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December 1986
Revised April 1987

EXTERNAL AND DOMESTIC DEBT CONSTRAINTS OF LDCs
A THEORY WITH A NUMERICAL APPLICATION TO BRAZIL AND MEXICO

by

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N°8710

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(1) This paper was prepared for the International Economic Association conference "Global Macroeconomics" held in London on February 12-13. Many thanks to my discussant Jon Eaton and to my "overviewer" Rudi Dornbusch for their comments. Partial financial support from the Commissariat Général du Plan is grateful acknowledged. This paper draws extensively on research undertaken while I was a consultant at the External Debt Division of the World Bank. Further results are reported in a companion paper (1987). I thank Violetta Rosenthal for her excellent research assistance, Nicholas Hope, Homi Kharas, Violetta Rosenthal and John Underwood for their numerous comments, and the External Debt Division for its very warm hospitality. The views expressed here do not necessarily represent the views of the World Bank.

EXTERNAL AND DOMESTIC DEBT CONSTRAINTS OF LDCs
A THEORY WITH A NUMERICAL APPLICATION TO BRAZIL AND MEXICO

ABSTRACT

This paper presents, first, a theoretical framework in which the optimal repayment strategy of an indebted nation is to spread out the service of it external debt by ear-marking a fixed fraction of its ressources to its foreign creditors.

To these considerations on the service of the external debt, I add another crucial element : the service of the domestic debt. Governments may push their country into a trade surplus by rationing imports or subsiding exports, but this is not the end of the story. If the external debt is government debt (as it is mostly), a secondary burden must be borne: domestic taxes must be raised in order to repay the government debt. Otherwise, domestic debt will simply replace external debt and this process, if pushed too far and too fast, many seriouly damage the economy.

I evaluate the extent to which this secondary burden has been borne in the case of Brazil and Mexico. I show (using a methodology which I explain in the text) that it has been borne by Mexico but not by Brazil.

DETTE EXTERIEURE ET DETTE INTERIEURE DES PAYS EN VOIE DE DEVELOPPEMENT
THEORIE ET APPLICATION NUMERIQUE AU CAS DU BRESIL ET DU MEXIQUE

RESUME

Cet article présente, tout d'abord, un cadre d'analyse au sein duquel la stratégie optimale de remboursement de la dette extérieure d'une nation est d'allouer une fraction fixe de ses ressources au service de sa dette extérieure.

A ces considérations sur la dette extérieure doit toutefois s'ajouter une autre considération fondamentale: le service de la dette intérieure. Les gouvernements peuvent obtenir un surplus de la balance commerciale en dévaluant la monnaie ou en rationnant les importations. Si la dette extérieure est une dette gouvernementale (comme c'est en effet essentiellement le cas pour les pays en voie de développement), un fardeau supplémentaire doit être payé: celui de lever des impôts intérieurs pour rembourser la dette publique. Sinon, la dette domestique se substituera à la dette extérieure, et ce processus, s'il est poussé trop loin et trop rapidement, peut être très dommageable au pays.

J'évalue jusqu'à quel point ce fardeau supplémentaire a été porté par le Mexique et le Brésil. En utilisant une méthodologie qui est expliquée dans le texte, je montre qu'il a été porté par le Mexique, mais pas par le Brésil.

Keys words - LDC Debt. External and Domestic Borrowing.
Mots clés - Dette extérieure et dette intérieure des pays en voie de développement.
J.E.L : 430

I - INTRODUCTION

In a previous work (1985), I have argued that most debtor nations need allocate no more than 15 % of their exports to the service of their debt in order to be declared solvent. A country like Brazil serviced twice more between 1983 and 1986 and -as a result- her debt-to-export ratio went down substantially (from 4 to 3). An often-heard argument was that a debtor should hurry to bring down its debt-to-export ratio so as to allow "voluntary lending" to resume. In other words, the debt-to-export ratio should go down, so as to go up later on ! It is hard to think of any optimizing model which would predict this result (except for short-term fluctuations)[1].

In the first part of this paper, I present a theoretical framework in which the optimal strategy is not such a U turn policy, but instead one which spread out the service of the debt along the lines of my previous calculations. To these considerations on the service of the external debt, I add another crucial element : the service of the domestic debt. Governments may push their country into a trade surplus by rationing imports or subsiding exports, but this is not the end of the story. If the external debt is government debt (as it is mostly), a secondary burden must be borne: domestic taxes must be raised in order to repay the government debt. Otherwise, domestic debt will simply replace external debt and this process, if pushed too far and too fast, many seriouly damage the economy.

I evaluate the extent to which this secondary burden has been borne in the case of Brazil and Mexico. I show (using a methodology which I explain in the text) that it has been borne by Mexico but not by Brazil. As a result, the

fast repayment strategy adopted by this country caused an explosive increase in her domestic debt, pushed up the interest rate (to 25 % in real term) and made investment almost impossible. What Brazil needs at this stage, I conclude, is to reduce the servicing of its external debt and to raise domestic taxes.

II - A FRAMEWORK OF ANALYSIS

A) - The social planner case

1 - In this sub-section I will first consider the simplest case for analyzing the debt of a nation. I will assume that the economy is deterministic (an assumption which is relaxed in section C), and that the economy produces only one good which is exogeneously endowed to the nation (endogeneous capital accumulation is analysed in my previous work with Jeff Sachs (1986) ; a traded-non-traded good model is considered in my companion paper (1987))[2].Furthermore, I will first assume that the government can raise lump-sum taxes, an assumption which will be relaxed in the next sub-section.

Since the government can raise lump sum taxes, it is equivalent to assume that it is a social planner which pursues its own objectives, and whose wealth is exactly that of the nation. The only relevant constraint which is faced by the planner, in this case, is the external debt constraint which is imposed by the lenders. Assume that the country consumes a private and a public good, C_t and G_t respectively. Call Q_t the nation's GDP at time t,n_t its rate of growth, D^*_t the external debt, r_t the world rate of interest. The constraints faced by the country are determined by the equations :

$$Q_t = (1+n_t)\, Q_{t-1} \qquad (1)$$

$$D^*_t = (1+r_t)\, D^*_{t-1} + C_t + G_t - Q_t \qquad (2)$$

$TB_t = Q_t - (C_t + G_t)$ is the trade balance, measured as the difference between GDP and domestic absorption. $TB_t - r\, D^*_{t-1}$ is the current account. I

shall assume that the social planner's objective is to maximize $\sum_{1}^{\infty} \beta^t \text{ Log } C_t^{\alpha} G_t^{1-\alpha}$, with $\beta = \frac{1}{1+\delta}$. δ is the domestic discount factor of the economy. The country has no initial external debt.

2 - Let us first consider the case when the country has not the option to repudiate its debt. The only constraint that the lenders will impose is that the sum of the discounted values of the trade balance adds up to zero :

$$\sum_{1}^{\infty} \frac{TB_t}{\prod_{s=1}^{t} (1+r_s)} = 0 \qquad (3)$$

a condition which is known to be equivalent to imposing :

$$\lim_{t\to\infty} \frac{D_t^*}{\prod_{s=1}^{t} (1+r_s)} = 0 \qquad (4)$$

or that the debt is always smaller than the wealth :

$$D_t^* \leq \sum_{s=t+1}^{\infty} \frac{Q_s}{\prod_{u=t+1}^{s} (1+r_u)} \equiv W_t \qquad (5)$$

In a world where growth and interest rates fluctuate (even in a perfectly foreseen manner), it is not enough to compare the domestic discount factor with the world interest rate in order to know whether the country will choose to borrow or to lend. If the country expects a sharp drop of its income, it will decide to lend even if the interest rate is below its domestic discount factor. In general, the precise determinants of the decision to borrow depend upon all future interest and growth rates. In the simple case which I analyze this decision is more simple. The country compares its domestic discount factor

to an "average" difference between future interest and growth rates. This average is defined as follows :

$$\theta_t^a = \left[\sum_{s=t}^{\infty} \frac{\prod_{u=t}^{s} (1+n_u)}{\prod_{u=t}^{s} (1+r_u)} \right]^{-1} \qquad (6)$$

In the simple case when r_t and n_t are constant, θ_t^a is simply equal to $\theta = \frac{r - n}{1 + n}$. Otherwise, θ_t^a may be interpreted as an average of the future values of $\theta_t \equiv \frac{r_t - n_t}{1 + n_t}$.

The reader will check[3] that consumption is $C_t + G_t = (1-\beta)(1+r_t)[W_{t-1} - D^*_{t-1}]$ so that the law of motion of $h_t \equiv \frac{D^*_t}{Q_t}$ is given by :

$$h_t = \beta\,(1+\theta_t)\,h_{t-1} + \frac{1}{\theta_t^a}\left[(1-\beta)(1+\theta_t) - \theta_t^a\right] \qquad (7)$$

In the particular case where the domestic discount factor is large enough that $\delta \geq \theta_t$, $\forall t$, it is easy to check from equation (7) that the country will desire to borrow up to the point where the service of the debt will swallow up all its GDP in the stationary state.

This is clearly a very unlikely feature : lenders usually worry about the creditworthiness of their client before he drives himself to asymptotic starvation.

3 - In order to cope with this extreme case, the literature on external debt has introduced the possibility that a lender might repudiate his debt if the burden of its repayment becomes "too heavy". (See the pioneering paper by Eaton and Gersovitz (1981) and our earlier work with J.Sachs (1985)). "Too

heavy" means that the cost to service the debt (measured in terms of foregone utility) is larger than the cost that the country would bear if it were to default. This latter cost is certainly extremely complex to evaluate but it seems natural to assume that it will represent some fraction of the country's income. Here, I will simply assume that a country which defaults at a time t* will lose a fraction λ_{s-t*} Q_s of whatever penalty lenders may impose) is of its income at time s and will be forced to financial autarky afterwards ; $\{\lambda_s\}_{s\geq 0}$ measures the cost of debt repudiation. It need not be a constant. It may be that the cost of defaulting (due to disruption of trade or because of whatever penalty lenders may impose) is up-fronted, being much heavier just after default than 10 years later.

