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Foreign debt, exchange rates, and prices

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INTRODUCTION

During the second half of the 1970's, Latin American countries faced a fast growth of their external debt. Since 1980, these countries started having problems in the servicing of their debt because of the increase in international interest rates. Also, increases in the inflation rates, macro-devaluations and a sudden reduction of investment levels have been general phenomena in the region since 1982.

The main hypothesis of this paper is that Latin American countries are caught in a dynamics driven by their high level of external indebtedness which also conditions their inflation rates and the amount of domestic savings that could be used for productive investment. This has in turn important implications in short-term macroeconomic policies and in long-term development strategy.

The purpose of this paper is to explain the external indebtedness dynamics of Latin America within an analytical framework that explains how indebtedness influences exchange rate policies, which in turn influence the price levels and the assets market, specially in capital investment. Theoretical background of this paper may be found in Dornbusch and Fischer (1980), Dornbusch (1975, 1976), and Kouri (1976, 1984).

The paper has been divided into three parts. The first will develop a model of three goods: two produced by the country and a third imported

good. The relationship between the external terms of trade and the level of the external debt will be determined with this model. That relationship will, lead us to the determination of the exchange rate depreciation required for the debt level. Furthermore, a few exercises of comparative statistics will be presented and the model will be used to analyze Latin American experiences. The short-run effects of the external debt on price levels and on GNP composition will be considered in the second part.

The third section will analyze the domestic interest rate, determination given the exchange depreciation rate and its effects on wealth and on assets portfolio. Special emphasis is place on the behavior of capital formation. Finally, the last chapter contains the conclusions.

The empirical part of the paper uses a sample of five Latin American countries: Argentina, Brazil, Chile, Mexico, and Peru.

I. The Model

a) Overview

We shall analyze a small open economy that produces two goods: investment goods, not traded internationally, and a differentiated consumption goods, that is traded on the world market, and whose demand depends on its relative price with respect to a third good, which is imported into the country.

It is a small country with respect to imports since its price given internacionally Nevertheless, it is a big country in relative to the goods exported, because the country has a bearing on its price determination.

There are two sorts of assets: money and real capital, and one lialility, i.e., the foreign debt. The assets demand depends on the rate of return and on wealth. The residents of the country can maintain a foreign debt in the form of bonds owned by foreigners, these bonds promised to pay one unit of the exported good (eP^*_a)[1] for an indefinite period of time. International interest rate is given (r^*).

The short-run equilibrium in this economy corresponds to a real exchange rate and a domestic price level that equilibrate the goods and assets markets.

Equilibrium will depend on the indebtedness level which will, in turn, determine savings and investments in the economy, and therefore, the current account and the foreign debt accumulation to the point at which a long-run equilibirum is achieved, with a balanced current account.

b) Description of the Model

The model is made up of eight equations: aggregate demand (Y), wealth (W), and current account (CC), money market (M/P), real interest rate (r), savings (S), investment (I), and capital (K). The complete model appears in Appendix I.

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1) eP^*_a = payment flow of the foreign debt in domestic currency.

where: a = foreign debt (bonds held by foreigners)

P* = international price levels.

e = nominal exchange rate.

Wealth is equal to the sums of the real balances, plus the real capital value, minus the present value of the external debt, adjusted by the terms of trade. The small letters represent real variables: w = W/P:

$w = m + q\,K - \lambda a/r^*$

$m = M/P$ = real balances

$\lambda = e\,P^*/P$ = terms of trade, where e, the nominal exchange rate, is fixed

K = capital stock

q = relative price of capital

The equilibrium in the money market is achieved when the money demand is equal to the money supply, demand being a negative function of the domestic interest rate (r) and a positive functions of disposable income[2].

Investment is a function of Tobin's "q", where q is the relative price of capital. The "q" is equal to the marginal productivity of capital (f'K) over the replacement cost, that here is represented by the domestic interest rate (r), so that $q = f'K/r$.

$$I = I^{(+)}(q) \tag{2}$$

In the goods market, aggregate demand, D, es a function of the terms of trade (λ), interest rates, and real wealth. Likewise, export demand (X) is a function of the terms of trade.

$$Y = D^{(+)(-)(+)}(\lambda, r, w) + X^{(+)}(\lambda); \tag{3}$$

When the imports price increases (p^*), it is assumed that domestic demand increases as a result of the substitution effect since the price of the domestic good is relatively lower. Likewise, an increase in wealth increases the aggregate expenditure, part of which will be in domestic production, thus increasing its demand. On the other hand, an increase in the interest rate reduces the value of "q" and the demand for investments.

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2) Disposable income is equal to: $y = Y - e\,P^*a$

When the goods market is in equilibrium, the current account is equal to the surplus of savings over investments. Furthermore, the equilibrium of the balance of payments requires the current account to be equal to the increase in the present value of the foreign debt.

(4) $$CC = S - I = \lambda \dot{a} \; ; \; \dot{a} = \frac{\Delta a}{a}$$

Savings are assumed a decreasing function of wealth and a positive function of the interest rates; that is, we are assuming a Metzler savings function:

(5) $$S = S^{-,+}(w,r);$$

Under the assumption that the economy is externally indebted, a current account surplus should be equal to the repayment of that debt, and assuming a fixed exchange rate and a constant interest rate, it could be written as:

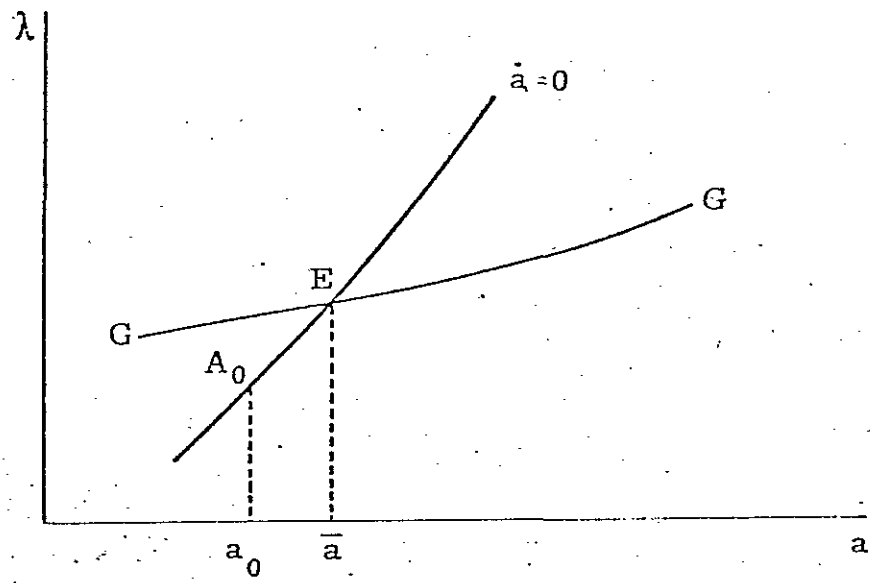
(6) $$\frac{S(w) - I(q)}{\lambda} = \dot{a}/_{r^*}$$

c) Short-run equilibrium determination

In order to describe the dynamics of the model, we are assuming that Y, r, e, g, k, are fixed. Given the money demand, function and assuming that income and interest rates are constant, real balances will also be constant. Therefore, changes in wealth will be only a function of the terms of trade movements (λ), and of the foreign debt (a). Thus "q" will not be affected because capital stock and r are given in the short-run.

