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# INFLATION, GROWTH AND WAGE POLICY: IN SEARCH OF A BRAZILIAN PARADIGM

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# I - Introduction

Most current analyses of stabilization problems in Brazil use the standard IS-LM (or quantity theory) plus Phillips curve apparatus (Contador, Lemgruber, Simonsen). This amounts to completely disregarding a unique structural characteristic of the Brazilian economy, vis, the existence of a wage policy which imposes compulsory wage settlements of fixed periodicity for all registered workers.

This paper builds on previous work by Bacha, Cardoso, Lara-Resende, Lopes, Lopes-Williamson and Taylor. We are interested in incorporating the wage policy explicitly into the macro model. We also want to emphasize the role of the inflation tax in financing Government investment, as in Mundell, which seems to be a relevant feature of recent Brazilian experience (Porto-Gonçalves).

The following section contains a stylized description of Brazilian wage policy, leading to a surprisingly simple period analysis representation of the system of compulsory wage settlements at fixed intervals in this country. This is followed by a discussion of labor market dynamics in the context of a labor surplus economy, to suggest the effectiveness of legal wage settlements as a determinant of observed market wage behavior. The growth-inflation model is specified in section 4. We first study the determination of capacity growth and its relationship with the inflation rate through the forced savings and the inflation tax effects. Effective demand and capacity utilization issues are then briefly dealt with in a formulation that for simplicity presumes the dominance of the quantity theory over Keynesian autonomous expenditure funtions. There follows a modelling of the disequilibrium behavior of the inflation rate in the context of a fix-flex price adjustment mechanism. Section 5 deals with the equilibrium and stability properties of the model. Relevant stabilization policy issues are discussed in Section 6. We deal first with the short and long-run adverse consequences of an orthodox stabilization policy. This part argues that an autonomous reduction in money supply growth implies both a temporary and a permanent decrease of potential output growth if the wage formula as in Brazil provides for less than full price indexation. There follows a discussion of issues relating to full wage indexation. The section concludes with some observations about ways and means of fighting inflation through capacity expansion. A brief section of conclusions closes the paper.

## 2 - Brazilian Wage Policy

Brazilian wage policy has changed frequently since it was first introduced in 1965 (see Simonsen for a good description of the initial conception and subsequent changes). The policy has always imposed compulsory wage settlements of fixed periodicity for all registered workers although settlement dates differ among different industries or labor categories. Under the present rule (last change was in November 1979) wages are reset every six months in accordance with the cost of living increase in the period plus a productivity factor which is negotiated between workers and firms. This establishes a lower bound on wages: Brazilian law does not allow the firm to give less than the full inflation as wage readjustment to all its employees. Actually the only way a firm can reduce the pay for a given job is by firing the worker and getting a new one (if it can find one) to perform the same job under a lower wage, that is, labor turnover is the only way that the wage law can be evaded downwards. Of course, upward wage flexibility is not restrained as long as firms can negotiate larger productivity increases for the work force as a whole or give selective wage increases as job promotion.

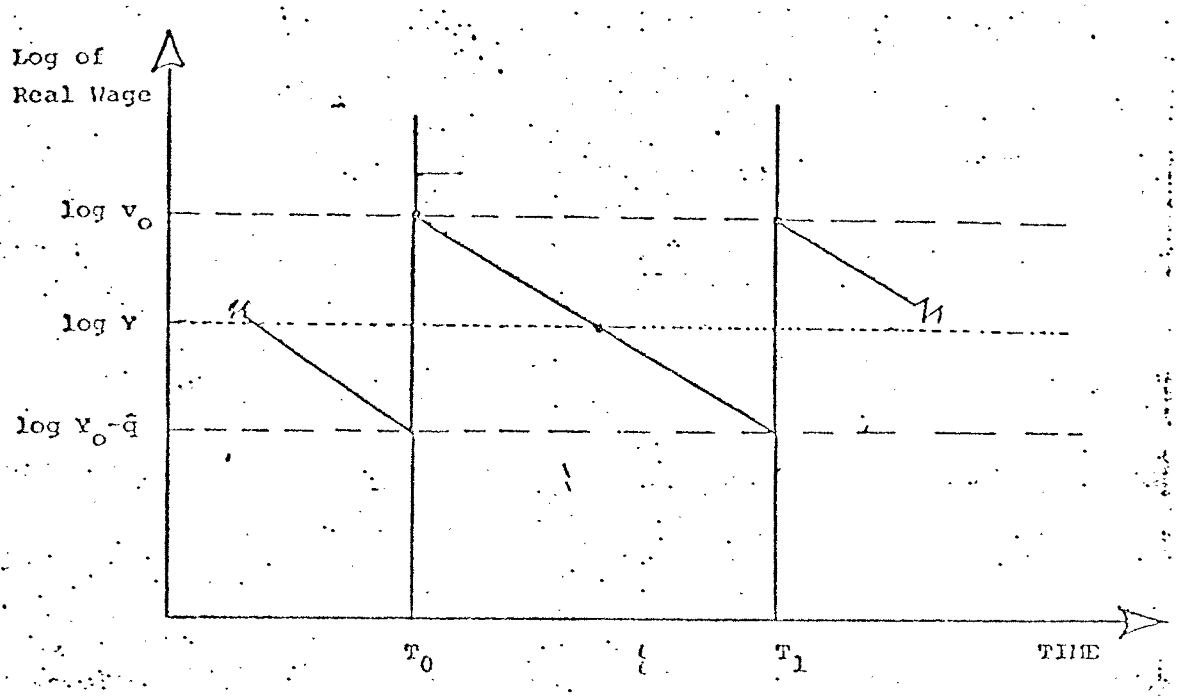


FIGURE 1

The consequences of this wage law for the behavior over time of the real wage of any given group of workers which share the same settlement date is shown in Figure 1. We simplify the exposition by assuming away any productivity increase. The figure shows the path over time of the logarithm of the real wage of a representative worker. At any settlement date, such as time $T_o$, his nominal wage is reset in accordance with past inflation, which is just sufficient to restore his real wage to its "peak" level $v_o$. Between settlement dates, however, as the nominal wage remains fixed, and inflation goes on steadily, there is a continuous fall in his real wage. In the figure we depict a linear fall of the logarithm of the real wage, which amounts to assuming that instantaneous (or monthly) rate of inflation is constant within settlement dates. Let the rate of inflation over the whole period be $\hat{q}$. Then at time $T_1$ at the end of the period, just before his nominal wage is once more reset, his real wage will have reached its trough level $v_o/(1+\hat{q})$. Writing the logarithm of this lowest real wage level as approximately equal to (log $v_o$ -