At each point of time t, a country has therefore the ability to get a post-default stream of utility defined by :

$$U_{at}(Q_t) = \sum_{s=t+1}^{\infty} \beta^{s-t} \text{ Log } C_s^{\alpha} G_s^{1-\alpha}$$

subject to $C_s + G_s = (1-\lambda_{s-t}) Q_s$

Call $U_t(D_t, Q_t)$ The utility that the country would obtain by <u>not</u> defaulting at time t. Lenders must design their lending strategy so that $U_{at}(Q_t) \leq U_t(D_t, Q_t)$, which is, here, equivalent to meeting a credit ceiling h_t^* the debt-to-GDP ratio.

How is this credit ceiling calculated ? In the framework which is analysed, the answer comes as follows : the country will never be willing to repay more than some fixed fraction b* of its resources each period[4]. This fixed fraction b* depends upon the cost of default only and is a solution to :

$$\text{Log}(1-b*) = \sum_{0}^{\infty} \beta^t (1-\beta) \text{ Log } (1-\lambda_t) \qquad (8)$$

As one sees, b* is an average of the costs of debt repudiation. In this context, the credit ceiling is therefore readily obtained : the debt should never exceed the discounted sum of all transfers corresponding to this fixed fraction b* of the country's ressources :

$$D_t^* \leq b^* \sum_{s=t+1}^{\infty} \frac{Q_s}{\prod_{u=t+1}^{s} (1+r_u)} \qquad (9)$$

4) Numerical exercice and some economic policy implications

If one accepts this framework as a benchmark analysis, one sees that the first step in assessing whether a country would rather repudiate its debt than service it is to calculate what is the fixed fraction of its resources which should be devoted to servicing the debt. In my earlier work (1985), I did exactly that, taking the exports of the country as a proxy for measuring its resources. I found that most countries should devote no more than 15 percent of their exports to service their debt. This calculation was based upon a pessimistic assumption on future interest rates and growth . In order to see the intuition behind this result, consider the case where the "average" difference between interest rates and growth is 5 percent in real terms. Then a country like Brazil whose net debt-export ratio is 3 should devote 15 percent of its exports to servicing its external debt. In other words (under these assumptions), 15 percent of the country's exports are sufficient : (1) to keep its debt-export ratio constant on average ; and (2) to meet the solvency condition that the sum of the discounted flows of income transferred abroad is equal to the face value of the debt.

The policy implications which stem from this analysis should be clear. When designing the adjustment program of a country which is believed to have reached its credit ceiling, the World Bank of the IMF should not aim at reducing the debt-to-export ratio (except for possible short-term fluctuations along the line spelled out in equation (9)), but rather should aim at stabilizing it. The idea that the debt should be brought down to a point where

invalid notion. If voluntary lending is to resume, it means that the debt-export ratio might go up again. It is hard to conceive why it should then go down in the first place.

B) - Domestic and external government debt

In the previous sub-section, I assumed that the government could levy non distortionary taxes so that it was equivalent to considering directly the social planner case. This is an assumption which obviously fits LDCs economics rather poorly. In this section, I now want to consider explicitly the case where taxes are welfare reducing. In such a case, the government's and the nation's solvency must be carefully distinguished. In order to simplify the analysis I will further assume that only the government has access to the world financial market while the private agents have access only to the domestic financial market. When taxes are not distortionary, this restriction would not modify the previous analysis, and the government would face the external debt ceiling as it only relevant constraint. Instead, when taxes are distortionary the government really faces two constraints : a domestic and an external one.

These two constraints can be written as follows. Call T_t the taxes collected by the government at time t. The law of motion of the country's external debt is written as before :

$$D^*_t = (1+r_t)\, D^*_{t-1} + C_t + G_t - Q_t \qquad (2)$$

Let us now write the law of motion of the government debt :

$$\left[D_t - D_{t-1} \right] + \left[D^*_t - D^*_{t-1} \right] = r_t\, D^*_{t-1} + \varrho_t\, D_{t-1} + G_t - T_t \qquad (10)$$

D_t is the government domestic debt, ϱ_t is the domestic real interest rate. The left-hand side of the equality is governement's new debt raised on the world and home markets. The right hand side is the government deficit :

interest falling due ($r_t D^*_{t-1} + \varrho_t D_{t-1}$) and the new "primary" deficit $G_t - T_t$. Subtracting (10) from (2), one finds the following new relationship :

$$TB(t) = (T_t - G_t) + [D_t - (1+\varrho_t) D_{t-1}] \qquad (11)$$

The trade balance is the sum of the government's primary surplus and of the net new savings which are drained from the domestic financial markets. Any surplus of the external account is necessarily the counterpart, whether of a government surplus or of an increase of domestic debt. This is a result which comes from our assumption that all external debt is government debt. Any trade surplus reduces the net external debt of the government. If this surplus is not the counterpart of a primary surplus, it must be the counterpart of new domestic debt.

How does this equality works in the real world ? Assume that a country has a surplus. Exporters sell their foreign currencies to the Central Bank. This triggers money creation. If the surplus is monetized, then it appears in our equation (11) as part of T_t : it represents an increase in the seigniorage tax of the government. Otherwise, it must be the case that the government has generated a primary surplus and/or that new domestic debt is issued. It is crucial to note that this equality provides no clue as to which causality underlies the trade balance surplus. It can very well be that a large devaluation or direct rationing of imports are the primary forces which have led the economy into a trade surplus. Yet the equality tells us that whatever the cause of a trade surplus, it must necessarily be accompanied by an increase in government domestic debt if it is not accompanied by a government surplus. More shortly, without a government surplus, total government debt cannot be reduced.

Let us analyse how the framework of the previous section can be modified to allow for distortionary taxes. The private sector's income in each period is now $Q_t - T_t + \varrho D_{t-1}$. Assume that it maximizes an intertemporal criterion $\sum_1^\infty \beta^t \text{Log } C_t$ (The private sector also cares about how much of the public good is

produced but this is a decision which is beyond its scope). This yields the following first order condition for the private sector :

$$C_{t+1} = \beta\ (1+\varrho_{t+1})\ C_t \qquad (12)$$

Governement, on the other hand, cares both about private and public goods but also tries to minimize the welfare loss due to distortionary taxes. This loss, I assume, can be summarized by a convex loss funtion $\phi(T_t)$. In other words, the government maximizes :

$$U = \sum_{1}^{\infty} \beta^t\ [\alpha\ \text{Log}\ C_t + (1-\alpha)\ \text{Log}\ G_t\ -\ \phi(T_t)]$$

The private sector's financial wealth W_t follows the law of motion :

$$W_t = (1+\varrho_t)\ W_{t-1} + Q_t - T_t - C_t$$

Since there is no capital accumulation in this economy, one has necessarily

$$W_t = D_t$$

the private agents' financial wealth is the government's debt. The government, on the other hand, faces the two constraints (2) and (10) which we wrote above. In addition, there is an external debt constraint

$$D_t^* \leqslant F_t\ [D_t,\ Q_t]$$

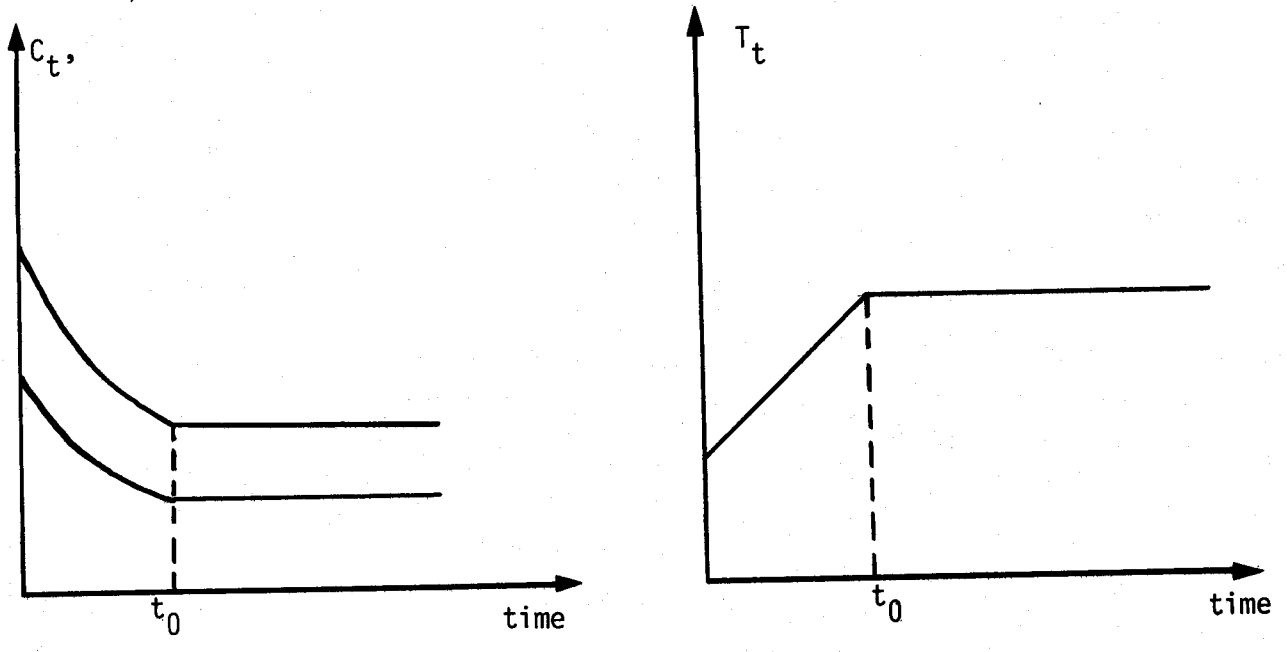
which depends both upon the level of domestic debt and upon GDP and which specifies that the country will never choose repudiation of its external debt. Whatever the precise form of this constraint, as long as it not binding, the government's first order conditions are :

$$G_{t+1} = \beta(1+r_{t+1})\, G_t \quad ; \quad G_t = \frac{\alpha}{1-\alpha}\, C_t$$

$$\phi'(T_t) = \beta(1+\varrho_{t+1})\, \phi'(T_{t+1}) \quad ; \quad r_t = \varrho_t \qquad (13)$$

In particular, one sees that <u>as long as the external debt contraint is not binding, domestic and world interest rates are equal</u>.