Given these assumptions, an increase in the external debt will induce a fall in the real net wealth, causing a declive in the aggregate demand, and increasing (deteriorating) the terms of trade in order to restore the equilibrium in the goods market, because the import prices must rise to make domestic production more competitive.

Figure 1



In this way, a higher external debt requires higher terms of trade; therefore, the $\dot{a} = 0$ curve, that shows the relationship between the terms of trade and the real external debt, is upward sloping. Slong this curve the current account is in balance, as it is shown in equation (4): $\dot{a} = 0$, implies that $CC = 0$ and that $S = I$.

The GG curve shows the goods market adjustment path. Since the current account balance is represented by $\dot{a} = 0$, outside the intersection of the two curves, the economy is becoming more or less indebted. This

curve upward sloping [3].

For the stability of the model, the slope of the current account balance curve must be steeper than the goods market curve; this implies that there is disequilibrium *outside of* $\dot{a} = 0$. Thus, to the left of $\dot{a} = 0$, wealth is above its equilibrium value, and therefore investment is higher than savings and there is current account deficit and accumulation of the external debt value. The deficit will persist up to $\bar{a}$, the point at which interest payment on the debt is equal to the surplus of the trade account and new debt make up for capital amortizations.

On the contrary, to the right of $\dot{a} = 0$, there is a current account surplus, thus, these is a declive on the level of the external debt. At any point in time there is a debt level that determines expenditures, terms of trade equilibrium $\lambda(a_o)$ and current account balance. For instance, at the p oint A_o, with debt a_o on figure 1, there is a current account deficit that has to be financed by an accumulations of foreign debt[4].

d) Comparative static analysis

d.1) Export demand increase

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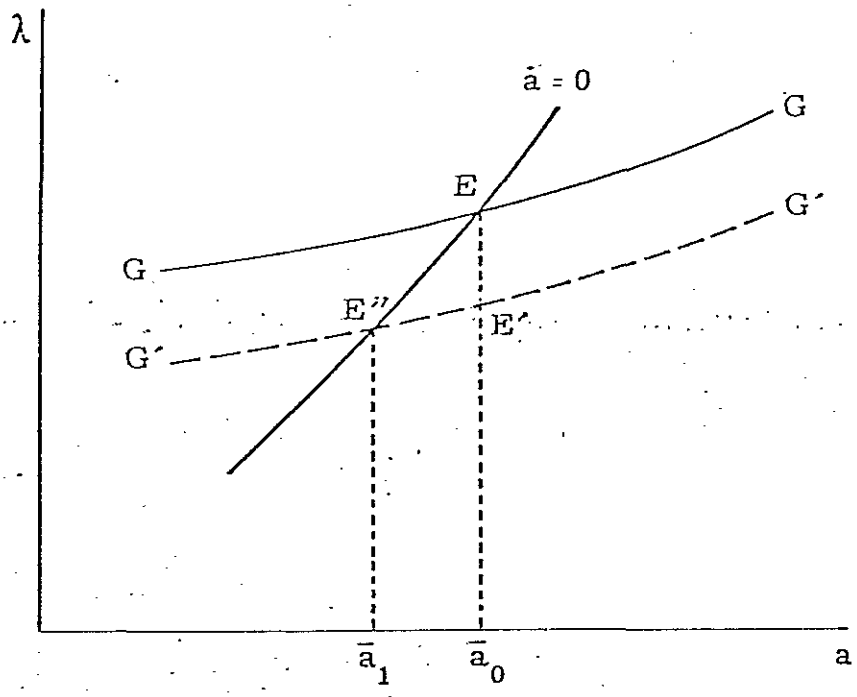
3) See mathematical derivation in Appendix I.

4) The formal condition of the models stability is:

Sw $[\frac{m'r}{\lambda} - (1 + \psi)] - \psi\frac{\dot{a}}{a}$, where $\psi = \frac{d\lambda}{da}\frac{a}{\lambda}$,

i. e., the elasticity of foreign debt relative to the terms of trade.

Figure 2



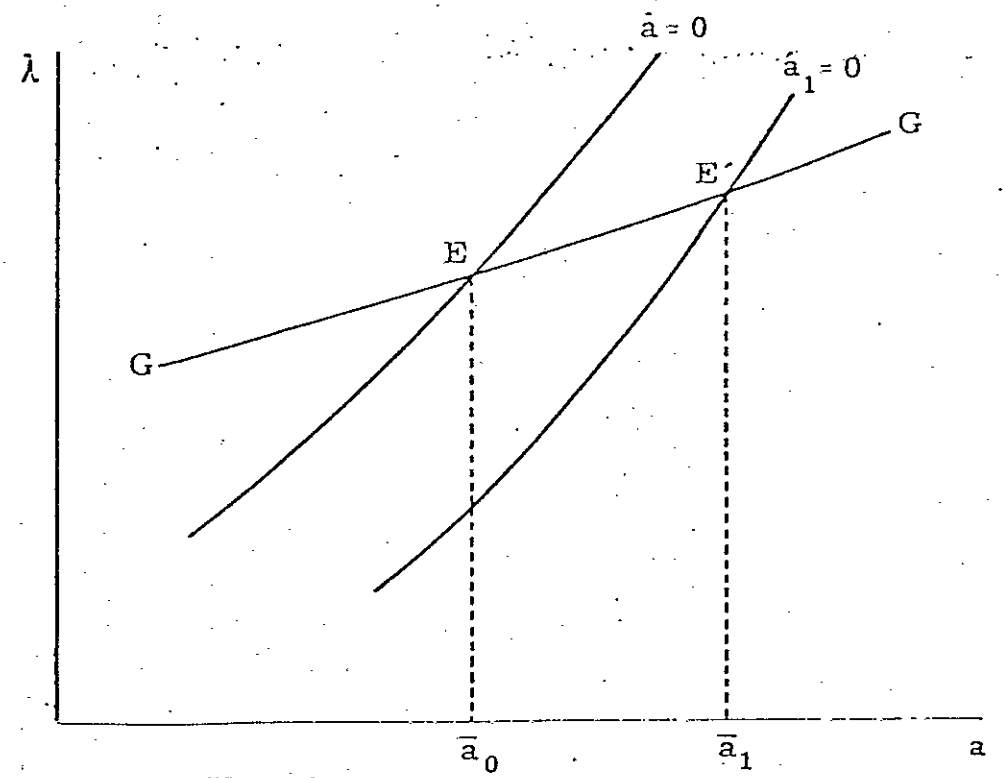
An increase in the world demand for the domestic product results in export growth, and this in turn, makes curve GG shift downwards and to the right. At the initial equilibrium point (E) there is now excess demand for the domestic products (surplus) so an improvement in the terms of trade (a real appreciation) or a decline in the external debt level is required to restore the market equilibrium. Therefore, in figure 2, it could be seen that the new long-run equilibrium, "E", is at a point with a lower external debt level and an improvement in the terms of trade.