$\hat{q}$), we may compute the geometric average of the real wage over the period, call it v, from:

$$(1) \quad \log v = \frac{1}{2} (\log v_o + \log v_o - \hat{q}) = \log v_o - 0.5\hat{q}.$$

Since the wage policy always reestablishes the same peak real wage level $v_o$ at every settlement date (under the assumption of no productivity increase), the average real wage within settlement dates will remain constant as long as the rate of inflation remains constant. Also, if the rate of inflation changes, the average real wage will also change but in the opposite direction.

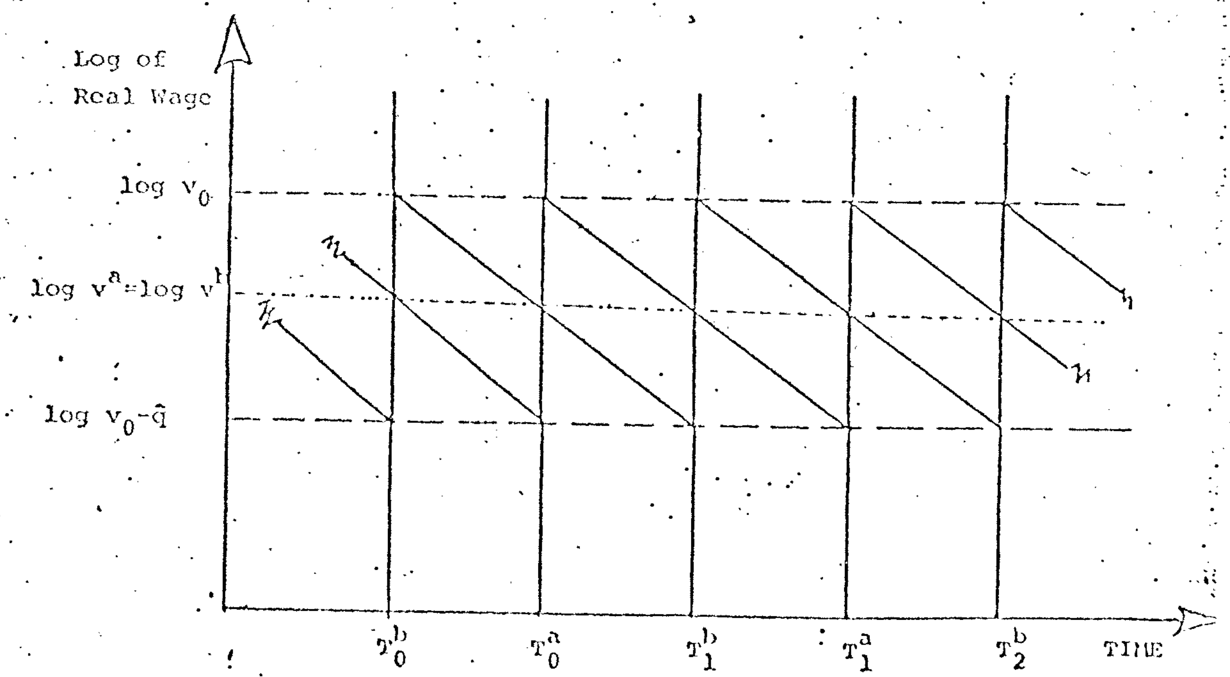


FIGURE 2

This is the story for any single settlement group. What can we say about aggregate wage behavior? Figure 2 shows the behavior over time of the real wages of two representative workers, with the same peak real wage level but different settlement dates, with the later denoted by the subscript n=0, 1, 2. We indicate by $T^a_n$ and $T^b_n$ on the time axis the different settlement dates for the two wage earners. The figure was constructed under the assumption that the rate of inflation stays constant over time and simple inspection shows that in this case the average real wage for any given within-settlements period, such as for example $T^a_o T^a_1$, is the same for the two workers. This however would not be true if the rate of inflation had changed in the time period between settlements dates $T^b_o$ and $T^b_2$ as the reader may easily verify by redrawing the figure for this case.

Let us assume, as an aggregation rule, that for any given time period which has the same lenght of the standard wage settlement period (which by law is the same for all workers) the average real wage for workers as a whole is the same as (or at least proportional to) the average real wage for the representative worker whose settlement dates coincide with the extreme points of the period. As any aggregation rule this is an approximation, which is exactly true only under special conditions: in our case only under a constant rate of inflation.

If we indicate by w the average nominal wage of workers as a whole for, say, period $T_0 T_1$ in Figure 1, and by p the average price level for the same period, we have by the aggregation rule:

(2) $v = \frac{w}{p}$

where v is, as before, the average real wage for the representative worker with wage settlements at $T_0$ and $T_1$. It follows that:

(3) $\log w = \log v + \log p = \log v_o - 0.5\, \hat{q} + \log p.$

A similar equation holds for the time period of the same lenght that ends at $T_0$ in Figure 1, that is:

(4) $\log w_{-1} = \log v_{-1} + \log p_{-1} = \log v_o - 0.5\ \hat{q}_{-1} + \log p_{-1}$

and, if we let $\hat{w} = \log w - \log w_{-1}$ and $\hat{p} = \log p - \log p_{-1}$ indicate percentage rates of change, we derive:

(5) $\hat{w} = \hat{p} - 0.5(\hat{q} - \hat{q}_{-1})$

Note that $\hat{p}$ and $\hat{q}$ represent differente concepts of the rate of inflation: $\hat{q}$ is the percentage rate of change of the price level between $T_0$ and $T_1$ (a December to December rate if the period is annual), while $\hat{p}$ is the percentage rate of change of the average price level between two consecutive periods. As an additional aggregation rule, which again is strictly valid only in the case of constant inflation, we assume that

(6) $\hat{p} - \hat{p}_{-1} = \hat{q} - \hat{q}_{-1}$

that is to say, the variation in the rate of inflation is the same whether measured by period averages or by and-of--period values.

