difference is in the effects on the distribution of income, nontraded output and urban employment. In the Keynesian closure, the regressive shift in the distribution of income lowers demand and thus output in the nonagricultural sectors. In the foreign exchange constrained model, however, income is redistributed toward the lower income strata and output and urban employment expand. This puts upward pressure on the price of domestic agriculture which shifts income toward peasants (and away from agricultural workers whose nominal income is tied to the fixed level of agricultural output).

TABLE 4
10% DEVALUATION (KEYNESIAN CLOSURE) -- % CHANGE FROM BASE SAM

GDP	-1.0		Real Exchange Rate		9.9
Deflator	1.6		Government Deficit		4.1
Exports	12.3		Foreign Savings		-12.5
	Prices	**Output**		**Share***	**Income**
Export Ag.	10.0	0.0	Ag. Caps.	0.6	4.6
Domestic Ag.	-6.9	0.0	Urban Caps.	0.2	-2.6
Ag. Processing	7.0	0.4	Ag. Workers	0.0	-0.7
Petroleum	7.7	-3.8	Urban Workers	-0.2	-2.4
Basics	2.8	-1.8	Peasants	-0.5	-2.7
Nonbasics	2.7	-2.1	Petty Caps.	-0.2	-3.7
Commerce	1.0	-1.4			

Source model computations
*Does not sum to zero due to rounding.

Workers and peasants get a greater share of total income, but workers' real income declines in both simulations. If the economy is foreign exchange constrained, rural workers suffer the most; under the Keynesian closure, urban workers lose due to the inflation traditionally feared as the product of devaluation.

The IDI Hypothesis

Does the model support the existence of an inflation–devaluation–inflation vicious cycle as described by the standard model? In the simulation of a devaluation in Table 3 above, the GDP deflator fell; the real income of the most organised segment of the Sandinistas' popular base, urban workers, barely changed while the share of income accruing to the popular classes increased. Clearly, this is not entirely consistent with the IDI hypothesis which holds that devaluation unleashes an inflationary spiral. Nor are the results consistent with the conventional wisdom that devaluation increased the rate of inflation after early 1988.

Note, however, that if foreign exchange savings produced by the devaluation were not used to increase output in the flex-price sectors, the devaluation will be more inflationary. Table 5 presents the results of a simulation in which the foreign exchange constraint is tightened along with the devaluation. The levels of output of petroleum and nonbasics are held constant.

Table 5 shows that devaluation is now stagflationary. Currency depreciation principally affects the fix-price commodities in proportion to their direct and indirect use of foreign exchange. No flexible price reaches its lower bound. Flex-price commodities, however, suffer a decline in their prices due

TABLE 5
10% DEVALUATION WITH PETROLEUM AND NONBASIC OUTPUT HELD AT BASE SAM LEVEL – % CHANGE FROM THE BASE SAM

GDP	-0.4	Real Exchange Rate	9.8
Deflator	1.0	Government Deficit	5.3
Exports	11.1	Foreign Savings	-10.0

	Prices	Output		Share	Income
Export Ag.	10.0	0.0	Ag. Caps.	0.9	10.3
Domestic Ag.	-3.5	0.0	Urban Caps.	-0.7	-7.0
Ag. Processing	6.7	0.4	Ag. Workers	0.0	-1.5
Petroleum	-3.8	0.0	Urban Workers	-0.1	-2.3
Basics	1.5	-1.0	Peasants	0.1	0.1
Nonbasics	-0.8	0.0	Petty Caps.	-0.2	-2.9
Commerce	0.1	-0.8			

Source: model computations

to the shift in the composition of final demand from consumption to exports and government spending as well as the redistribution of income. Indeed, it is these shifts in the distribution of income among social classes as well as in the composition of final demand combined with flexible prices which most seriously undermine the IDI hypothesis.

If in order to redress the fall in the standard of living of the working classes, policymakers allow an increase in nominal wages, they will see the effects of the devaluation cancelled, at least in part. Table 6 shows the results of a devaluation while increasing nominal wages by ten per cent. To give the IDI hypothesis the greatest advantage, there is no supply response and output of petroleum and non-basics is limited to their base-SAM levels. Petroleum reaches its fix-price minimum and thus contributes to the foreign exchange savings. What is remarkable is that the GDP deflator only increases by 4.7 per cent in this simulation. Even with a tightening of the foreign exchange constraint, devaluation accompanied by an increase in nominal wages does *not* cause prices to rise by a proportional amount. The IDI hypothesis apparently derives no support from this model no matter how hard it is pushed.[16]