The adjustment path to the new equilibrium has two steps: an instantaneous improvement in the terms of trade point E', where there is still a surplus in the current account that leads to the payment of part of the foreign debt. This in turn, induces a new revaluation of the terms

of trade until the current account reaches its equilibrium again at point E" where real wealth has increased because of the reduction in the value and the amount of the foreign debt.

d.2) An import prices increase

Figure 3



An increase in the value of imports means a smaller planned saving. It implies a shift to the right of the curve $\dot{a} = 0$. A higher foreign debt is needed to keep the balance between saving and investment.

At the new equilibrium E', there is an increase in the foreign debt and a deterioration of the terms of trade. The new equilibrium is reached through a current account deficit in the previous point E, leading to an increase in foreign savings. The aggregate demand is reduced with the fall in wealth, and domestic competitiveness has to be reached through

a reduction of the relative price of the domestic product in order to keep the equilibrium in the goods market.

e) Exchange rate determination in the adjustment process.

The exchange rate is determined jointly with the general equilibrium in the goods and assets markets.

From the definition of terms of trade $\lambda = eP^*/P$, the exchange rate may be written as: $e = \lambda P/P^*$, multiplying and dividing by M, we find:

$$e = \left[\frac{\lambda}{M/P} \cdot M/P^*\right] \tag{7}$$

The equilibrium terms of trade are determined from aggregate demand equation (3). They are shwon in the GG curve, and given income they are a function of the foreign debt value.

We are assuming that the real balance equilibrium is a function of the value of the external debt when income and interest rates remain constant. Therefore, the equilibrium exchange rate could be defined as an increasing function of the debt level.[5]

$$\bar{e} = \frac{\lambda(a)}{M/P(a)} (M/P^*) = J_{(a)}(M/P^*);\ J'_a > 0$$

If the above equation is expanded around the long-run equilibrium value, the linear approximation can bewritten as follows:[6]

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5) $\frac{de}{da} = \frac{\lambda}{m}\frac{M}{P^*} > 0$

6) Using Taylor's expansion series.

$$e = \bar{e} + \gamma(a - \bar{a}); \text{ where } \gamma = J_{(a)}(M/P^*) > 0$$

The short-run equilibrium value of the exchange rate is equal to the long-run equilibrium of the exchange rate value $(\bar{e})$, adjusted by the difference of the actual value of the foreign debt of its steady state equilibrium value $(\bar{a})$. This implies that:

$$e - \bar{e} = \gamma(a - \bar{a})$$

In other words, the exchange rate should be devalued at a speed similar to $\dot{e} = \gamma(a - \bar{a})$ over the steady state value of the exchange rate to keep the current account in short-run equilibrium, in case that the value of the debt exceeds its long-run equilibrium value $(\bar{a})$. This means that a higher external debt level requires greater service; thus, a greater devaluation rate is needed in the adjustment process.

f) Latin American experience

Since 1982, Latin American countries have suffered a severe economic crisis originated and sustained byt its foreign debt, among many other factors.

One way of validating the foregoing model is by using it to try to explain this in debtness as well as the origin and evolution of the crisis affecting the countries of the region.

A sample of five countries of the area will be used for this analysis: Argentina, Brazil, Chile, Mexico, and Peru. From 1976 through 1981,

they showed a fast growth in their respective external debts, accompanied by a real appreciation of their exchange rates, as can be seen in Tables 1 and 2.

Table 1

Disbursed External Debt

(Millions of US dollars)

Countries	1975	1976	1977	1978	1979	1980	1981
Argentina	6026	1111	8210	1220	19668	27065	32276
Brasil	23344	28776	35119	46466	51482	64631	74051
Chile	4854	4720	5201	6664	8484	11084	15542
México	16900	21800	27105	33600	40800	52652	75496
Perú	4066	5456	6200	7135	7116	8839	8844

Source: Interamerican Development Bank, Latin American external debt and economic development, January, 1984.

Table 2

Index of Real and Effective Exchange Rate

(1980 = 100)

Countries	1975	1976	1977	1978	1979	1980	1981
Argentina	269.9	195.1	225.6	181.5	129.7	100	129.7
Brasil	71.2	70.2	71.2	74.8	82.4	100	86.3
Chile	111.5	100.6	94.7	115.2	115.0	100	83.8
México	91.4	102.6	125.3	118.9	112.2	100	89.1
Perú	65.8	72.3	85.5	115.6	110.7	100	86.4

Source: Inter-American Development Bank, Latin American economic and social progress. External debt crisis and adjustment, Report 1985.

The first impression derived from these tables is that instead of validating the model used, they are rejecting it since a negative relationship may be seen between the real exchange rate and the external debt in the five countries in the sample for the period studied.

What happens with this behaviour, that could be considered anomalous?

If we observe Table 3, showing exports at constant prices from the mentioned countries, we can see their extra-ordinary growth from 1976 through 1978, and only Peru shows a reduction from 1979 to 1981.

Table 3

Total Exports at 1970 Constant Prices

(growth rates)

Countries	1976-1978	1979-1981
Argentina	53.88	2.16
Brasil	20.64	52.86
Chile	11.31	5.05
México	56.56	46.78
Perú	41.12	-16.82

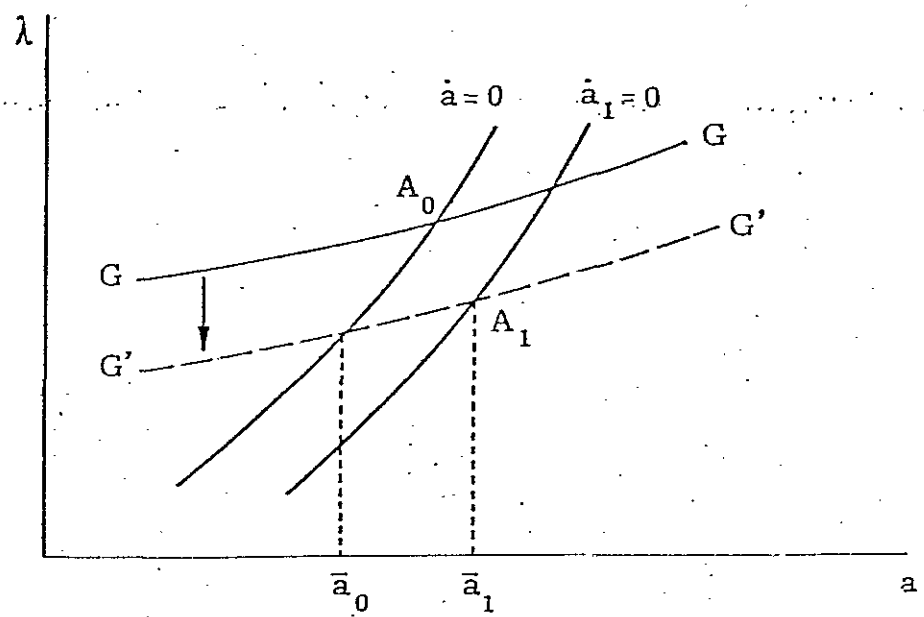
Source: ECLA, Statistical Yearbook for Latin America, 1983-1984 Eds.