It follows that

(7) $\hat{w} = 0.5\ \hat{p} + 0.5\ \hat{p}_{-1}$

which means that, when measured in terms of period averages, the rate of wage inflation is equal to the simple average of current and past rates of price inflation. This is the period analysis equivalent of the complex time staggered process represented in Figure 2.

We have so far chosen our period of analysis to coincide exactly with the wage settlement period, which under the present Brazilian law is a semester. Hence, the variables in equation (7) must be semestral rates of inflation. What would be the equation appropriate to represent the same process when our period of analysis is annual?

Figure 3 illustrates the argument now. Here $\hat{q}$ is the twelve month rate of inflation between $T_0$ and $T_2$. Since wages are reset after each six months period, the trough

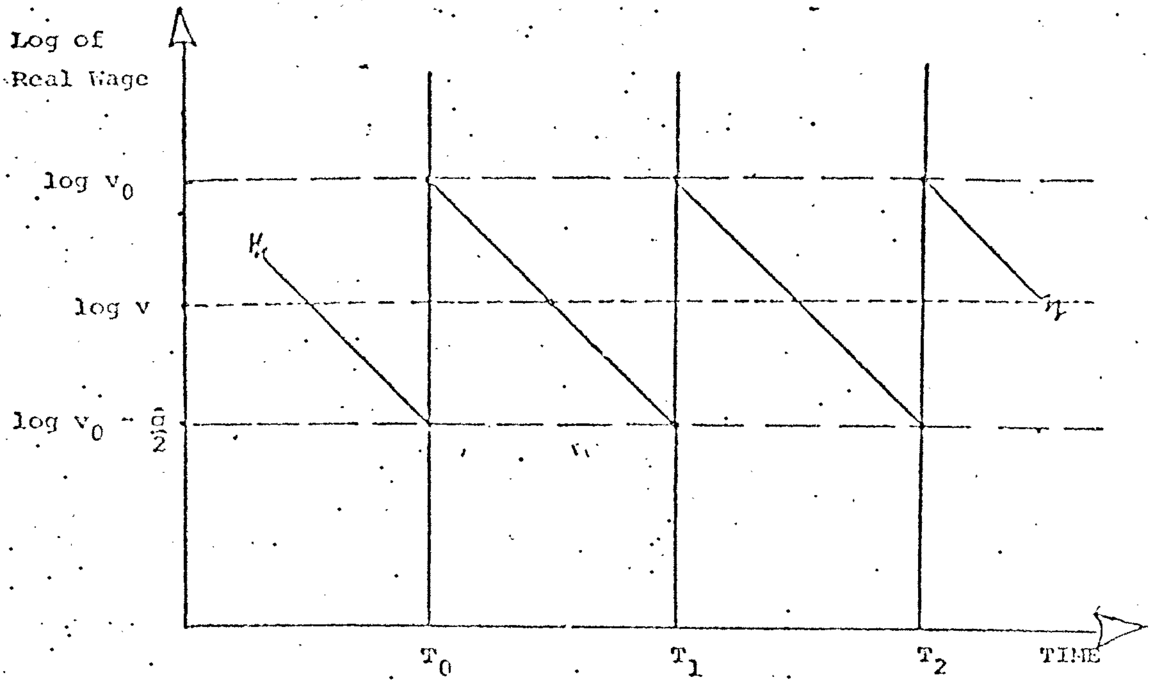


FIGURE 3

real wage level is reached at both $T_1$ and $T_2$ and its value is $v_o/(1+\hat{q})^{0.5}$, the logarithm of which is approximately equal to log $v_0$ - 0.5 $\hat{q}$. Hence equation (1) becomes:

(8) $\log v = \log v_0 - 0.25\ \hat{q}$

equation (5) becomes:

(9) $\hat{w} = \hat{p} - 0.25(\hat{q} - \hat{q}_{-1})$

and from (6) we obtain:

(10) $\hat{w} = 0.25\ \hat{p} + 0.75\ \hat{p}_{-1}$

It is easy to show that, in general, if there are n wage readjustments per period of analysis, the formula is:

(11) $\hat{w} = h\hat{p} + (1-h)\hat{p}_{-1}$

where $h = 1 - \frac{1}{2n}$ . This is the generalized period analysis representation of a Brazilian type wage indexation system. From this equation we derive, by integration:

$$(12) \quad w = v^* \, p^h p_{-1}^{1-h}$$

where v* is an integration constant (This can be interpreted as the desired real wage target under price stability - see Bacha).

Therefore:

$$(13) \quad v = w/p = \frac{v^*}{(1+\hat{p})^{1-h}}$$

which establishes an inverse relationship between the average real wage level and the rate of inflation. It is clear that as the number of wage reajustments per period increase and the h parameter approaches unity, the system converges to perfect indexation. In the limit, when h=1, the real wage is fully protected from inflation.

## 3 - Wage Policy and the Labor Market

Up to here we have modelled the Brazilian wage policy in a form appropriate for period analysis. However the wage policy defines only a "statutory wage" which in principle can be evaded by firms, either through voluntary wage increases in the upward side or through labor turnover in the downward side. The issue we must face now is the relationship between market wages and statutory wages. In other words, how much of the statutory wage readjustment is wiped out of actual wages by the market mechanism?

This of course is an empirical issue. Conventional Phillips curve analysis of the Brazilian experience (such as Lemgruber, Contador) implicitly assume that the wage policy does not matter at all for market wages. However, a recent empirical test of this hypothesis by Lara-Resende and Lopes produced the opposite result. It was found that for Brazilian industry in the period 1960-1978, prices can be explained by the cost of domestic and imported inputs plus the statutory wage. Cyclical variables that could account for discrepancies between statutory and market wages are not significant.