The Sandinistas were widely criticised for this strategy of increasing nominal wages at the same time as devaluing the currency [*IMF, 1988*]. But given the structural rigidities of the Nicaragua economy, the strategy appears to be far less inflationary than is ordinarily assumed. Indeed, it appears to have been a shrewd tactic in that it raises the income of agricultural capitalists while at the same time improving workers' incomes. Rather than falling by 1.5 per cent, rural workers' income rises by 4.1 per cent while the decline in urban workers' income is reduced from 2.3 per cent to 1.2 per cent. Peasants lose somewhat but

TABLE 6
10% DEVALUATION WITH A 10% INCREASE IN NOMINAL WAGES – % CHANGE FROM THE BASE SAM

GDP	-1.6	Real Exchange Rate	7.6
Deflator	4.7	Government Deficit	5.9
Exports	11.1	Foreign Savings	-10.9

	Prices	Output		Share*	Income
Export Ag.	10.0	0.0	Ag. Caps.	0.3	1.5
Domestic Ag.	1.7	0.0	Urban Caps.	-1.7	-12.5
Ag. Processing	8.6	0.5	Ag. Workers	0.7	4.1
Petroleum	-2.8	-0.9	Urban Workers	0.4	-1.2
Basics	6.6	-3.3	Peasants	0.1	-1.5
Nonbasics	-2.4	0.0	Petty Caps.	0.1	-2.6
Commercé	7.5	-3.1			

Source model computations
*Does not sum to zero due to rounding

the share of total income accruing to workers and peasants increases. It is further evident from the table that the combination of policies reduces the incentive to participate in the urban informal sector as petty capitalists' income falls by 2.6 per cent. This is, again, consistent with government policy objectives.

Toward Reality

The obvious question that arises is why, if these are indeed the policies followed by the *FSLN*, did the Nicaraguan economy do so poorly and indeed contribute to the eventual downfall of the Sandinistas? Up until the elections of 1990, why did the inflation rate continue unabated so that further devaluations were continually required? The answer seems to be twofold: first, a uniform rate of devaluation has been applied here to both imports and exports. In reality, the agroexport guarantee price did not managed to keep up with the rate of devaluation [*Arana, 1989*]. Second, and more importantly, the government was not fully successful in curbing government spending due to the continued effects of the Contra war, preparation for the elections and the reconstruction effort after hurricane Joan [*Taylor et al., 1989*]. Part of the rapid expansion of credit to the private sector in 1989 was to abet the *concertación* initiative.

To see how the model behaves under these additional assumptions, consider a heterodox set of policies in which the *córdoba* is devalued by

ten per cent, but the agroexport guarantee price is increased only by five per cent and the wage rate by ten per cent. This simulation mimics the policies applied after February 1988. Even though the government had announced a plan to reduce the size of the bureaucracy, the simulation includes a ten per cent *increase* in government spending. To consider a somewhat longer horizon, there is supply response in both agricultural sectors. The results are shown in Table 7.

What is striking about this simulation is how the combination of policies so thoroughly undermines the ingenuity of a devaluation with an increase in wages. Table 7 shows that there is no foreign exchange savings and the government deficit skyrockets. Agricultural output declines as does the real income of agricultural capitalists, workers and peasants. Inflation begins to pick up in the model, to 9.2 per cent, and the real exchange rate appreciates for the first time. The simulation is beginning to look more like the real economy did in 1989: the government goes into deep deficit and exports fall. Only urban capitalist income increases due to the heightened scarcity of foreign exchange in the face of the demand. On a percentage basis, it is agricultural capitalists and peasants who lose the most. This urban bias was clearly contrary to the policy objectives of the Sandinistas who sought to redirect income to the rural sector in order to stimulate exports.

The conclusion which emerges is that the inflation is *not* caused by the devaluation, but by the piling on of coincident policies which rob devaluation of its power.[17] Clearly, there appears to be no inflation–devaluation–inflation vicious cycle as suggested by the fixed-price vision of the economy common in the work of country economists. Given the foreign exchange constrained nature of the economy, it is rather an

TABLE 7

5% INCREASES IN GUARANTEE PRICE, 10% DEVALUATION, 10% INCREASE IN GOVERNMENT SPENDING, 10% INCREASE IN WAGES--% CHANGE FROM BASE SAM

GDP	-3.9	Real Exchange Rate	-3.6
Deflator	9.2	Government Deficit	17.4
Exports	-7.4	Foreign Savings	0.0

	Prices	Output		Share	Income
Export Ag.	5.0	-4.3	Ag. Caps.	-1.0	-19.2
Domestic Ag.	6.5	-3.1	Urban Caps.	1.1	1.8
Ag. Processing	7.1	-4.2	Ag. Workers	-0.2	-4.1
Petroleum	19.9	-7.5	Urban Workers	0.1	-2.4
Basics	11.8	-6.0	Peasants	-0.3	-4.3
Nonbasics	17.6	-7.5	Petty Caps.	0.3	-3.4
Commerce	11.5	-4.5			

Source: model computations

inflation–devaluation-excess demand-inflation cycle that appears to have had Nicaragua in its grip.