If this extraordinary increase in exports were considered permanent by these countries,[7] they could assume that their GG curve showing

7) This supposition is quite feasible, since in the case of Brazil, Peru, Chile and Mexico, these were non-traditional exports.

the relationship between terms of trade and external debt had shifted to the right (downwards), as shown in Figure No. 4.

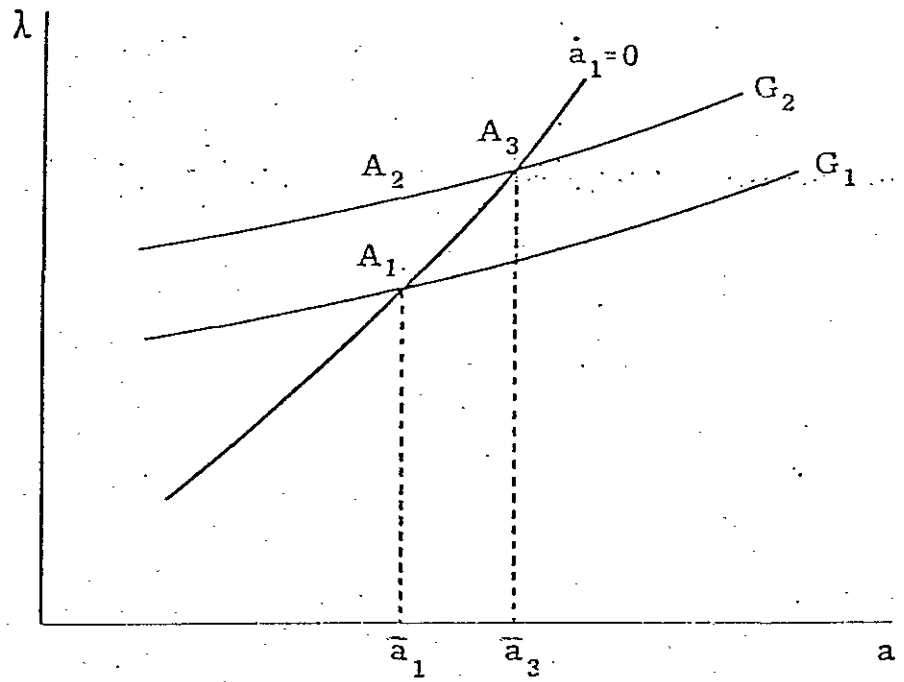
Figure 4



In this figure it is clearly shown, that in the event of a permanent increase in exports, it was feasible to decide on a growth strategy using more external savings, that implies a current account deficit, and a reduction on planned savings. This means a shift of the $\dot{a} = 0$ curve to the right (downwards) and an icrease in the external debt, with an appreciation of the exchange rate.

In this context, the fall of the terms of trade in 1981, and the increase of the interest rates on international loans would imply a shift towards the left (upwards) of the GG curve, while the $\dot{a} = 0$ curve remains as it is, or if it were to shift, it would move to the right, as shown on figure No. 5.

Figure 5



The economy will move from point A_1 to A_2, requiring a devaluation of the exchange rate to make domestic goods more competitive and to increase the foreign indebtedness to cover the debt service, while the necessary adjustment are made in the economy, to go back to an equilibrium point A_3, where the increase in the service will have to be covered with new exports.

Alternatives

Note that if net exports increased both in value and in volume, the GG curve on figure 5 will again shift downwards, making amortization of the external debt feasible. Therefore, a lower servicing would be paid, reducing in turn the domestic savings spent to this effect.

On the other hand, an increase in direct foreign investment, will be shown as a shift to the left of the $\dot{a} = 0$ curve; in other words, it will be like an increase in the desired savings that would allow a reduction in foreign debt and more favorable terms of trade.

Mention should be make of the fact that capital flight would have exactly the opposite results, i. e., it would shift curve $\dot{a} = 0$ to the right, with more foreign debt and higher deterioration of the exchange terms ensuing.

II. Short-run Analysis

In order to facilitate the short-run analysis we will use logarithms in the functions, and the assumption of static expectations, used so far, will be changed for one of rational expectations. Domestic interest rates may thus differ from international interest rates because of the expectated devaluation rate. It will be assumed that economic agents expect a devaluation whenever the current debt level is well above its trend value.

$r = r^* + \dot{e}$ and in that case, $\dot{e} = \gamma\ (a - \bar{a})$

Starting with an equilibrium situation where supply is equal to aggregate demand, $y = D$, we can rewrite equation (3) as follows:

$$\ln D = \mu + \delta\ (e - p) + \beta w - \sigma r, \tag{8}$$

Where μ is a shifting parameter. From the money demand function, the domestic price level may be shown as follows:

$$p = m + \theta\ r^* - \phi y + \dot{e} \tag{9}$$

In the long run, as a steady state condition, $\dot{e} = 0$; therefore the long-run price level is:

$$p = m + \theta r^{*} - \phi y \tag{10}$$

If we substitute $\dot{e}$ for its value in equation (9) and then subtract (10), we obtain:

$$p - \bar{p} = \gamma(a - \bar{a}) \tag{11}$$

The diference between the current and the steady state price level is obtained through the difference between current and steady state external debt.

In other words, if the current debt level exceeds that of constant equilibrium, the current price level is higher than the steady state price level.

Assuming that inflation is a positive function of the gap between demand and production:

$$\dot{p} = \Pi \ln(D/y) = \Pi[\mu + \delta(e - p) + \beta w - \sigma r] \tag{12}$$

and taking into account that in steady state $\dot{p} = 0$; $e = \bar{e}$ and $r = r^{*}$, and making the corresponding substitutions, we find that:

$$P_{(t)} = \bar{P} + \gamma(a_o - \bar{a}) \exp\ (-\Pi\sigma_t) \tag{13}$$

[8/]

The domestic production price will converge at its steady state level at a rate determined by the product of the parameter of interest rate sensitivity of aggregate demand (σ) by the adjustment parameter to the gap between supply and aggregate demand (π).