There are some plausible theoretical arguments in support of the idea that the wage policy in Brazil may be a very effective determinant of observed wage rates. First, labor turnover is a rather costly way to evade the statutory wage because of its negative repercussions on work force morale and productivity. (See Solow). On the other hand, upward real wage flexibility in response to cyclical factors is not likely to occur in a basically labor surplus economy. (This does not deny the possibility of a real wage drift as a result of labor productivity growth, which has apparently occurred in Brazil - see Bacha - Taylor). We may also invoke a "social custom" argument on the lines proposed by George Ackerloff: the wage policy establishes a norm that firms and workers find difficult to disobey because of loss of "reputation", even though there is an obvious cost associated with obeying it.

These seem to be good arguments as far as the formal segment of the labor market is concerned, that is, industry and the modern parts of services and agriculture. What can be said of the informal labor markets that characterize most of agriculture and a substantial part of the service sector? There is no presumption that the wage policy should be very effective there since workers in the informal sector of the economy are not typically registered workers, and therefore are not covered by the wage law. On the other hand, it is not clear that the informal labor market should be very sensitive to cyclical aggregate demand fluctuations. Perhaps the most plausible model for this segment of the labor market in Brazil is the traditional labor surplus economy model, which amounts to assuming that the real wage is constant over time (or at least responsive only to structural factors such as productivity in subsistence agriculture and the costs of migration). Hence, consideration of an informal labor market besides the formal labor market in which the wage policy is fully effective does not invalidate the inflation-real wage tradeoff (equation 13) derived in the previous section. To witness, let $w_f$ and $w_i$ be the nominal wage in the formal and informal sectors. Then:

$$\hat{w} = a\hat{w}_f + (1-a)\hat{w}_i = a(h\hat{p} + (1-h)\hat{p}_{-1}) + (1-a)\hat{p}$$

where $\underline{a}$ is the share of formal sector in wage bill, and $\hat{w}_i = \hat{p}$: the informal sector wage is perfectly indexed. It follows that:

$$w = v^* \, p^{ah+1-a} \, p_{-1}^{a(1-h)}$$

and therefore:

$$v = \frac{v^*}{\hat{p}^{a(1-h)}}$$

The relationship between wage policy and market wages in Brazil is still an open empirical issue deserving of further research. At the present stage of knowledge, it seems worthwhile to examine the implications for stabilization policy of the assumption that the wage policy is fully effective. (A similar approacha was adopted by F. Modigliani and T. Padoa-Schioppa in their analysis of 100% plus indexation in the Italian economy). This is done in the next two sections.

## 4 - A Growth-Inflation Model

This section develops a model that highlights the steady-state relationship between inflation and real output growth under the labor market assumptions of the previous section.

### A) Capacity Growth

Our first equation relates capacity growth to inflation as a result of two acummulative effects of inflation on savings and investment:

a) The Forced Savings Effect, a consequence of the inverse relationship between the real wage, and hence the wage share in national income, and the rate of inflation, that results from the wage policy. This implies that higher profits, savings and private investment are associated with higher inflation rates. (Cardoso, Lara-Resende, Taylor, Bacha);

b) The Inflation Tax Effect, a consequence of the fact that inflation works as a tax on real balances which finances government investment.1/ 2/ (Mundell)

To derive this equation we start by noting that, if we assume money illusion away, real private disposable income in an inflationary economy should be defined as real output minus taxes minus the inflation tax on real balances, 3/ that is:

(14) $y^d = y - T - \hat{p}m = L - T_L - \hat{p}zm + W - T_W - \hat{p}(1-z)m$

where Y, L and W are aggregate income, profits and wage bill, gross of taxes, $T_L$ and $T_W$ are taxes on profits and wages ($T = T_L + T_W$); m is real money supply and z is the share of it that is held by profit-earners. We simplify the argument assuming that z is constant.

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1/ In Brazil, the government is an important lender to the private sector, hence the inflation tax may end up financing private investment. In this context the term "government investment" should be understood as "government sponsored investment".

2/ In a growing economy the government also collects resources from the private sector as a result of monetary expansion, caused by the fact that people want to hold some fixed share of their wealth in monetary form, or to keep constant their real balances per unit of output. This however does not add anything to aggregate savings as it only implies a transfer of savings from the private to the public sector.

3/ See Foley-Sidrauski or Sargent. This concept of disposable income is equal to the maximum rate at which the private sector can consume while at the same time leaving its real wealth intact. Government bonds in the hands of the private sector are assumed to be fully indexed and hence inflation-proof.

Let the propensity to consume be $(1-s_W)$ for wages and $(1-s_L)$ for profits. It follows that private consumption is:

(15) $$C = (1-s_L)(L - T_L - \hat{p}zm) + (1-s_W)(W - T_W - \hat{p}(1-z)m)$$

and aggregate investment, from the national income identity, can be written as:

(16) $$I = Y - G - C = W + L - G - C$$
$$= s_L(L-T_L) + s_W(W-T_W) + (T_L + T_W - G) + \hat{p}md$$

where G is government consumption and $d = (1-s_L z-s_W(1-z))$ is the fraction of the inflation tax that reduces private consumption rather than private savings and thereby contributes to finance aggregate investment.4/

Dividing both sides of (16) by y we obtain a relationship for the investment rate according to:

(17) $$\frac{I}{Y} = s'_L - (s'_L-s'_W)bv + \emptyset + \hat{p}\theta d$$

where $s'_L=s_L(1-\frac{T_L}{L})$; $s'_W = s_W(1-\frac{T_W}{W})$, $bv=\frac{W}{Y}$ with b representing the labor income coefficient; $\emptyset = \frac{T_L+T_W-G}{Y}$ government savings as a share of aggregate income; and $\theta= m/y$ is the inverse of the income-velocity of money.