To solve the model further let us simply consider a stationary economy ($Q_t = Q$, $r_t = r$). Once the external debt has reached its ceiling $\bar{D}^*$, one has $T\, B_t = r\, \bar{D}^*$, $C_t = \alpha\, [\, Q - r\, \bar{D}^*]$; $G_t = (1-\alpha)\, [\, Q - r\, \bar{D}^*]$. At the moment when the external debt constraint binds, the domestic rate δ and taxes must be raised so that $T = r\, \bar{D}^* + \delta\, D$ where D is the level of the domestic debt when the external debt has reached its ceiling. Taxes and expenditures follow the pattern indicated in Figure 1 :



D I A G R A M 1

All variables experience a (continuous) break at the time when the constraint become binding. Before t_0, taxes are smoothly increasing according to the law of motion (13) and reach their maximum value when foreign loans become rationed.

A secondary burden to government finance

At the time t_0 when external debt becomes rationed, the domestic interest rate jumps immediately : it reflects the need for the country to rely (marginally) on domestic finance only for its intertemporal allocations. If the government is a domestic lender ($D_t \leq 0$) this is equivalent to imposing a capital levy on domestic borrowers. If instead the government is a domestic borrower, this is like a secondary burden imposed on the public finances : the government deficit is all of a sudden increased because of the jump of the domestic interest rate. In the deterministic economy which we considered this is a jump which is forecast in advance and which should not be accompanied by a jump of the tax burden (according to Figure 1).

C) A stochastic environment

1 - Let me indicate briefly now how the analysis would be modified if one were to allow for stochastic disturbances of the world interest rate. Assume that the world interest rate oscillates between the rates r_1 and r_2 which are driven by the following stochastic process : when the world is in state 1, the world interest rate is r_1 and the probability of staying in state 1 is p_1, that of moving 2 is $p_2 = 1-p_1$. When the world is in state 2, the world interest rate is r_2 ; the probability of moving to state 1 is q_1, that to stay in state 2 is $q_2 = 1 - q_1$. Furthermore, assume that the country's rate of growth is n_1 in state 1 and n_2 in state 2.

First, let us assume away the problem of raising distortionary taxes and consider the social planner problem. Depending upon which state of nature the world financial markets are in, the planner solves one of the two following problems :

$$J_1(D^*, Q) = \underset{C}{\text{Max}} \Big\{ \text{Log } C + \beta\, p_1\, J_1 \left[(1+r_1)\, D^* - C - G - Q\,(1+n_1),\ Q(1+n_1) \right]$$

$$+ \beta(1-p_1)\, J_2 \left[(1+r_1)\, D^* - C - G - Q(1+n_1),\ Q(1+n_1) \right] \Big\}$$

if the world is in state 1 ; and

$$J_2(D^*, Q) = \underset{C}{\text{Max}} \Big\{ \text{Log } C + \beta\, q_1\, J_1 \left[(1+r_2)\, D^* - C - G - Q\,(1+n_2),\ Q(1+n_2) \right]$$

$$+ \beta(1-q_1)\, J_2 \left[(1+r_2)\, D^* - C - G - Q(1+n_2),\ Q(1+n_2) \right] \Big\}$$

if the world is in state 2.

Assume, to simplify, that $r_1 < n_1$ and $r_2 > n_2$. State 1 of the world is like the seventies : world interest rates are lower than the debtor nations' rate of growth. State 2 is like the eighties, this hierarchy is reversed.

Let us assume that the lenders are interested in making sure the country will default neither in state 1 nor in state 2. They want that $J_1(D,Q) \geq J_{1a}(Q)$ and $J_2(D,Q) \geq J_{2a}(Q)$. Where J_{1a} and J_{2a} are the autarkic level of utility when the countries are in states 1 or 2. Now, it is clear that $J_1 \geq J_{1a}$ will never be a binding constraint : the country always has the ability to refinance its debt at a cost r_1 which is smaller than its rate of growth n_1. In other words, even with a trade balance in equilibrium, the country can afford to reduce its debt-to-GDP ratio at no cost (no trade balance surplus). One therefore sees that the lenders will only need to make sure that $J_2(D,Q) \geq J_{2a}(Q)$ all the time. As in the deterministic case, this says that the lenders will impose an upper bound h^* to the debt-GDP ratio. But one also sees that <u>it is the same upper bound which applies in both states of nature. Any argument according to which the debt-GDP ratio should be lower in the eighties than in the seventies because interest rates are none higher is therefore invalid in this set up</u>.

When the credit ceiling is binding, the country consumes :

$$C_1 = Q_1 \left[1 + (n_1 - r_1)\, h^*\right] .$$

in state 1, and

$$C_2 = Q_2 \left[1 + (n_2 - r_2)\, h^*\right]$$

in state 2.

Even when the credit ceiling is binding, the country can keep borrowing as long as the world stays in state 1. However when the world moves into state 2, the country must attain a trade balance surplus, and domestic spending becomes smaller than GDP.

2 - Let us now return to the case when the government must raise distortionary taxes. Call ϱ_1 and ϱ_2 the interest rates that prevails domestically. As long as the external debt constraint is not binding, domestic and world interest rates should coincide just as in the deterministic case. When the external debt constraint is binding, the first order condition of the private sector yields that :

$$1 + \varrho_1 = (1+\delta) \frac{u_1}{p_1\, u_1 + (1-p_1)\, u_2}$$

$$1 + \varrho_2 = (1+\delta) \frac{u_2}{q_1\, u_1 + (1-q_1)\, u_2}$$

with u_1 and u_2 the marginal utility of consumption in states 1 and 2 respectively.

Since consumption is lower in state 2 than in state 1, $u_1 < u_2$ and one sees that domestic interest rates fluctuate around the domestic discount factor. They are lower than the domestic discount factor in state 1 and larger than the domestic discount factor in state 2. In this case, domestic

taxes also bounce around depending upon which state of nature the economy is in. The government's first order conditions yield

$$\frac{\phi'(T_1)}{\phi'(T_2)} = \frac{u'(G_1)}{u'(G_2)} = \frac{u_1}{u_2}$$

Taxes are therefore lower in state 1 than in state 2 (because of lower interest rates). In this case, one sees that all the bad news really come together when the economy goes from state 1 into state 2. First, the country must bear the primary burden of going <u>suddenly</u> from a trade deficit to a surplus. It must also pay the secondary burden of a sudden rise in interest rates and in domestic taxation.

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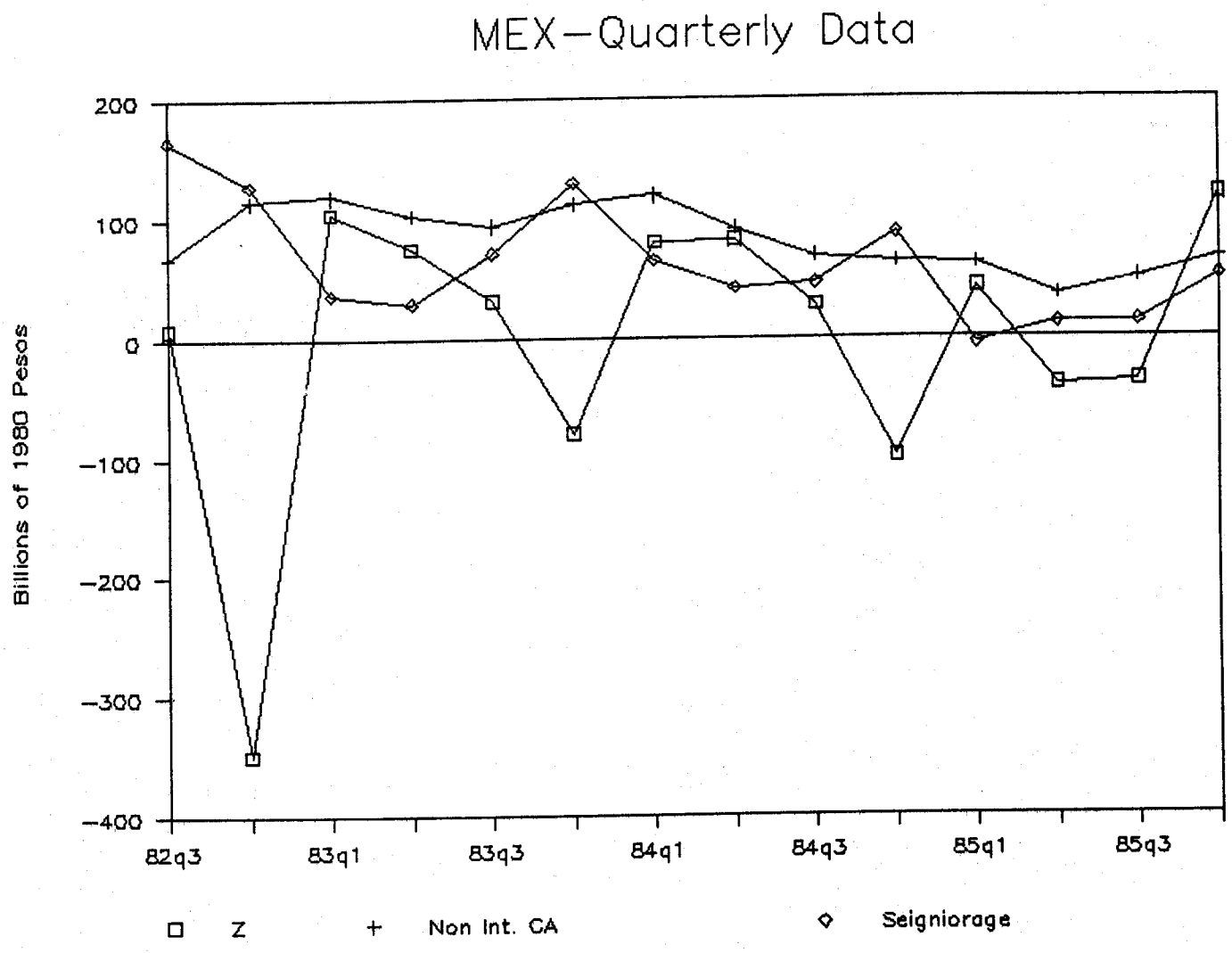
III - A COMPARISON OF BRAZIL'S AND MEXICO'S ADJUSTMENT OVER THE PERIOD 1983-85