In figure No. 6, curve $\dot{p} = 0$ shows the combinations between price level and foreign debt that equilibrates the goods market.

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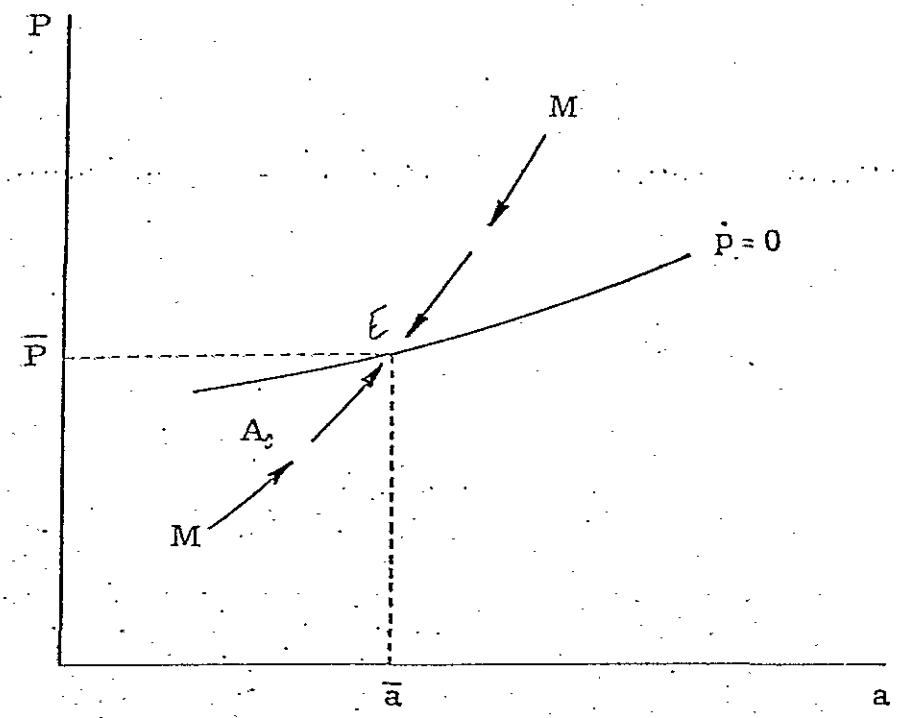
8) See derivation in Appendix I, second part.

Figure 6



Points to the left and above this curve belong to an excess supply of goods and, therefore, to declining prices. On the contrary, points that are below and to the right of the curve reflect an excess demand.

This curve is upward sloping because an increase in the debt means a deterioration of the terms of trade because of the relationship explained in chapter I. Therefore, this implies an excess demand for domestic production, and to reestablish the equilibrium an increase in the price level is needed.

On the other hand, the assets market is always in equilibrium. This implies a relationship between prices and debt as shown in curve MM and

in equation (9). For any debt level, given the expected devaluation, the interest rates will adjust to equilibrate the assets market.

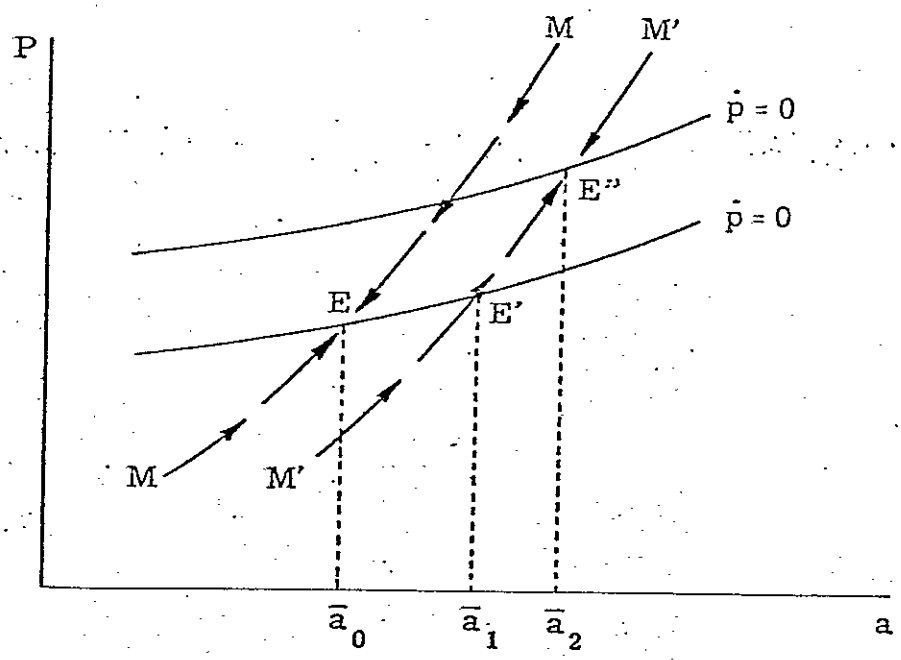
The equilibrium in the goods market is obtained at a slower pace. In a point such as A_o in figure 6, there is an excess demand, since at that point prices and interest rates are very low. The excess demand will produce a rise in prices that will reduce the competitiveness of domestic goods, thus, reducing exports, and generating a current account deficit and an increase in foreign debt. This last consequence leads to an increase in the real interest rate in response to the devaluatory expectations created thereby.

The increase in prices and interest rates will reduce excess demand, moving the economy toward the steady state equilibrium, point E, where prices remain constant; then, the economy had arrived at a point where there is external debt equilibrium and a balanced current account.

a) International interest rates increase

An increase in the international interest rates (r*) in this context implies a shift to the right of the MM curve since at the same price level there will be a current account deficit that will have to be financed by an increase in the foreign debt. The equilibrium will be displaced from E to E' on figure No. 7, but E' is a short-run equilibrium point because the increase in the debt will create devaluatory expectations that will push up the interest rate, that in turn will reduce real balances.

Figure 7



Furthermore, an increase in the price level will be needed to reduce domestic demand and create a surplus for export. This means that a devaluation will be required to compensate for this price increase. So, curve $\dot{p} = 0$ will shift to the left, where E" is the long-run equilibrium, with higher price and debt levels. Note that when the increase in r* is temporary, the results in the economy are permanent since the debt incurred to pay higher interests will require an increase in servicing to cover this new debt, and the economy will have to generate new exports to meet this commitment.

b) Empirical evidence

The increase in international interest rates, begun in 1980, is reflected with all the previous characteristics in our five countries. This means that the increase produced a reduction of real balances and an increase in the price level, as shown in Tables 4 and 5; it also led to an increase in the foreign debt, as can be seen in Table 1.