CONCLUSION

Objections to devaluation *cum* nominal wage increases leading to an IDI spiral are grounded in a conception of the macro adjustment mechanisms which have little to do with the real limits of the Nicaraguan economy. From the perspective of a fix-price Keynesian closure, the policies followed by the Sandinistas in their last two years in power appear to have made no sense. But the mark-up pricing model in which wage and foreign exchange costs are fully passed through implies an elasticity of supply simply unattainable in an economy severely dependent upon foreign resources.

In the foreign exchange constrained model, however, the changes brought about by a devaluation are precisely what the Sandinistas would have liked to have seen take place. Taking into account its effect on output, devaluation shifts income from the richer to the poorer classes and from the urban to the rural sector and discourages speculation in commercial and informal sector activities. The foreign exchange constrained model in itself shows little tendency toward an IDI spiral. This is true so long as government expenditure is kept under control and agroexport guarantee prices rise in step with devaluation.

The more general message of the study is that structural features of an economy at any given moment in time heavily condition the conventional wisdom as to how it is likely to react to different policy regimes. An all encompassing theory of how the economy should behave cannot typically be relied upon as the foundation for coherent policy advice. Shifts in the distribution of income leading to changes in the pattern of demand for a mix of flex- and fix-price commodities produce complex and surprising results. *Ad hoc* policies, even those which directly challenge the orthodoxy, may well be necessary, indeed, the best available.

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NOTES

1 1989 was a qualified success in Nicaragua's battle against inflation. ECLAC's preliminary data show that the CPI index increased by only 3,452 per cent compared with the dismal showing for 1988 of more than 33 thousand per cent [*ECLAC, 1989: 20*].

2. In February, 1988 the *córdoba* was devalued from 70 to ten thousand *córdobas* per dollar, one of the largest devaluations in Latin American history For a general overview of recent policy see Taylor *et al.* [*1989*]. For background to the crisis see Gibson [*1987*] and sources cited therein.

3 The basic references are Taylor [*1983*] and Dervis, de Melo and Robinson [*1982*]

4 The base SAM was produced in Nicaragua by the author in conjunction with the *Centro de Estudios y Investigaciones de la Reforma Agraria* under the direction of O. Neira The SAM was built to conform to national accounts for 1983 and used internal sources of data.

5. For details on the agrarian structure see Colburn [*1986*] and Deere *et al.* [*1985*].

6. Note that the APP is not disaggregated from the urban sectors, even though there is some participation APP profits are counted as savings for processes 10–12.

7 The output of the peasant and APP sectors, however, remain fixed
8 Computed from IHC [*1988: 33*]
9. This is true unless one or both of these sectors hits its zero-profit floor In that case, the foreign exchange constraint is not binding.
10 Thus, the table reports that there was an increase of only 7 2 per cent (rather than ten per cent) in the use of foreign exchange
11 The weights to form the real exchange rate index are those of the base SAM
12 An elasticity of 2 in agroexports is sufficient for exports to increase
13 The average CPI increases, however, by 1 9 per cent capitalists' CPIs both falling and those of the remaining classes rising This explains why, in the table below, real GDP increases while income deflated by the CPI falls Taylor *et al* [*1989*] notes that the CPI substantially diverges from the GDP deflator since the former is heavily weighted toward food which is more volatile Thus is the only simulation in which the CPI and the GDP deflator move in opposite directions
14 As agricultural supply begins to respond to the depreciation of the real exchange rate, these positive effects of devaluation intensify Output rises, inflation abates even further and exports increase. The devaluation is more progressive in its effect on the distribution of income and favours the rural versus the urban sector
15. Here the price of domestic agricultural goods remains flexible; were it to be determined via a mark-up as well, inflation would be 3.2 per cent and output would have contracted by 1.5 per cent
16. Surprisingly, with supply response, inflation is marginally higher since the additional employment drives up the price of food.
17 Even if the exchange rate were uniformly devalued, inflation would be *lower* than in this simulation due to the effect of the additional foreign exchange on supplies of petroleum and non-basics