1 - Both Brazil and Mexico have accomplished a very substantial external adjustment during the three years 1983-85. As is well known, this adjustment was attained by a sharp real devaluation and, notably in the case of Mexico, an abrupt rationing of imports. The question which I here want to investigate is the following : while both countries made the required external adjustment, did their governments undertake their own adjustment ? Was the secondary burden of raising domestic taxes shouldered ?

In order to answer this question, I first decompose governement resources into those which arise from money creation (the seigniorage tax) which I call S(t) and those arising from the primary surplus, which I call Z(t). S(t) + Z(t) is therefore the overall government surplus, T(t) - G(t) in equation (11). This last equation can therefore be written :

$$TB(t) = S(t) + Z(t) + [D(t) - (1+\varrho_t)\, D(t-1)] \qquad (11')$$

It states that a trade surplus is necessarily accompanied by (1) money creation ; or (2) by a government primary surplus ; or (3) by an increase of domestic debt ; or a combination of these three items. Each of these items is plotted in the diagrams 2A and 2B in the case of Brazil and Mexico respectively.


MEX—Quarterly Data
Billions of 1980 Pesos
200
100
0
−100
−200
−300
−400
82q3
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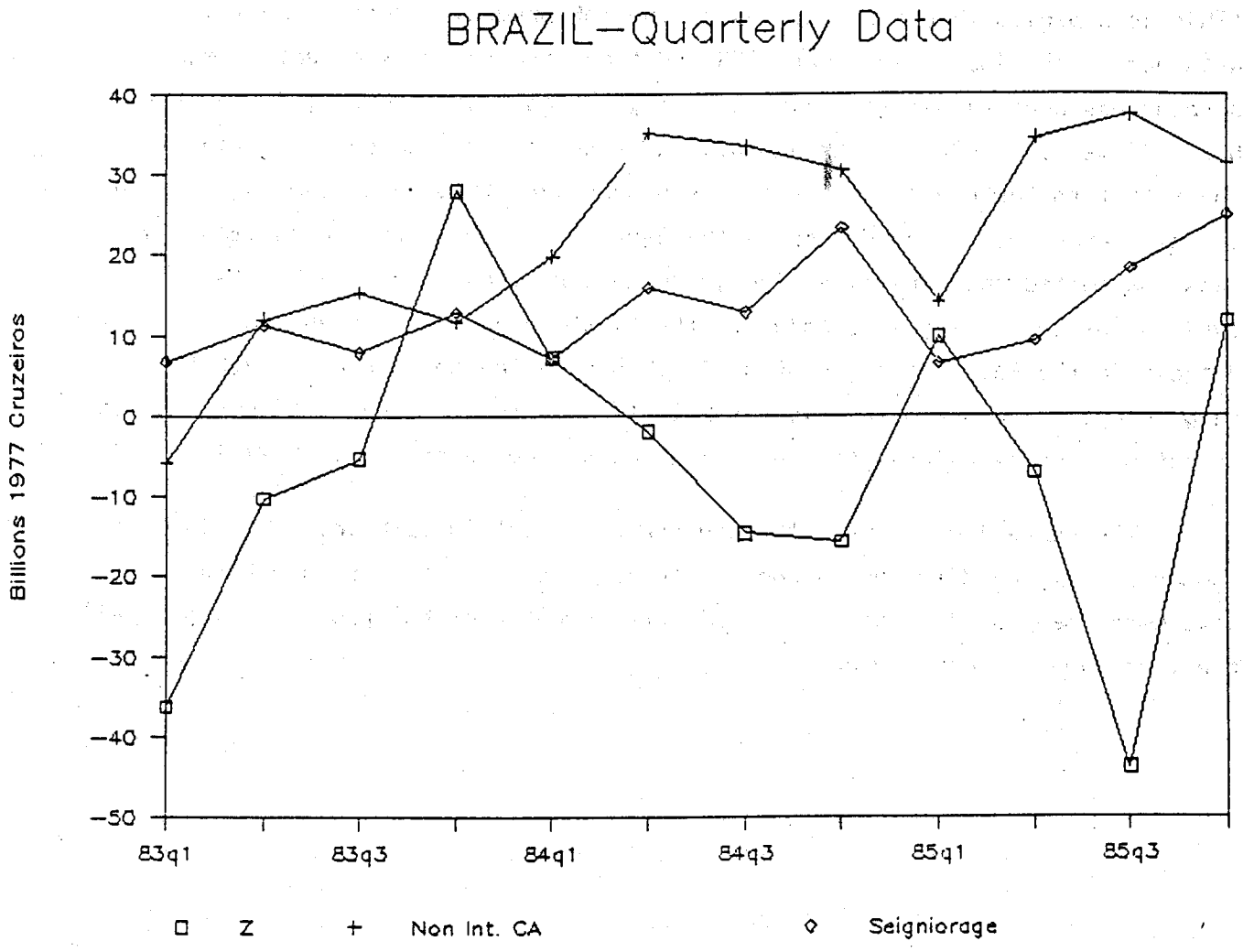
Seigniorage

D I A G R A M 2A


BRAZIL—Quarterly Data
Billions 1977 Cruzeiros
40
30
20
10
0
−10
−20
−30
−40
−50
83q1
83q3
84q1
84q3
85q1
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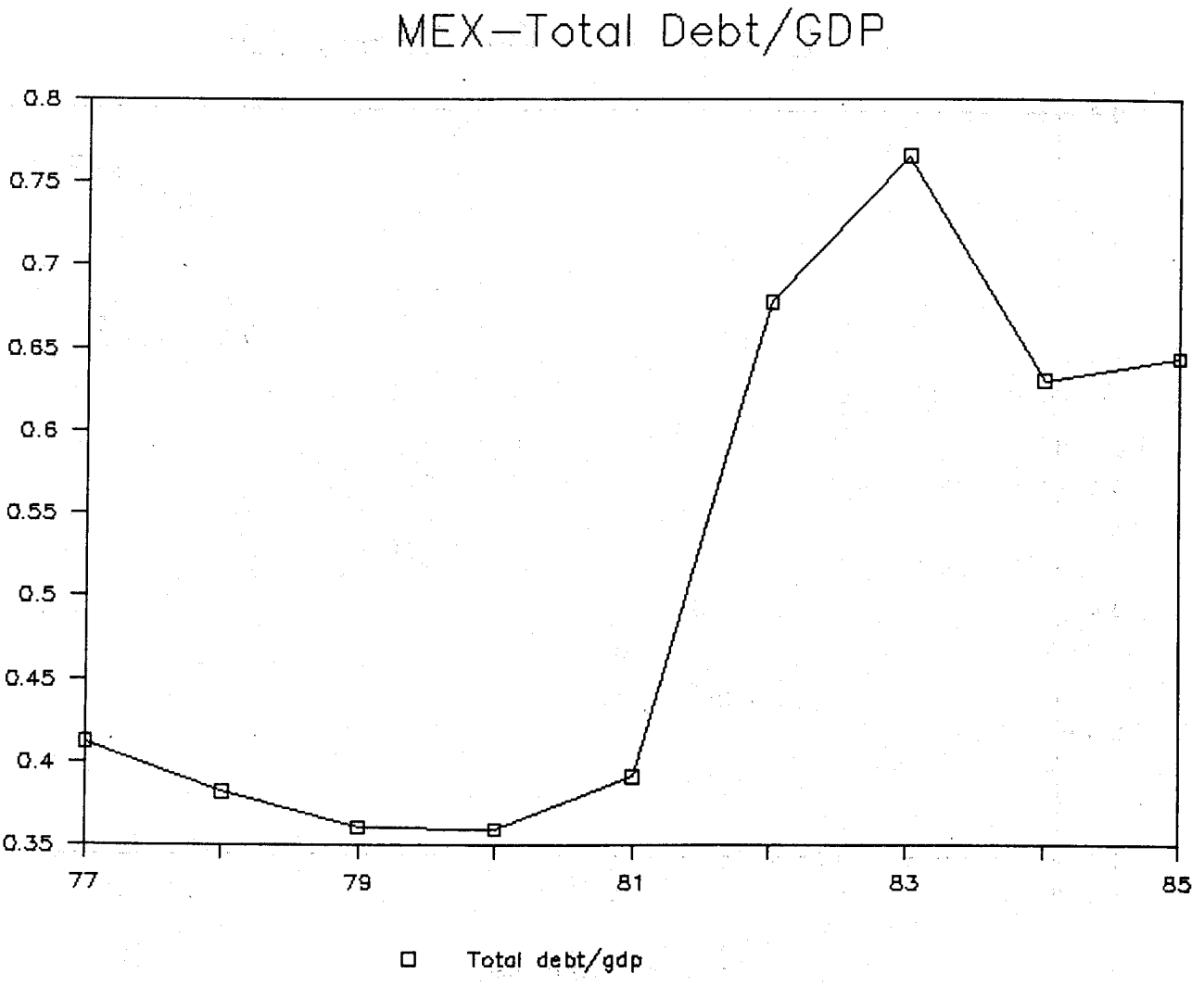
Z
Non Int. CA
Seigniorage