Assuming away capital stock depreciation, capacity growth therefore can be written as the following function of the inflation rate:

(18) $$g_k = \frac{I}{K} = \frac{I}{Y}\frac{Y}{Y}\frac{Y_k}{k} = \frac{x}{k}\left[s'_L - (s'_L-s'_W)\frac{b\ v^*}{(1+\hat{p})^{1-h}} + \emptyset+\hat{p}\theta d\right]$$

where $x=Y/Y_k$ is a measure of the degree of capacity utilization ($Y_k$ is full capacity output) and $k=K/Y_k$ is the

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4/ Both Cardoso and Taylor write the equation as $I=sL+I_G$ assuming that $s_w$ and $T_L$ are zero and that government investment $I_G$ can be computed from the fiscal budget $I_G+G-T_W= \frac{\Delta M}{P}$. This implies that private investment is equal to private savings out of profits, which ignores the facts that: a) the inflation tax reduces private savings (as d is less than one) through its effect on real disposable profits $(L-\hat{p}zm)$ and b) the accumulation of real balances, in order to maintain the real money-output ratio in a growing economy, is financed by private savings and hence crowd out private investment - this is just a transfer of savings from the private to the public sector.

capital-output ratio. As usual, we assume that $s'_L > s'_W$. In this equation we have substituted the real wage v by the inverse function of the rate of inflation derived in equation (13).

To simplify the argument we assume that both the labor-output ratio (b) and the capital-output ratio (k) are constant. We also assume that the income-velocity of money is an increasing function of the rate of inflation, hence:

(19) $\theta = \theta(\hat{p})$; $\theta' < 0$

Equation (18) defines a relationship between capacity growth and the inflation rate such as that represented by the KK curve in Figure 4. Capacity growth increases with inflation as a result of both the forced savings effect (associated with private investment) and the inflation·tax effect (associated with government investment). There is however an upper limit for the rate of capacity growth - shown as $\bar{g}$ in the figure - because as inflation increases the real wage decreases hence the forced savings effect tends to disappear, also the income velocity of money increases eventually annihilating the inflation tax effect (that is, at high inflation rates the product $\hat{p}\theta$ will be negatively rather than positively related to $\hat{p}$).

B) Effective Demand and Capacity Utilization

So far we have concentrated on the supply side of the model. On the demand side, for simplicity we have real output growth (g) given by:

(20) $\hat{M} = \hat{p} + g + \hat{\theta}$

where $\hat{M}$ is the exogenously given rate of growth of nominal money, and $\hat{\theta}$ is negatively related to the acceleration of inflation (see equation 19). Any discrepancy between capacity and real output growth will, by definition, produce a change in the degree of capacity utilization:

(21) $\hat{x} = g - g_k$

where $\hat{x}$ indicates the percentage variation in the capacity utilization index x.

Equation (20) is a short-cut effective demand function that ignores problems associated with the monetary transmission mechanism. We have buried in it a short-run investment function, an explicit consideration of which would introduce autonomous velocity shocks in equation(19).

C) Price Dynamics

The disequilibrium dynamics of the economy is basically determined by its inflation dynamics. Equation 11 gives the nominal wage indexation system,

$\hat{w} = h\hat{p} + (1-h)\hat{p}_{-1}$

We assume a price equation of the form:

(22) $\hat{p} = \hat{w} + j(x-\bar{x})$

where j is a positive constant and $\bar{x}$ is the normal capacity utilization rate, which we take as exogenously given. The responsiveness of the aggregate mark-up to the excess capacity utilization term $(x-\bar{x})$ reflects the existence of a flex-price sector in the economy (mostly agriculture and commerce in Brazil). It follows that:

(23) $\hat{p} = \hat{p}_{-1} + b(x-\bar{x})$ with $b = j/(1-h)$

This is a difference equation on the rate of inflation, with dynamic implications that can be illustrated by considering points such as "a" and "b" on the left-hand part of Figure 4. At all points on the left of the vertical line above the normal capacity utilization rate $\bar{x}$ inflation is accelerating, while to the right of this line the rate of inflation is falling. Inflation will remain constant over time only when the economy is in a position on the vertical line.

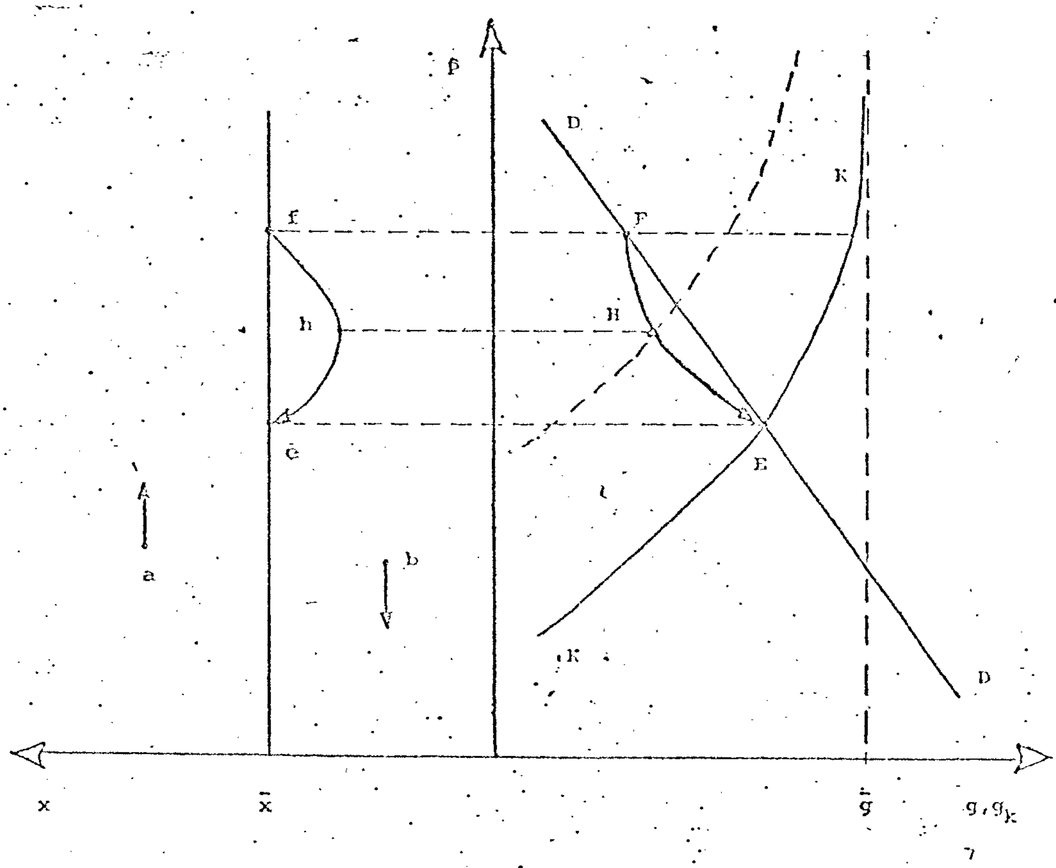


FIGURE 4

TABLE 1: THE GROWTH-INFLATION MODEL

CAPACITY GROWTH:

(18) $g_k = \frac{x}{k}\left[ s'_L - (s'_L - s'_W)\frac{bv^*}{(1+\hat{p})^{1-h}} + \emptyset + \hat{p}\theta d \right]; \quad s'_L > s'_W$

MONEY VELOCITY:

(19) $\theta = \theta(\hat{p}); \quad \theta < 0$

REAL OUTPUT GROWTH:

(20) $\hat{m} = \hat{p} + g + \hat{\theta}$

CAPACITY UTILIZATION:

(21) $\hat{x} = g - g_k$

PRICE DYNAMICS

(23) $\hat{p} = \hat{p}_{-1} + b(x - \bar{x}); \quad b = j/(1-h), \; j > 0$

## 5 - Working of the Model: Equilibrium and Stability

Table 1 summarises the growth-inflation model. A steady state equilibrium will be characterized by a constant rate of inflation, hence $x=\bar{x}$, therefore $\hat{x}=0$ and $g=g_k$. We must also have $\hat{\theta}=0$. It follows that an equilibrium position can be identified in Figure 4 by the intersection, such as in point E, of the KK curve, which is constructed from the capacity growth equation with $x=\bar{x}$, with the DD curve, which results from the real output growth equation when $\hat{\theta}=0$. To each equilibrium position, such as point E on the right-hand side of the figure, there corresponds a point, such as e, on the vertical line above $\bar{x}$ on the left-hand side of the figure.

The dynamic stability of the model can be analysed by considering a situation in which the economy finds itself at position (F,f) out of the equilibrium (E,e). The gap FG in Figure 4 indicates the excess of capacity growth over output growth which must cause a continuous fall in the capacity utilization index. But as soon as this index moves below its normal value $\bar{x}$, the rate of inflation also begins to fall continuously over time. Since this by its turn produces a continuous decrease of the income-velocity of money (or a positive $\hat{\theta}$), it follows that as long as the rate of inflation is falling, the economy must stay under the DD curve, as shown by the FHE path in Figure 4.

On the left-hand side of the figure the dynamic path of the economy is represented by the fhe line. The path bends back toward the equilibrium locus above $\bar{x}$ at point h. This happens because a fall in the capacity utilization index shifts the KK curve leftwards (as shown by the capacity growth equation (18)), so eventually the economy moving along its disequilibrium path must reach a point, such as H in Figure 4, where real output growth becomes greater than capacity growth, and thereafter the capacity utilization index declines continuously. The economy will in the end land at the equilibrium position. In Figure 4 we illustrate a non-oscillatory convergence to equilibrium, but we may as well have a disequilibrium path in the form of a convergent spiral.

## 6 - Stabilization Policy Issues

In this section we use the growth-inflation model to discuss some stabilization issues. We want particularly to focus on the problems of designing a stabilization plan for a high inflation developing economy.

### A) Costs of Orthodox Stabilization Policy

We consider first the consequences of an orthodox stabilization plan that concentrates only on reducing the rate of growth of nominal money supply. The consequences of such a policy are illustrated in Figure 5. The initial

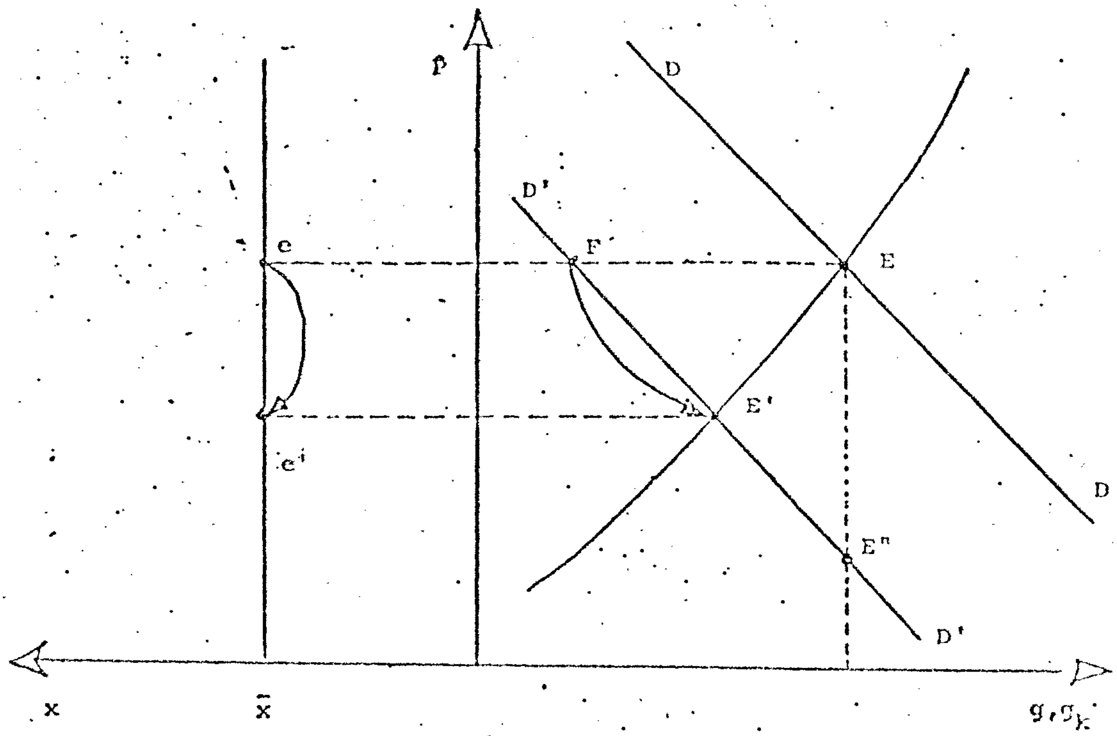


FIGURE 5

effect of a leftward shift in the DD curve is a reduction of output growth as the economy jumps from point E to point F; in a second stage, as the rate of inflation falls over time, the growth rate moves up again. A new equilibrium is reached at point E', but with a permanent reduction in the growth rate of the economy.