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APPENDIX 1

BASE SOCIAL ACCOUNTING MATRIX-1983 (BILLIONS OF 1983 CORDOBAS)

Appendix 1 Base Social Accounting Matrix 1983 (Billions of 1983 Cordobas)

	INTERMEDIATE DEMAND												CONSUMPTION							FINAL DEMAND			
	Agrosports			Domestic Agriculture			Ag. Processing		Industry				Capitalists		Workers								
	Capital	Peasant	APP	Capital	Peasant	APP	Capital	APP	Petro	Basic	Nonbasic	Comm	TOTAL	Ag.	Urban	Ag.	Urban	Peasants	Petty Caps.	Total Cons	Govt	Invest	Exports	Total
1 Export Agric.							3180	2031		103			5314									237	154	5705
2. Domestic Agric.	50	70	26	12	63	4	210	676		98	9		1218	59	152	1002	1841	1784	987	5826	7	48	-335	6764
3 Ag. Processing	65	69	38	65	177	41	422	119		409	156	11	1571	588	998	1234	2688	1172	2161	8641	42	21	2951	13225
4. Petroleum	85	24	44	82	30	62	90	182	76	397	65	36	1174	43	111		22		723	900	221	8	412	1892
5. Basic Industry	840	510	453	689	717	496	266	424	27	801	585	808	6616	26	132	87	267	155	858	1525	1873	3807	136	13684
6. Nonbasic Industry							117	89	5	1202	347	727	2487	147	295	48	315	99	411	1316	1994	1313	33	7076
7 Commerce	157	108	86	137	174	97	486	459	375	1387	481	587	4533	186	455	538	1199	705	1220	4302	1880	1943	825	13482
TOTAL	1197	781	647	985	1162	700	4771	3980	481	4396	1643	2169	22912	849	2143	2909	6332	3915	6361	22509	6017	7376	3015	61829
1 Ag. Caps.	291			205			1545						2042								25			2067
2. Urban Caps.									201	2554	1927		4683								572			5254
3. Ag. Workers	1021		554	375		228	329	405					2911											2911
4. Urban Workers									16	2363	664	1180	4223								2463			6686
5 Peasants		1155			2760								3915											3915
6. Petty Caps.							104			925	2028	6595	9652											9652
Total Income	1312	1155	554	580	2760	228	1979	405	217	5841	4619	7776	27425								3060			30486
Net Tax	17	173	4	47	1	147	1043	165		156	277	1107	2403	320	812		343		746	2222				4625
Taxes	22		12	19	1	11	1043	282		913	277	1107	3687	320	812		574		746	2452				6139
Subsidies	5	173	8	66		157		116		757			1284				230			230				1514
Savings			80			328		755	0	2338	124	2412	6058	861	2189			0	2011	5061	5459		3777	9416
VALUE ADDED	1329	982	638	533	2760	409	3022	1325	217	8336	5021	11295	35866											
Imports	68	26	38	90	55	69	55	72	1194	953	412	18	3050	38	109	2	11		534	694	1006	2040		6791
Total	2594	1789	1322	1608	3977	1178	7848	5377	1892	13684	7076	13482	61829	2067	5254	2911	6686	3915	9652	30486	4625	9416	6791	

APPENDIX 2
The Equations of the Model

In the formal definition of the model, we employ indices i for goods, j for processes and k for social classes. The supply-demand balances for the seven goods are:

$$q_i = \sum_{j=1}^{12} a_{ij}x_j + \sum_{k=1}^{6} c_{ik} + (I_i + G_i)/p_i + E_i \qquad i = 1,2,\ldots,7$$

where q_i is the quantity produced of the ith good, a_{ij} is the input-output coefficient describing the amount of the ith good required by process j, x_j the output of process j, and c_{ik} is consumption of the ith good by the kth class. I_i is the nominally given investment including change in inventories, G_i is the nominally fixed government consumption, E_i is exports, for simplicity considered to be net of competitive imports. p_i is the producer price of the ith good. The quantities of each of the seven goods supplied are:

$$\begin{aligned} q_1 &= \Sigma x_i && (i = 1,2,3) \\ q_2 &= \Sigma x_i && (i = 4,5,6) \\ q_3 &= \Sigma x_i && (i = 7,8) \\ q_j &= x_i && (j = 4,5,6,7;\ i = 9,10,11,12) \end{aligned}$$

Supply in the two agricultural markets is determined by:

$$x_i = \bar{x}^s_i\,(p_j/B_i)^{\alpha_i} \qquad i = 1,4,\ j = 1,2$$

where the bar indicates a constant and α_i is the response elasticity. Intermediates, import and wage costs are summarised in B_j defined as:

$$B_j = \sum_{i=1}^{8} p_i a_{ij} + w_j l_j \qquad j = 1,2,\ldots,12$$

where w is the wage rate, and l is the labour coefficient. The eighth input–output coefficient describes the amount of non-competitive intermediate imports required per unit of output. p_8 is then:

$$p_8 = e_m p_m$$

where e_m is the exchange rate for imports and p_m is the given international price of imports.