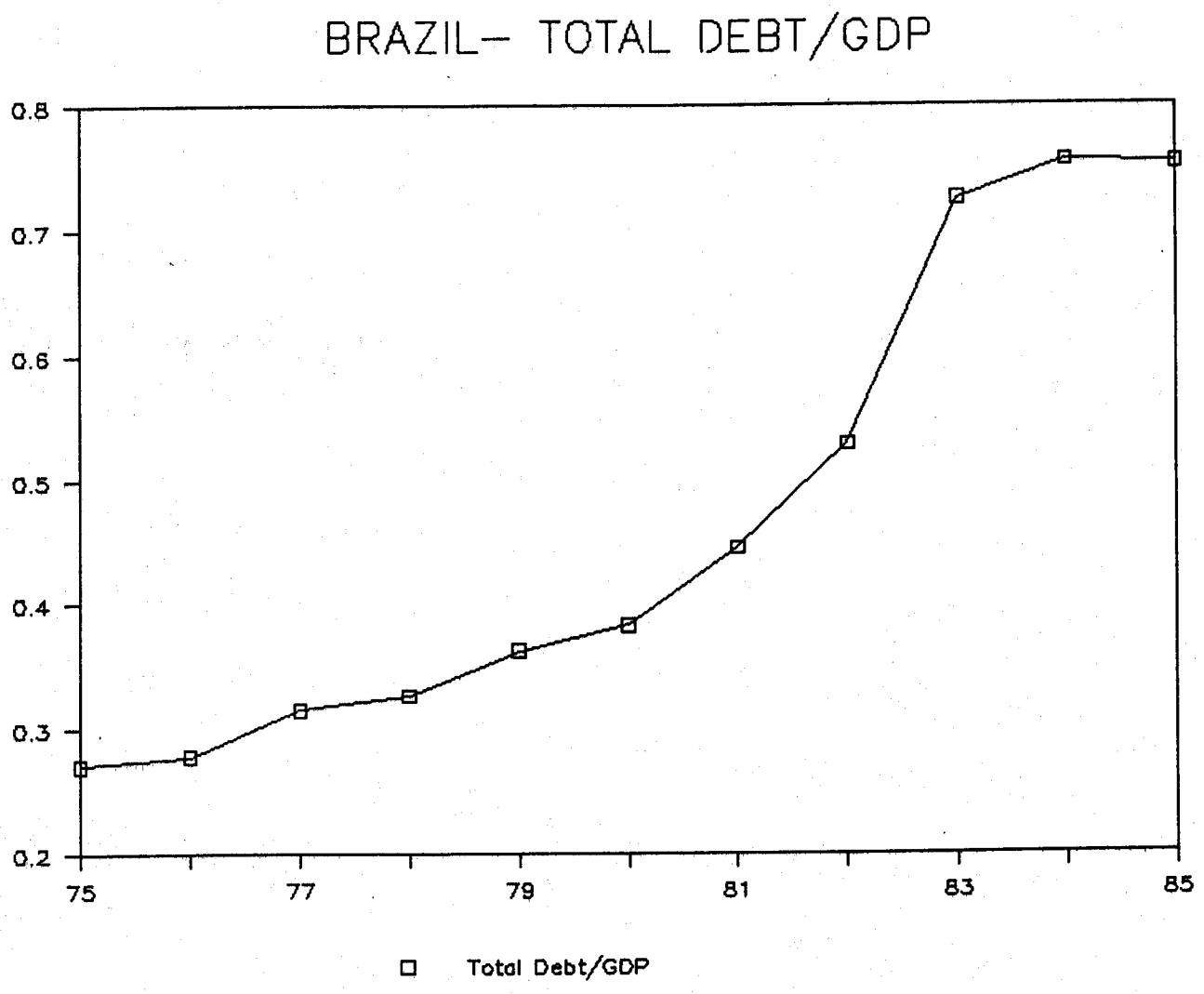
D I A G R A M 2B

In the case of Brazil, we can distinguish two stages in the adjustment pattern. In 1983, the non-interest payment current account surplus was accompanied by a sharp rise of the government primary surplus. (This is a period which corresponds to the IMF program). But the peak is attained in the last quarter of 1983 and from then on, governement primary surplus has been almost steadily declining. By contrast the seigniorage tax has followed very closely the variations of the current account, leaving little doubt that the external surplus has been monetized through the purchase of the dollars earned by the exporters by the Central Bank. Mexico's adjustment is less contrasted than Brazil's. The government primary surplus exhibits a cyclical patten, being in surplus in the first three quarters ans in deficit in the fourth (an exception is 1985). Furthermore, even though the seigniorage tax amounts to a very substantial part of the external surplus, it is not as closely related to the variations of the latter as in Brazil.

The comparison between the government effort in both countries is best summarized by the diagrams 3A and 3B. Mexico has been able to curb total government debt while Brazil's overall government debt has kept rising over all the three years under review.


MEX—Total Debt/GDP
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
77
79
81
83
85
Total debt/gdp

D I A G R A M 3A


BRAZIL– TOTAL DEBT/GDP
0.8
0.7
0.6
0.5
0.4
0.3
0.2
75
77
79
81
83
85
Total Debt/GDP

D I A G R A M 3B

In order to assess quantitatively the decomposition of the adjustment, I add up equations (11) as follows :

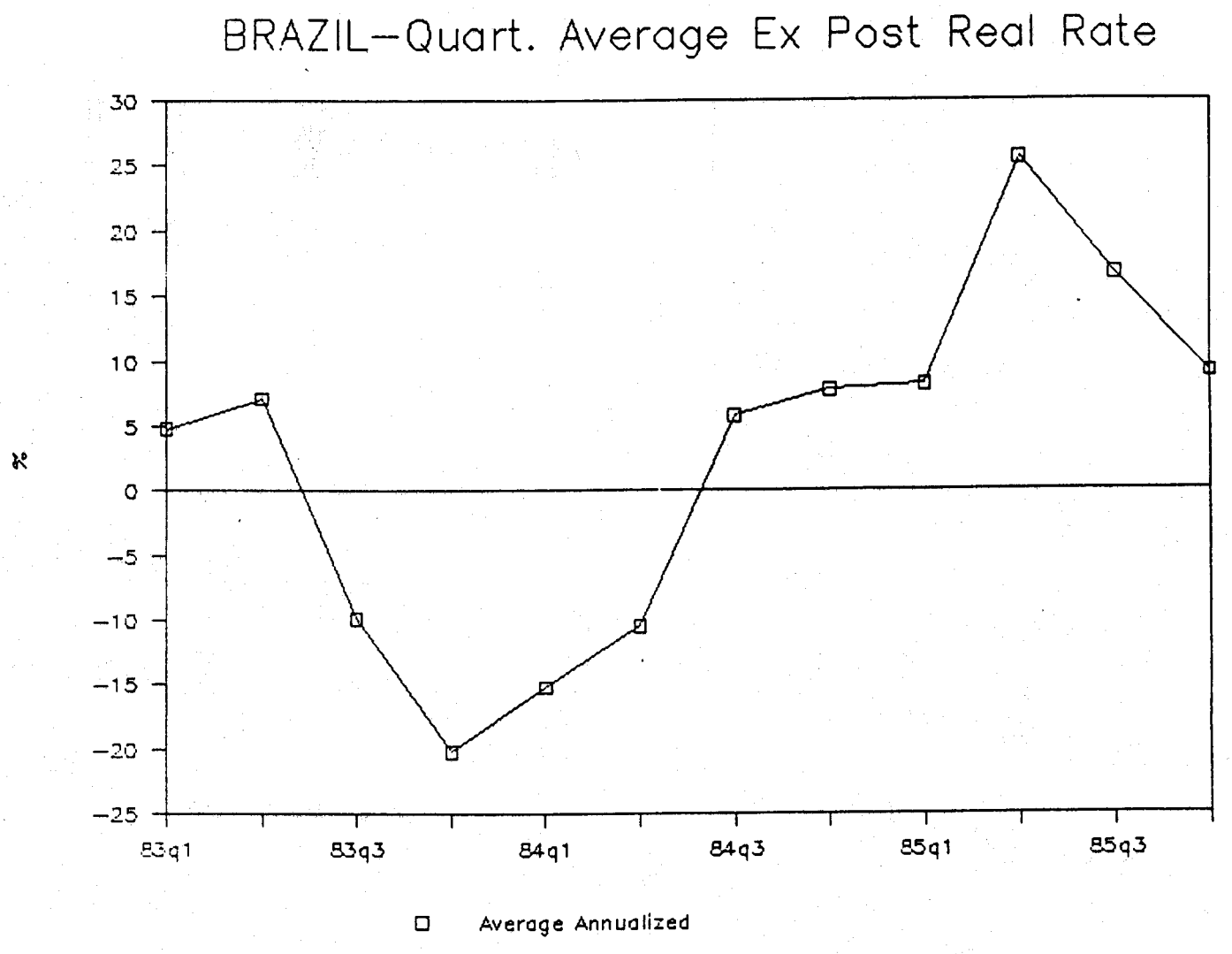
$$\sum_{t=1}^{T} \frac{TB(t)}{\prod_{i=1}^{t}(1+\varrho_i)} = \sum_{t=1}^{T} \frac{S(t)}{\prod_{i=1}^{t}(1+\varrho_i)} + \sum_{t=1}^{T} \frac{Z(t)}{\prod_{i=1}^{t}(1+\varrho_i)}$$