Table 4

Real Balances (M1/CPI)
CPI/1980=100
(in millions of national currency)

Countries	1980	1981	1982	1983	1984	1985
Argentina 1/	2.7	2.3	3.0	3.1	0.026	0.023
Brasil 2/	1288.0	1142.2	973.3	785.3	789.9	975.6
Chile 3/	78900.0	61904.8	61626.1	61313.4	57897.4	-
México 3/	477200.0	496481.6	515002.5	357557.3	345508.1	334438.0
Perú 4/	713.0	595.8	488.2	453.7	466.1	676.7

1/ Australes

2/ Cruzados

3/ Pesos

4/ Soles

Source: International Monetary Fund, International Financial Statistics, September, 1986.

Table 5

Inflation

(percentage Change of CPI)

Countries	1980	1981	1982	1983	1984	1985
Argentina	100.0	104.0	165.2	344.2	626.7	672.2
Brasil	81.8	106.0	97.6	142.0	196.8	226.9
Chile	35.1	19.7	9.9	27.3	19.8	30.7
México	26.4	27.9	59.0	101.8	65.5	57.8
Perú	59.2	75.4	64.4	111.2	110.2	163.4

Source: International Monetary Fund, International Financial Statistics, September, 1986.

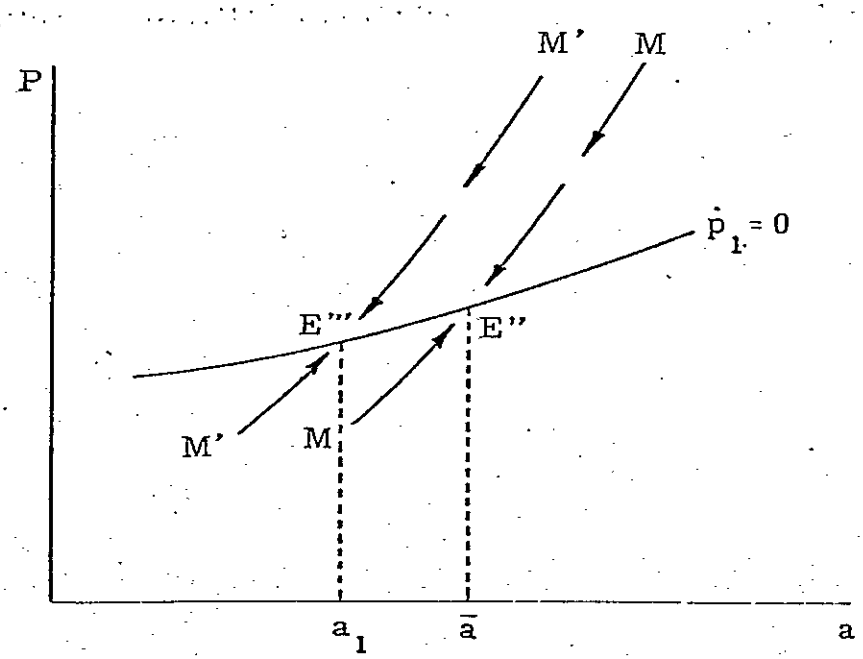
As shown in figure No. 7, the MM curve should have shifted to the right and the $\dot{p} = 0$ curve to the left, situating these economies at a point between E' and E", i. e., between the long and short-run equilibrium.

Note that any negative external shock that these economies may receive will shift both curves even further from the long-run equilibrium.

On the other hand, an increase in net exports would shift the MM curve to the left, as shown in figure No. 8, because these is now a surplus in the current account at point E". The long-run equilibrium would shift

to a point like E"' with a lower indebtness. This lower foreign debt would create revaluatory expectations of the exchange rate and would increase the real balances, when the price levels and interest rate decrease.

Figure 8



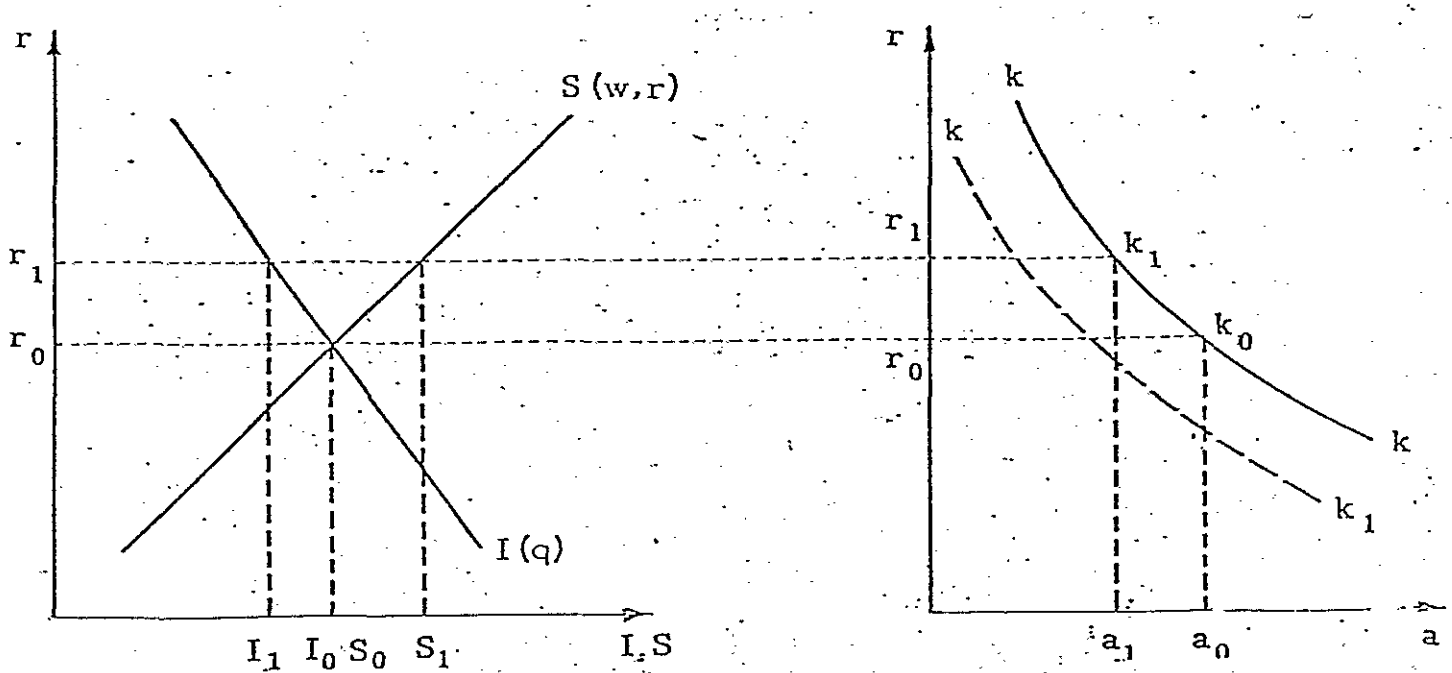
III. Effects on Investment and Capital Stock

When the amount of foreign debt exceeds its steady state equilibrium value, there must be a devaluation at a pace that maintains the short-run exchange rate above its long-run equilibrium value, as seen before. This implies a growing interest rate, and since the relative price of capital goods "q" is an inverse function of the interest rate $q = q(r)^{(-)}$, this means lower "q" values. On the other hand, the demand for capital goods is an inverse function of the interest rate and a positive function

of wealth[9]. From this we can deduce that an increase in the foreign debt, by causing an increase in the domestic interest rate, would produce a reduction in the capital goods price.