The following prices are given by straight-forward mark-up equations:

$$p_i = (1+\tau_i)(1+\tau_i)B_i \qquad i = 3,5,7;\ j = 7,10,12$$

where t is the indirect tax rate and τ is the mark-up. The agroexport price is given and the remaining prices are flexible.

Consumption is determined by a linear expenditure system:

$$c_{ik} = \theta_{ik} + (\mu_{ik}/ p^*_i) (\varepsilon_k - \sum_{i=1}^{6,8} p^*_i \theta_{ik}) \qquad \begin{matrix} i = 1,2,\ldots,8,6 \\ k = 1,2,\ldots,6 \end{matrix}$$

where θ_{ik} is the consumption intercept and μ_{ik} is the marginal propensity to consume out of supernumerary expenditure, $(\varepsilon_k - \Sigma p^*_{ik}\theta_{ik})$. The latter is total expenditure, ε_k, less expenditure on 'subsistence' (or more generally the intercept). Note in the commodity index that imports are included and commerce is not considered a good classes choose to consume. Expenditure depends upon savings rates, s_k, as well as the direct tax rates, d_k:

$$\varepsilon_k = (1-s_k)(1-d_k)y_k \qquad k = 1,2,\ldots,6$$

and y_k is income of the kth class.

The commercial expenditure for consumption is simply the commercial margins ψ_i, times real consumption:

$$c_{7k} = \sum_{i=1}^{6} \psi_i C_{ik} + \psi_m c_{8k} \qquad k = 1,2,\ldots,6,8$$

And, finally, p^*, is the *retail* price of good i, and is defined as:

$$p^*_i = p_i + p_7\psi_i \qquad i = 1,2,\ldots,6,8$$

where p_7 is the price of the physical commercial margin, ψ.

Agricultural capitalists' incomes are determined by:

$$y_1 = \sum_{j=1,4,7} \frac{[pp_j - (1+t_j)\, B_j]\, x_j}{(1+t_j)}$$

where pp_j is the price of the good produced by the jth process. Urban capitalist income is earned in processes 9 through 11, given by:.

$$y_2 = \sum_{j=9,10,11} \frac{[pp_j - (1+t_j)\, B_j]\, x_j}{(1+t_j)}$$

Agricultural and urban workers' income is respectively:

$$y_3 = \sum_{j=1}^{8} w_j l_j \qquad\qquad y^4 = \sum_{j=9}^{12} w_j l_j$$

Peasant income is determined in a similar way to that of capitalists':

$$y_5 = \sum_{j=2,5} \frac{[pp_j - (1+t_j)\, B_j]\, x_j}{(1+t_j)}$$

while for the purposes of the model, petty capitalists are assumed to capture a fixed and given fraction, Φ_j, of private value added in processes 10 through 12:

$$y_6 = \sum_{j=10}^{12} \Phi_j \quad [pp_j - (1+t_j) \sum_{i=1}^{8} p_i a_{ij}]x_j$$

So far these are 99 equations in 101 unknowns, E_4; q_i $(i = 1,2,\ldots,7)$; x_i $(i = 1,4,7,9,10,11,12)$; p_{ij} $(i = 2,3,\ldots,7)$; B_i $(i = 1,2,\ldots,12)$; p_8; c_{ij}, $(i = 1,2,\ldots,8)$, $(j = 1,2,\ldots,6)$; e_i $(i = 1,2,\ldots,6)$; p^*_i $(i = 1,2,\ldots,7)$; y_i $(i = 1,2,\ldots,6)$. To close the model, two additional equations are needed. The first is nothing more than the foreign exchange constraint:

$$s_f + \sum_{i=1}^{7} p_{ei} E_i = \sum_{j=1}^{12} p_m a_{8j} x_j + \sum_{k=1}^{6} p_m c_{8k} + I_8 + G_8$$

where s_f is foreign savings and p_{ei} is the dollar price of exports. The second allocates foreign exchange to petroleum and non-basics in proportion to current use:

$$a_{89}x_9 / a_{811}x_{11} = K$$

where K is a constant determined in the base SAM.