$$+ B(0) - \frac{B(T)}{\prod_{i=1}^{T}(1+\varrho_i)}$$

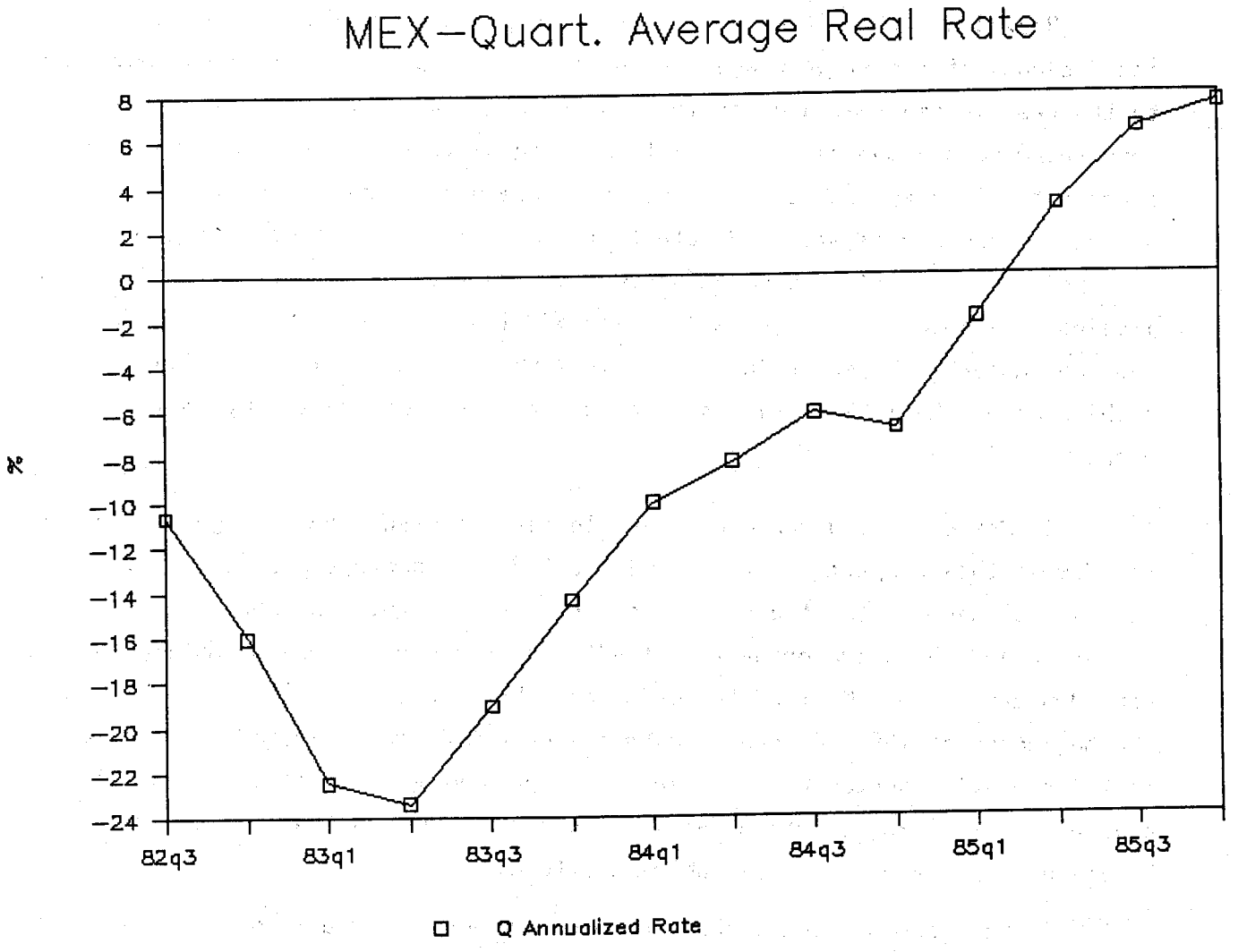
in which t=1 corresponds to 1983-1 and t = T correspond to 1985-4. The left-hand side is the discounted sum of the external surpluses : The right-hand side is the sum of the government revenues generated by seigniorage, primary surplus and the net increase of government domestic debt. Taking the right-hand side as the scale factor, the decomposition comes numerically as follows. In the case of Brazil, the seignorage tax amounts to 57.5 percent of the external adjustment, the domestic debt increase amounts to 71.0 % and the primary surplus of the government amounts to <u>minus</u> 28.6 percent. Taking Z + S as the measure of government total income, one sees that 29 percent of the external surplus was really paid for by the government and that 71 % was financed by domestic debt. In other words, one sees that the secondary burden of raising taxes in order to service the government's external debt has yet to be borne in the case of Brazil.

The same decomposition in the case of Mexico yields the following results. The seigniorage tax amounts to 93 % of the external balance surplus. The primary surplus amount to -8.6 % while the domestic debt increase amounts to 15.2 %. Taking the seigniorage tax and the primary surplus as the measure of government income, one sees that 85 % of the trade surplus has been financed through taxation.

It is not surprising, under these circumstances, to find a very different pattern for the real domestic interest in each country (see diagrams 4). Except for 1985, the real rates have been very substantially negative in Mexico while, except for 1983, they have been very substantially positive in Brazil. Until the cruzado plan was started, Brazil was entering into a deadly vicious circle. Real rates were around 20 % in real terms and domestic debt represented 33 % of GDP. Real interest payments on the domestic debt alone therefore represented 6.6 % of GDP.


BRAZIL—Quart. Average Ex Post Real Rate
30
25
20
15
10
5
0
−5
−10
−15
−20
−25
%
83q1
83q3
84q1
84q3
85q1
85q3
Average Annualized

D I A G R A M 4A


MEX—Quart. Average Real Rate
%
8
6
4
2
0
−2
−4
−6
−8
−10
−12
−14
−16
−18
−20
−22
−24
82q3
83q1
83q3
84q1
84q3
85q1
85q3
Q Annualized Rate