The fall of the capital goods prices means a lower value of the current capital stock and consequently a drop in real wealth, in addition to the one it has to bear because of the increase in the external debt. When investments drop because of the fall in "q" and savings increase because of the fall in wealth, the current account surplus will increase so as to repay the debt. This process can be observed in figure No. 9.

Figure 9



On the left side of this figure appears the investment equilibrium rate, as a function of the interest rate, corresponding to a capital stock K_o and a given level of foreign debt. An increase in the interest rate will reduce the relative price of capital; therefore the investment curve is downward sloping. For instance, for a r_o interest rate, the equilibrium investment is I_o.

9) This means that: $q\,(r)\,k = k^d\,(r, w)$

Savings are a positive function of the real interest rate; an increase in it reduces wealth through a decline in the value of the capital stock and real balances, thus savings increase. The savings curve is drawn for a given level of foreign debt and physical capital; for instance, at an interest rate level r_o, the equilibrium savings will be S_o.

a) Dynamics

An increase in the international interest rates shift up (to the left) the savings curve since at the new rate levels an increase in domestic savings is required in order to service the foreign debt. Likewise, the domestic equilibrium interest rate will increase, inducing a fall in investments and a movement along the KK curve because the rate of capital accumulation declines both physically and in value.

The short-run savings increase and the fall in investment should induce a current account surplus in order to reduce the debt value from a_o to a_1, with which the new equilibrium level of the current account should be at a lower debt value (a_1).

If at the same time that the foreign interest rate increases the external debt is not amortized in real terms, the KK curve will be force to shift to the right; thus the new long-run equilibrium would be at lower levels of investment and physical capital, as can be seen in figure No. 10[10)].

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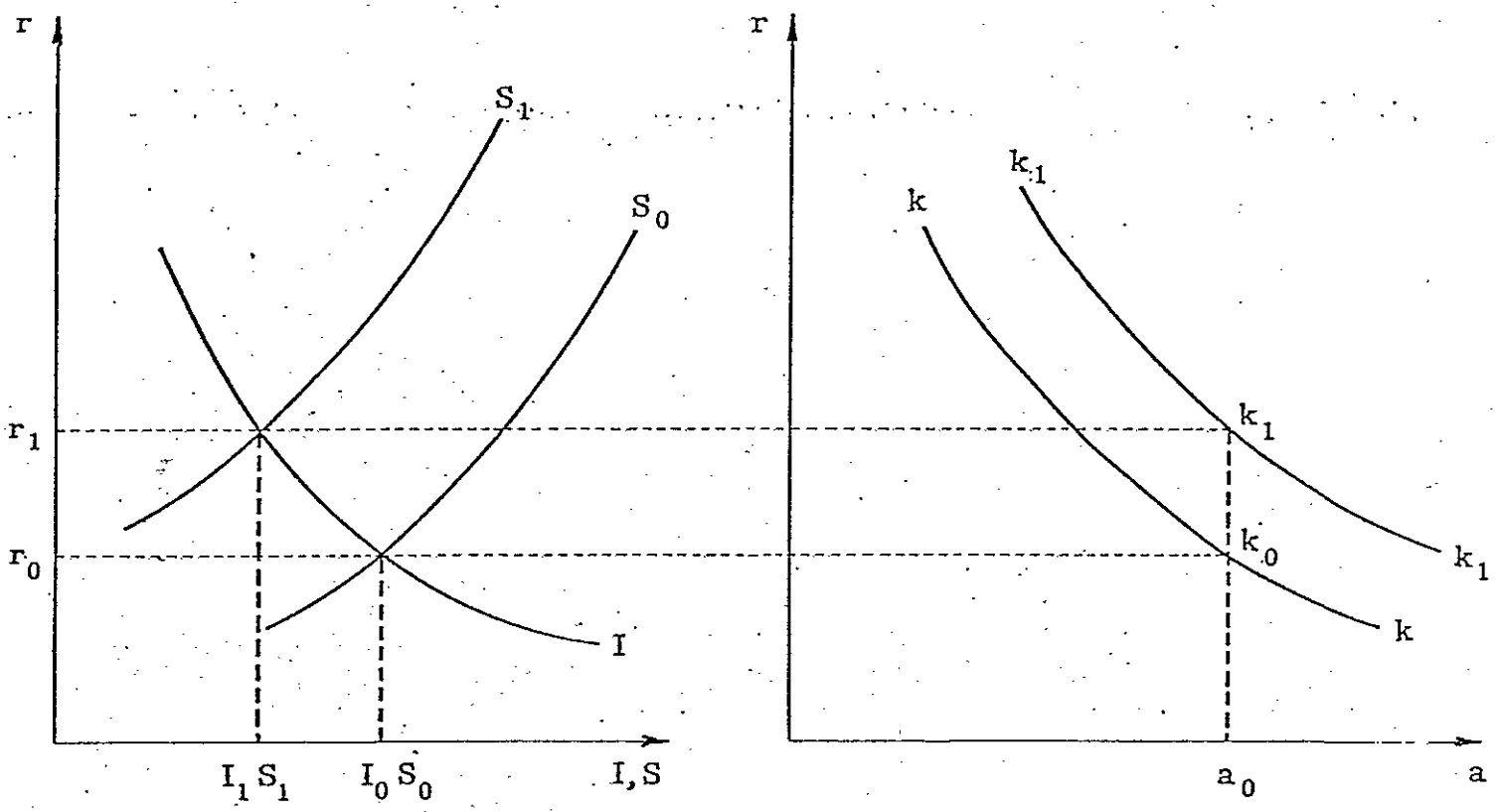
10) Note that we are assuming a permanent increase in the international interest rates.

Figure 10



b) Empirical evidence

The increase in international interest rates at the beginning of the eighties pushed up the foreign debt service as shown in Table No. 6. In turn, this forced an increase in the proportion of the domestic savings needed to cover the debt service and consequently a decline in the proportion goint to investment purp oses. Thus, there was a deep fall in the regional investment /GDP ratio. It declined below the levels reached by 1980., as can be seen in Table No. 7.

Table 6

Foreign Debt Service Payments

(millions of US dollars)

Countries	1980	1981	1982	1983	1984	1985
Argentina	3,525	7,329	6,700	6,763	6,187	-
Brasil	14,163	17,820	20,794	12,736	13,268	12,070
Chile	2,385	3,099	3,379	3,340	2,557	2,396
México	9,100	13,200	15,000	12,500	16,100	16,500
Perú	2,547	2,746	2,269	1,771	2,056	524

Source: International Monetary Fund, Data Fund.