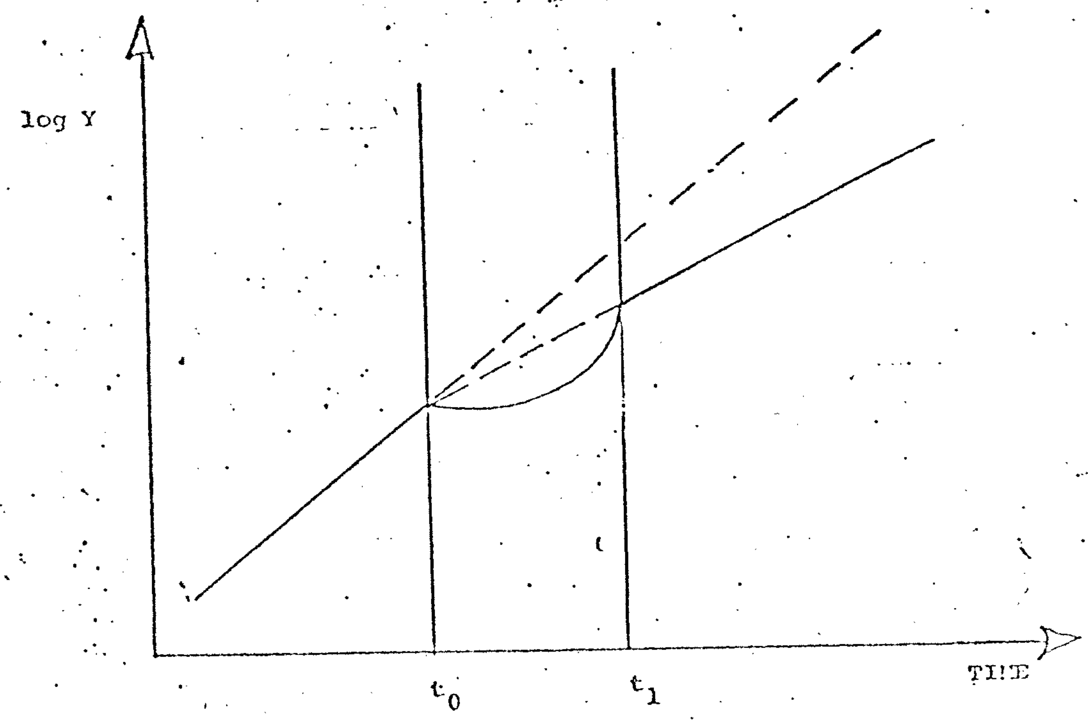


FIGURE 6a

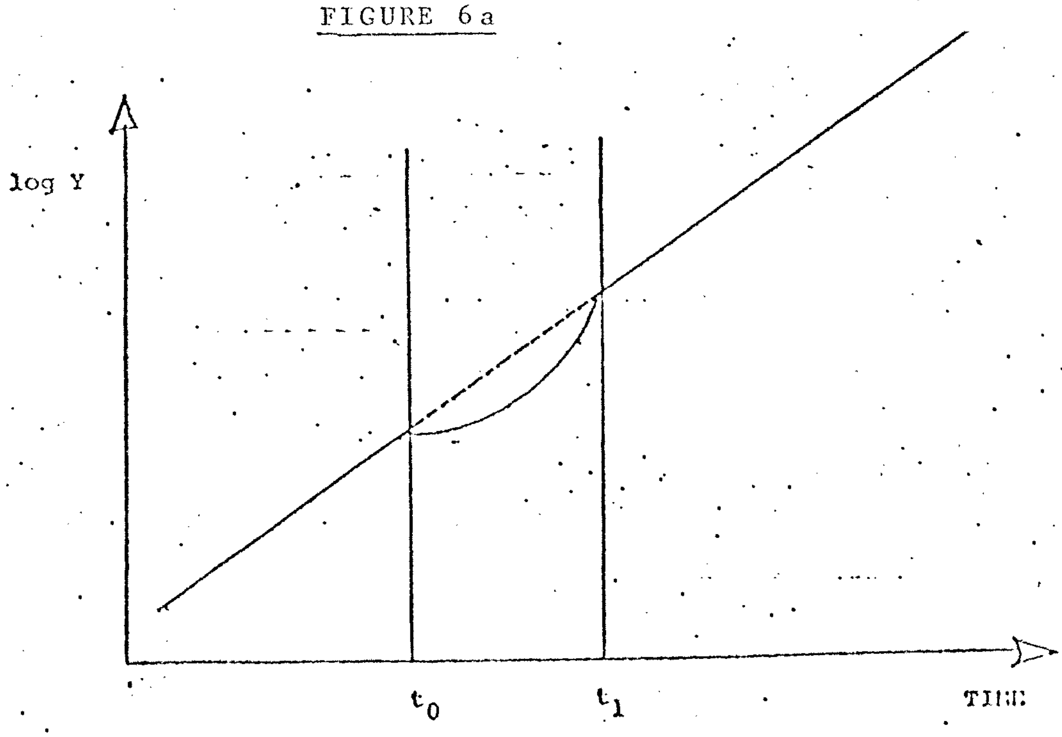


FIGURE 6b

Figure 6a corresponds to Figure 5: before time $t_0$ the economy is in steady-state equilibrium; at $t_0$ money growth is permanently reduced and as a consequence there follows a period of time, between $t_0$ and $t_1$, in which real output is below its normal capacity utilization level, which produces an upside-down bubble in the path of real output. After $t_1$ a new equilibrium position is reached and the output path once more coincides with the normal capacity utilization path but, since the rate of growth of capacity has been reduced, this path has now suffered a downward twist. The gap between actual output and the output level that would have been reached if the stabilization policy had not been implemented will be increasing over time.5/