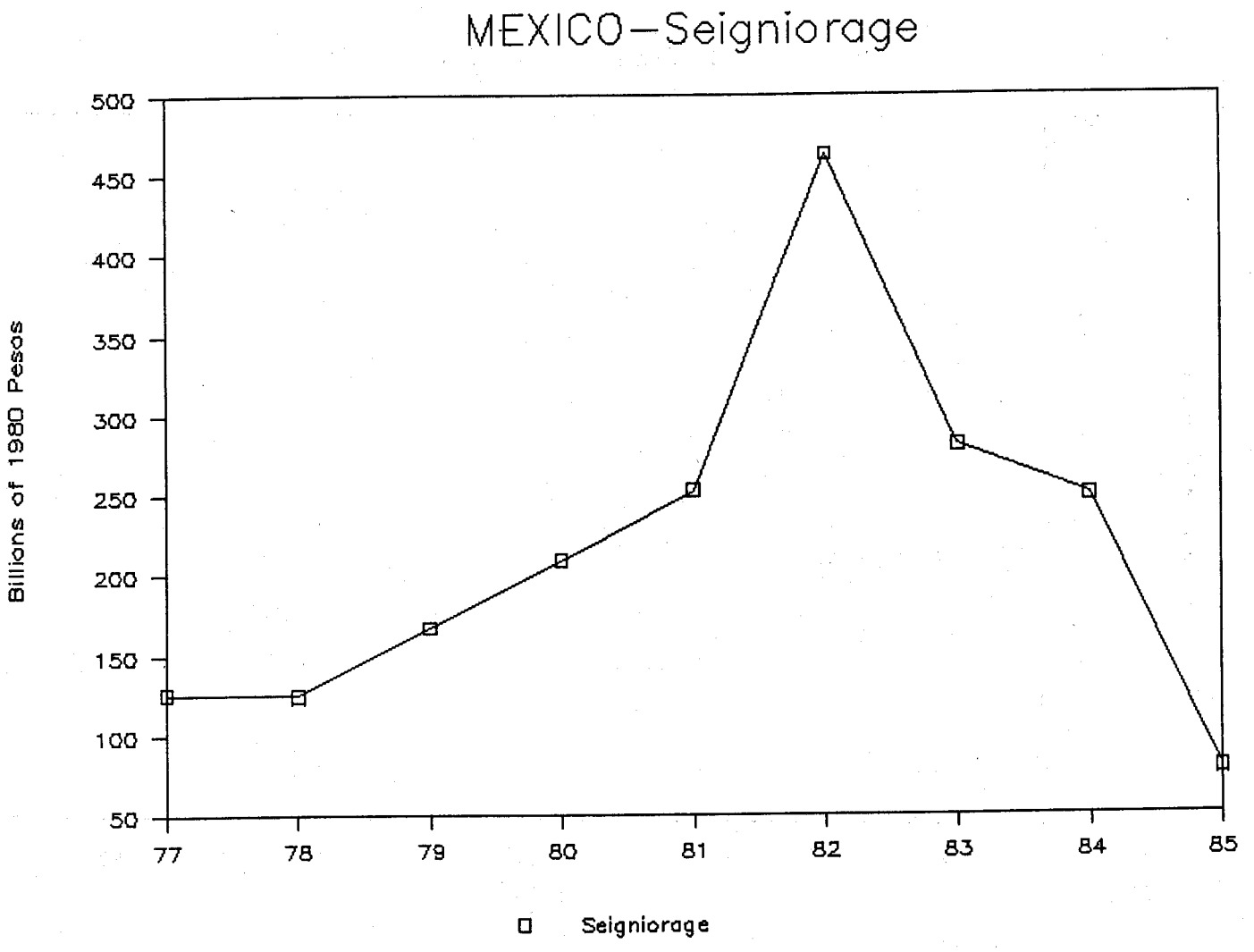
D I A G R A M 4B

The seigniorage tax

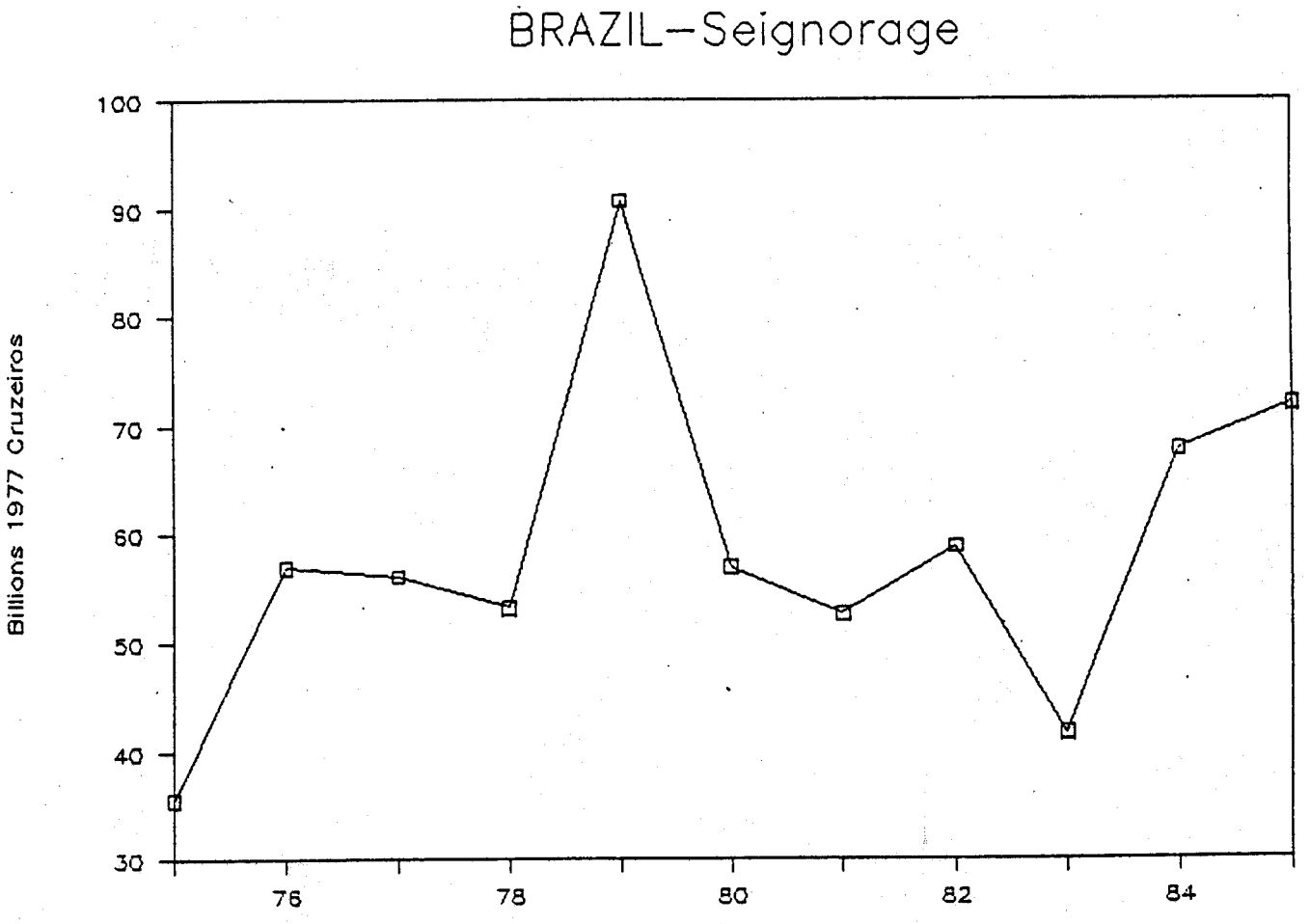
Brazil's difficulties were further complicated by the increased inefficiency of the seigniorage tax. As is well known, there is a maximum bound to the real income that a government can extract from money creation. The corresponding maximum rate of inflation is equal to the inverse of the semi-elasticity of money demand with respect to nominal interest rates. In the case of Brazil, rough estimates indicate that the inflation rate came very near that point. (The estimated value of the monthly semi-elasticity is 0.77, which implies a maximum monthly inflation rate of 11 % very near the actual rate reached in 1985). Direct evidence confirms this point. While the inflation rate doubled after the 1982 crisis, seignorage revenues were raised by only 17 percent in Brazil.

In Mexico, the government seems to have enjoyed a much larger degree of freedom in this respect. As we have indicated, seigniorage amounted to very substantial part of the trade surplus. Yet, as the diagrams show, both inflation and the seigniorage tax itself were rapidly decreasing during the period under review. Most of the gains have been concentrated in 1982 and in the beginning of 1983. It seems to be the case that the sharp 1982 inflation took the private sector by surprise and helped the government to finance the bulk of the 1982-83 adjustment easily. This is a luxurry that the indexed Brazilian economy has not been able to afford.

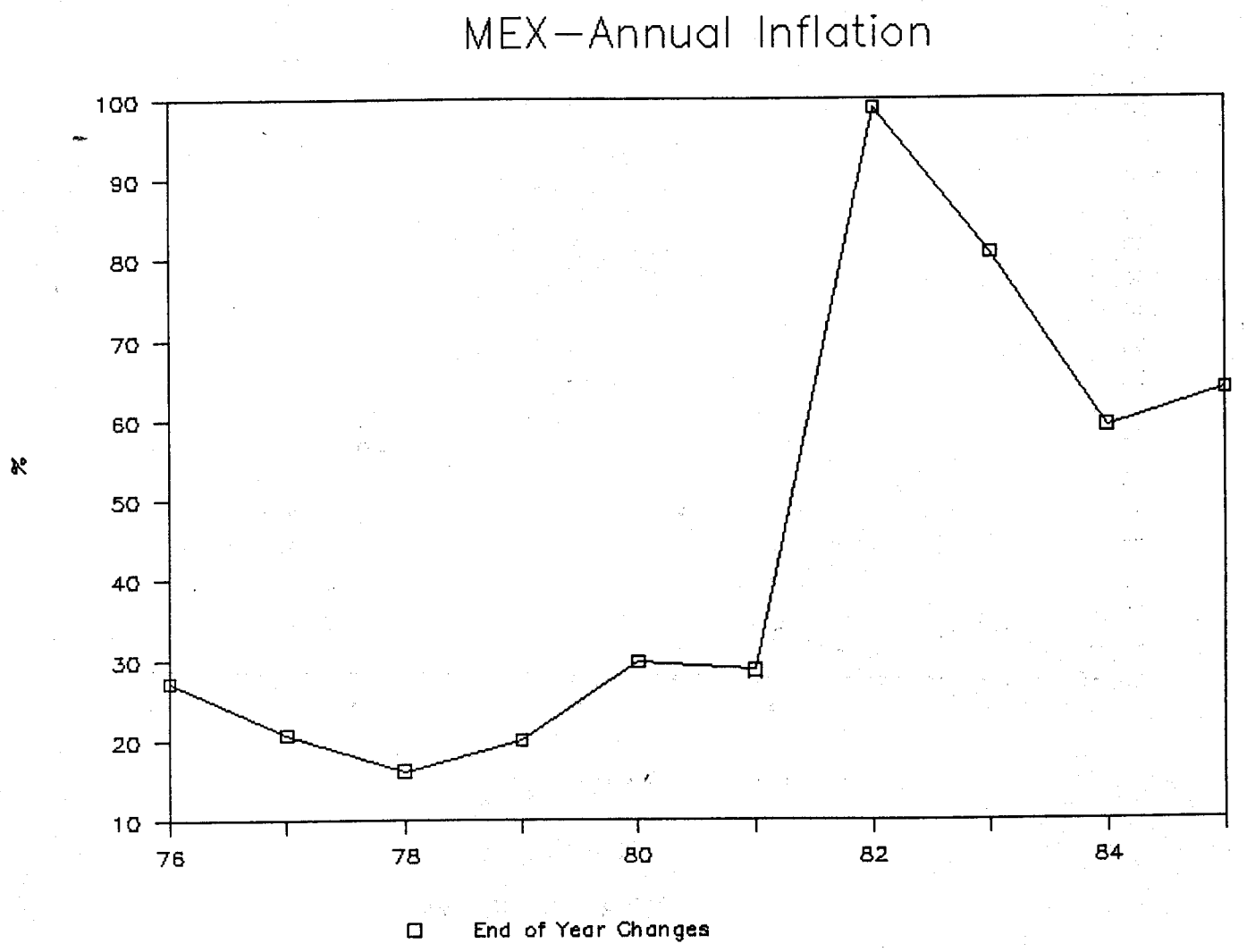
In both cases anyway, the decomposition above reveals the importance of the seigniorage tax in total government revenue. In both instances, any attempt to force the government to reach a monetary target would have been disastrous. In the balance of evils inflation must be carefully weighed against rising domestic debt and rising real interest rates. Here, any use of the monetary approach to the balance of payment might be very harmful if it were to imply that monetary restraint is the appropriate tool for managing the external debt.