Table 7

Total Investment to GDP Ratio

(in percentage)

Countries	1980	1981	1982	1983	1984	1985
Argentina	22.9	18.8	16.7	14.9	11.9	11.8
Brasil	27.4	24.4	23.4	21.6	19.8	19.9
Chile	23.9	23.9	9.6	9.2	15.0	3.2
México	28.0	30.0	21.5	17.0	17.4	18.6
Perú	17.0	21.1	19.9	14.7	14.0	13.0

Source: Inter-American Development Bank, Economic and Social Progress, 1985, Chase Econometrics, Third Quarter, 1986. Instituto Nacional de Estadística, Geografía e Informática (National Institute of Statistics, Geography and Informatics) (INEGI), National Accounts System, 1986.

As it was previously analyzed, the fall in investments represents a smaller future capital stock, and given that the foreign debt is not actually being amortized, the new steady state equilibrium will be found at lower levels of investment and physical capital, as shown in figure No. 10.

In this context, an increase in net exports, by creating expectations of exchange rate appreciation would reduce the domestic interest rate, causing an increase in the "q" value, inducing an increase in investment and real wealth.

Conclusions

The purpose of this paper was to develop an analytical framework to study the inter-relationships between foreign debt, the terms of trade, and prices in order to show that foreign debt levels condition the terms of trade in the economy and through them, the exchange rate policy, interest rates and prices.

From these inter-relations, we tried to stress that an excessive external indebtedness may depress investments and thereby the capital stock because of the forced increments in domestic interest rates.

The instrument used to develop these relationships was a model of three goods and two assets, using in the first part stationary expectations in the economic agents and rational expectations in the second.

To validate the model applied, we took a sample of five Latin American countries with serious foreign debt problems and with experiences that could be explained within this framework. We found that the considerable increase in the foreign debt of the five countries during the second

half of the seventies can be explained within a policy of non-traditional exports, increase taken as permanent for these countries. Th[illegible] it was rational to undertake a growth oriented strategy financed by external indebtedness accompanied by a real exchange rate appreciation, since these economies considered that they had an exporting capacity sufficient enough to cover the growing external debt.

The fall in the terms of trade and the increase in international interest rates since 1980, radically modified the external situation of these economies fully involving them in the dynamics of indebtedness, the main subject of this paper. At this stage we can see how the foreign debt conditions the exchange rate through an increase in debt service, and how the exchange rate changes it influence price levels and interest rates with the consequent effect on investment and capital stock in these countries.

Finally, we analysed the effect of an increase in net exports and of foreign direct investments within this framework and we found that both would reduce the effects of indebtedness while reducing the pressure on the exchange rates and on domestic savings.

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Appendix I

I. Complete long-run model (Stationary expectations)

1) $M = Py^{\phi}/\theta^{r}$; where $y = Y - eP^{*}a$

2) $r = r^{*} + \dot{e}$

3) $w = m + q\,K - \lambda a/r^{*}$; where $m = \frac{M}{P}$

4) $Y = D(\lambda, r, w) + X(\lambda)$, $D\lambda>0$; $X\lambda>0$; $Dw>0$, $Dr<0$

5) $S = S(w,r)$; $Sw<0$, $Sr>0$

6) $I = I(q)$; $Iq>0$

7) $CC = S - I = \lambda \frac{\dot{a}}{r^{*}}$; $\dot{a} = \frac{\Delta a}{a}$

With a fixed exchange rate and a constant interest rate

8) $\frac{a}{r} = \frac{S(w) - I(q)}{\lambda}$

Slope of the GG curve:

$$\frac{d\lambda}{da} = \frac{(\frac{\lambda}{r^{*}})\,Dw}{D\lambda + X_{\lambda}} - (\frac{a}{r^{*}})\,Dw > 0$$

Assuming that $D\lambda + X\lambda > \frac{a}{r^{*}}\,Dw$

II. Short-run model (rational expectations)

Assuming that the expected devaluation rate: $\dot{e} = \gamma(a-\bar{a})$ using logarithms and assuming that the supply is equal to the aggregate demand and assuming that P* remains constant, the following reformulation of equation (4) is possible:

$$(4') \quad \ln D = \mu + \delta(e-P) + \beta w - \sigma r$$

from (1), price level is solved for

$$p = m + \Theta r^* - \phi y + \dot{e}; \text{ substituting } \dot{e}$$

$$(9) \quad p = m + \Theta r^* - \phi y + \gamma(a - \bar{a})$$

In steady state $\dot{e} = 0$; therefore, the long-run level is:

$$(10) \quad \bar{p} = m + \Theta r^* - \phi y$$

substracting (10) (9)

$$(11) \quad p - \bar{p} = \gamma(a - \bar{a})$$

Inflation is a positive function of the gap between demand and p roduction

$$(12) \quad \dot{p} = \Pi \ln (D/y) = \Pi[\mu + \delta(e-p) + \beta w - \sigma r]$$

In steady state $\dot{p} = 0$; $e = \bar{e}$ y $r = r^*$, substituting we find the long-run exchange rate

$$(13) \quad \bar{e} = \bar{p} + \frac{1}{\delta}(\sigma r^* - \beta w - \mu)$$

Note that $\delta(\bar{e} - \bar{p}) - \sigma r^* = -(\beta w + \mu)$

and that $r - r^* = e - \bar{e} = \gamma(a - \bar{a})$

Therefore, substituting these values in (12) we obtain

$$(12') \quad \dot{p} = -\Pi\sigma\gamma(a - \bar{a})$$

solving this equation, we find:

$$P(t) = \bar{P} + (Po - \bar{P}) \exp(-\Pi\sigma_t)$$

that is,

$$(14) \quad P(t) = \bar{P} + \gamma(a_o - \bar{a}) \exp(-\Pi\sigma_t)$$

Appendix II

Definition of the variables in the Model

a = foreign debt

CC = Current account

D = Domestic aggregate demand

e = Nominal exchange rate

$\dot{e}$ = Depreciation rate of the exchange rate

I = Gross investment

K = Capital stock

$m = \frac{M}{P}$ = real balances

q = Relative price of capital

$\dot{p}$ = Inflation

p = Domestic price levels

P^* = Foreign price levels

r = Real domestic interest rate

r^* = Real international interest rate

S = Gross domestic savings

W = Real wealth

X = Exports

Y = Gross domestic product

y = Disposable income

Definition of Parameters

ϕ = Income elasticity of real balances

μ = Elasticity of real balances with changes in the domestic interest rate

λ = Terms of trade

Δ = Sensitivity of aggregate demand to interest rats

π = Adjustment of inflation to imbalances between supply and aggregate demand

β = Sensitivity of aggregate demand to changes in wealth

δ = Sensitivity of aggregate demand to variations in the real eschange rate