MEXICO—Seigniorage
Billions of 1980 Pesos
500
450
400
350
300
250
200
150
100
50
77
78
79
80
81
82
83
84
85
Seigniorage

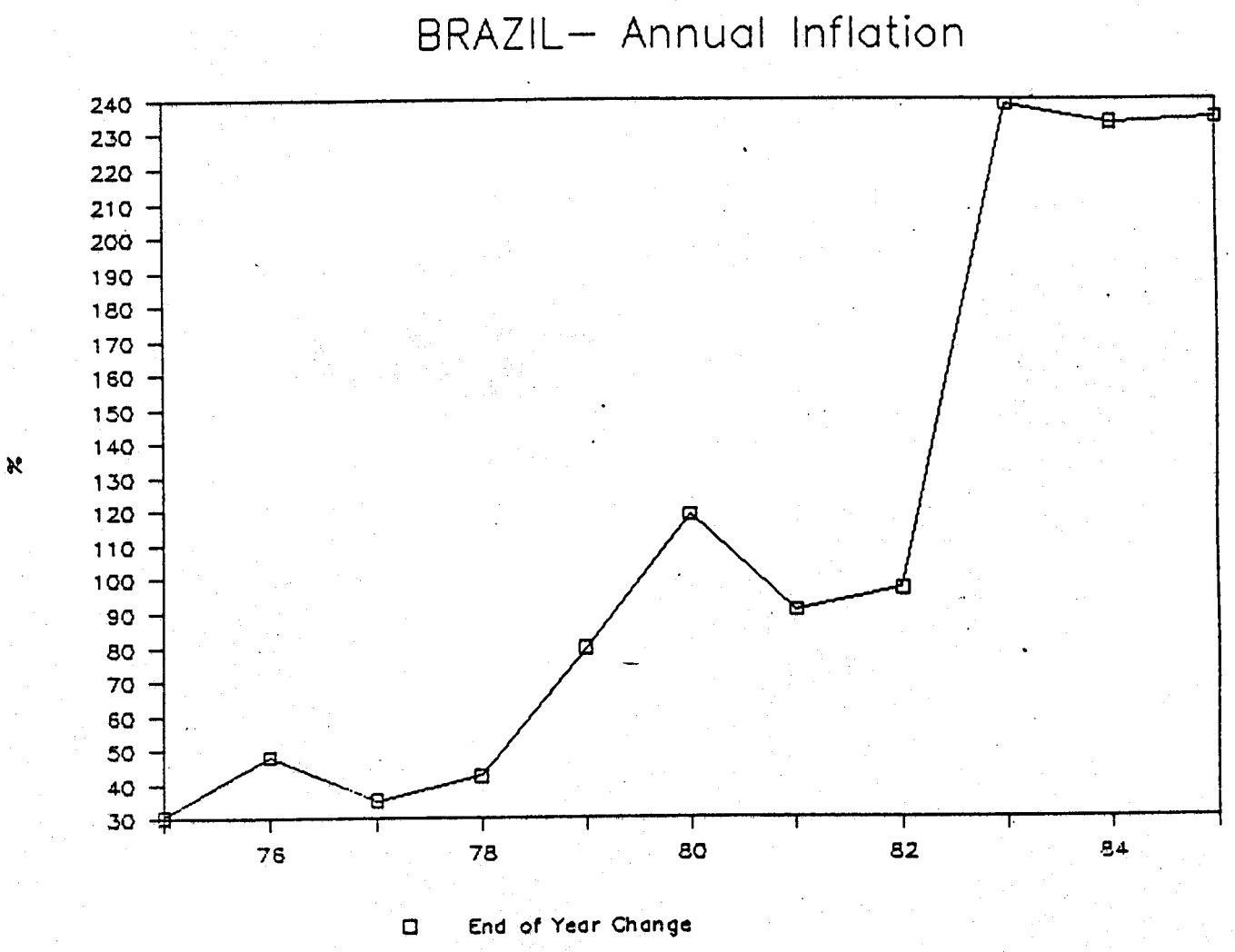
D I A G R A M 5A


BRAZIL—Seignorage
Billions 1977 Cruzeiros
100
90
80
70
60
50
40
30
76
78
80
82
84

D I A G R A M 5B


MEX—Annual Inflation
100
90
80
70
60
50
40
30
20
10
%
76
78
80
82
84
End of Year Changes

D I A G R A M 5C


BRAZIL— Annual Inflation
%
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
76
78
80
82
84
End of Year Change

D I A G R A M 5D

CONCLUSION

1986 and after : Brazil and Mexico at their crossroads

During 1985, Mexico went into another crisis, the price of oil falling by more than half. In 1986, Brazil launched a "cruzado plan" aimed at bringing inflation down from its rate of 200 %.

Mexico's crisis was an exogeneous event. As I have indicated, domestic policies did manage to adjust to the external constraint. Despite a very large trade surplus, inflation was going down while domestic debt and real rates of interest stayed under control, at least until mid-1985. It is very hard to think that Mexico should simply go into another round of domestic adjustment. A good case for a partial moratorium can be made. Indeed, there is a fundamental difference between the 1982 and the 1985 Mexican crises. In 1982, the crisis was worldwide. It corresponded to a swing of world interest rates above most countries' growth rates. Even though this is a swing which came out of a random shock (Reaganomics), it was the kind of risk which was implicitly accepted by both the borrowers and the lenders. It could not have been that interest rates were to stay forever below growth rates (but there is no reason why they should always stay above either). The 1985 Mexican crisis instead is much more idiosyncratic : it can be convincingly argued that a partial moratorium is necessary, which need not propagate itself to all the borrowers of the world. (See my paper (1987) for a possible framework of analysis).

Brazil's new crisis is of a very different nature. It stems from the government insolvency, not from the insolvency of the nation. Brazil has reached the point where repaying more external debt is potentially extremely damaging to its domestic economy and may be counter productive. As I have shown, it is a process which augments (almost one-to-one) the government domestic debt by the same amount as the service of the external debt. In my earlier paper, I have argued that 15 % of Brazil's exports revenues to debt servicing were sufficient to guarantee the country's external solvency. If this policy had been adopted, I have calculated that domestic debt would have risen much more moderately : by 22 % instead of the actual 80 % which was experienced

from 1982 to 1985. Today, the Brazilian government domestic debt represents 35 % of GDP. The very large real rate that was paid (more than 20 % in 1985) was clearly devastating and the underlying process had to be stopped. What answer Brazil will find to her domestic debt problem is anybody's guess. Will an hyperinflation wipe it out (in the newly de-indexed economy) ? The other option can only be to slow down the service of the external debt, and to raise domestic taxes[5].

FOOTNOTES

1. See however the following discusion by Eaton. My point here is simply the following : Assuming away short-run fluctuations (which are explicitly dealt with in my model) and focusing on a stationary economy, why should the lenders impose a U shaped (non-stationary) debt-to-GDP ratio (if the information is perfect) ?

2. In that paper, I argue that the ressources of a country should be measured by the linear combination of GDP and exports which fails to depend upon the real exchange rate. A numerical application for Brazil suggests that it is, for this country, 90 % of exports plus 10 % of GDP.

3. (a) The social planner's first order conditions are

$$C_{s+1} + G_{s+1} = \beta(1+r_{s+1})\ (C_s+G_s)$$

and, at each time t, his budget constraint is :

$$\sum_{s=t+1}^{\infty} \frac{C_s + G_s}{\prod_{u=t+1}^{s} (1+r_u)} = W_t - D_t^*$$

so that one finds $C_t + G_t = (1-\beta)\ (1+r_t)(W_{t-1} - D^*_{t-1})$ as indicated in the text.

(b) From equation (2) and the definition $h_t \equiv \frac{D_t^*}{Q_t}$, one finds :

$$h_t = \frac{1 + r_t}{1 + n_t} h_{t-1} + \frac{C_t + G_t}{Q_t} - 1$$

Since $W_t \equiv \sum_{s=t+1}^{\infty} \frac{Q_s}{\prod_{u=t+1}^{s} (1+r_u)} = \frac{1}{\theta^a_{t+1}} Q_t$ and

given the value of $C_t + G_t$ above, one finds

$$h_t = \frac{1+r_t}{1+n_t} h_{t-1} + (1-\beta) \frac{1+r_t}{1+n_t} \left(\frac{1}{\theta^a_t} - h_{t-1} \right) - 1$$

which is the equation (7) in the text.

4. This is shown by taking the first difference of the equation $U_{at}(Q_t) = U(D_t, Q_t)$.

5. Brazil's proposal to restrict the service of her external debt to 2.5 % of GDP seems acceptable. The external debt to GDP ratio is about 40 %. This 2.5 % figure is therefore compatible with an "average" difference between future interest and growth rates of 6.25 %.

REFERENCES

Cohen, D. (1985) - "How to Evaluate the solvency of an Indebted Nation", Economic Policy, N°1.

Cohen, D. (1987) - "Some Guides to the Management of Developing Countries Debt", Forthcoming in World Bank Economic Review, N°3.

Cohen, D. and J. Sachs (1986) - "Growth and External Debt Under Risk of Debt Repudiation", European Economic Review, June.

Eaton, J. and M. Gersovitz (1981) - "Debt with Potential Repudiation", Review of Economic Studies, March.

Sachs, J. and D. Cohen (1985) - "LDC Borrowing with Default Risk", Kredit und Kapital, (Special issue on international banking).