It is clear in Figure 6a that a monetary deflationary shock will ceteris paribus produce in our model not just the usual temporary recession bubble - as in Figure 6b -,

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5/ To obtain a rough estimate of the slope of the KK curve, and hence of the reduction of capacity growth rate associated with a given decrease in the rate of inflation, we note that:

a) According to Mundell, if velocity is a linear function of the rate of inflation, the inflation tax effect can only produce an increase of 1.5 percentage points in the growth rate when the rate of inflation goes to infinity. A reduction of the inflation rate from, say, 100% to 50% per year would cost a growth rate fall of less than one quarter of a percentage point.
b) Assume $x(s'_L - s'_W)/k = 0,2$. If wages are indexed on a semester basis (hence $h=0,25$), and the initial wage share in aggregate income is 60%, a reduction of the inflation rate from 100% to 50% per year will cause the growth rate to fall by four-fifths of a percentage point (The wage share increases to 64%).

Hence, a fifty percentage points fall of the rate of inflation from an initial value of 100% per year, will produce a permanent reduction in the rate of growth of real output of around one percentage point. Should we conclude, as Mundell does, that this effect is very small? From the standpoint of an economy like Brazil, that finds itself on a 100% a year inflation path and wants to desinflate, the perspective of a permanent one percentage point loss in its growth rate potential may be very discouraging.

but also a permanent loss in the economy's growth potential. This last effect can be eliminated if we abandon the ceteris paribus clause above and assume the monetary shock to be associated with a fiscal reform that increases government savings as a share of aggregate income (our $\emptyset$ parameter). As a consequence of this the KK curve will shift to the right and a new post-desinflation equilibrium may be reached at point E rather than at E' in Figure 5. In this case the growth rate is not permanently reduced and the output path over time is as shown in Figure 6b.

B) Role of Wage Indexation

How does wage indexation affects the costs of an orthodox stabilization plan? We have shown in section 2 that more wage indexation (that is, more frequent wage readjustments) imply larger values for the h parameter in wage equation (11). In the limit case of perfect wage indexation, h=1.

Consider now the price equation (23) rewritten as:

(24) $(1-h)\ (\hat{p} - \hat{p}_{-1}) = j\ (x-\bar{x})$

It is clear that h=1 implies $x=\bar{x}$, hence $\hat{x}=0$ and $g=g_k$. This means that the economy will always be in steady-state equilibrium, at some point of intersection of the DD and KK curves. It is important to not that as we move from a position with h<1 to another with h=1 the average real wage will increase for any given inflation rate. Consequently, the KK curve will rotate leftwards with pivot on its intersection with the horizontal axis, as private savings will be lower than before for any given inflation rate. This redistributive effect of introducing full wage indexation can be compensated for by a negotiated reduction of the wage target v* so as to leave the real wage constant for a given rate of inflation. In practice this can be achieved by negotiating a nominal wage increase somewhat lower than past inflation in exchange for full wage indexation henceforward. In the diagram, this means that the KK curve will rotate leftwards with pivot on its original intersection point with the DD curve.

The consequences of full wage indexation are that, first, the recession bubble of Figure 6a completely disapears, as the economy must now move along the vertical line above $\bar{x}$ in Figure 5; and, second, that the forced savings effect is eliminated, since with perfect indexation the real wage stays constant over time. Only the inflation tax effect remains operative in this case, but of course we know that this effect is rather small (as shown by Mundell). The conclusion is that a distributional neutral increase in the intensity of wage indexation will tend to reduce the output losses resulting from a monetary deflationary shock - which is the well-known proposition by Milton Friedman.

Stan Fischer and Jo Ann Gray have shown this proposition to have a counterpart which says that more perfect indexation increases the vulnerability of the economy to supply shocks. To illustrate this we rewrite equation (22) as:

$$(25) \quad \hat{p} = \hat{w} + j(x-\bar{x}) + e$$

where e reflects the impact of a supply shock on the inflation dynamics. Assume now that monetary policy is fully accomodative in the sense of making $g=g_k$ and $x=\bar{x}$ all the time. In this case equation (23) may be rewritten as:

$$(26) \quad \hat{p} = \hat{p}_{-1} + \frac{e}{(1-h)}$$

which shows that if h=1 any positive supply shock, no matter how small it is, will throw the inflation rate immediately to infinity. A way out of this real shock vulnerability problem is to cheat on the price index used in the wage indexation formula or, as done in Brazil recently, to use selective price controls to manipulate the cost-of-living index which goes into the wage formula. Let the wage equation be:

$$(27) \quad \hat{w} = h\hat{p}^c + (1-h)\hat{p}_{-1}$$

where $\hat{p}^c = \hat{p} - e(1-h)/h$ is the rate of variation of the price index "cleaned" of supply shocks repercussions. From equation (27) we derive exactly the same price dynamics equation (23) as was obtained before on the assumption of no supply shocks, which means that in this case supply disturbances have no effect on the economy's inflation dynamics. An undesirable consequence of this policy is that wage earners absorb fully the impact of any supply shock. Macroeconomic stability is achieved at the cost of less equity.

Attention should be called in this contex to the fact that a supply shock may affect not only the inflation dynamics but also the position of the KK curve, which with full wage indexation now is nearly vertical. For example, an open economy extension of our model would indicate that a deterioration of the terms of trade in the form of higher oil prices not only would add a once for all supply schock to the inflation rate dynamics as in (26), but would also bodily shift the KK curve to the left. In this case, the growth rate of potential output could be maintained only through a savings-increasing internal income redistribution (barring further growth of the rate of increase of external indebtedness).

## C) Fighting Inflation Through Capacity Expansion

Economists always twist their noses when they hear what seems to be businessmen's favorite policy prescription to end inflation: increase production. Our model seems to give some qualified support to this apparently nonsensical proposition.

Consider Figure 7 where the economy is originally at equilibrium position E. Suppose monetary policy adjusts passively to any change in the economic situation in order to maintain real output growth at its initial level g*.

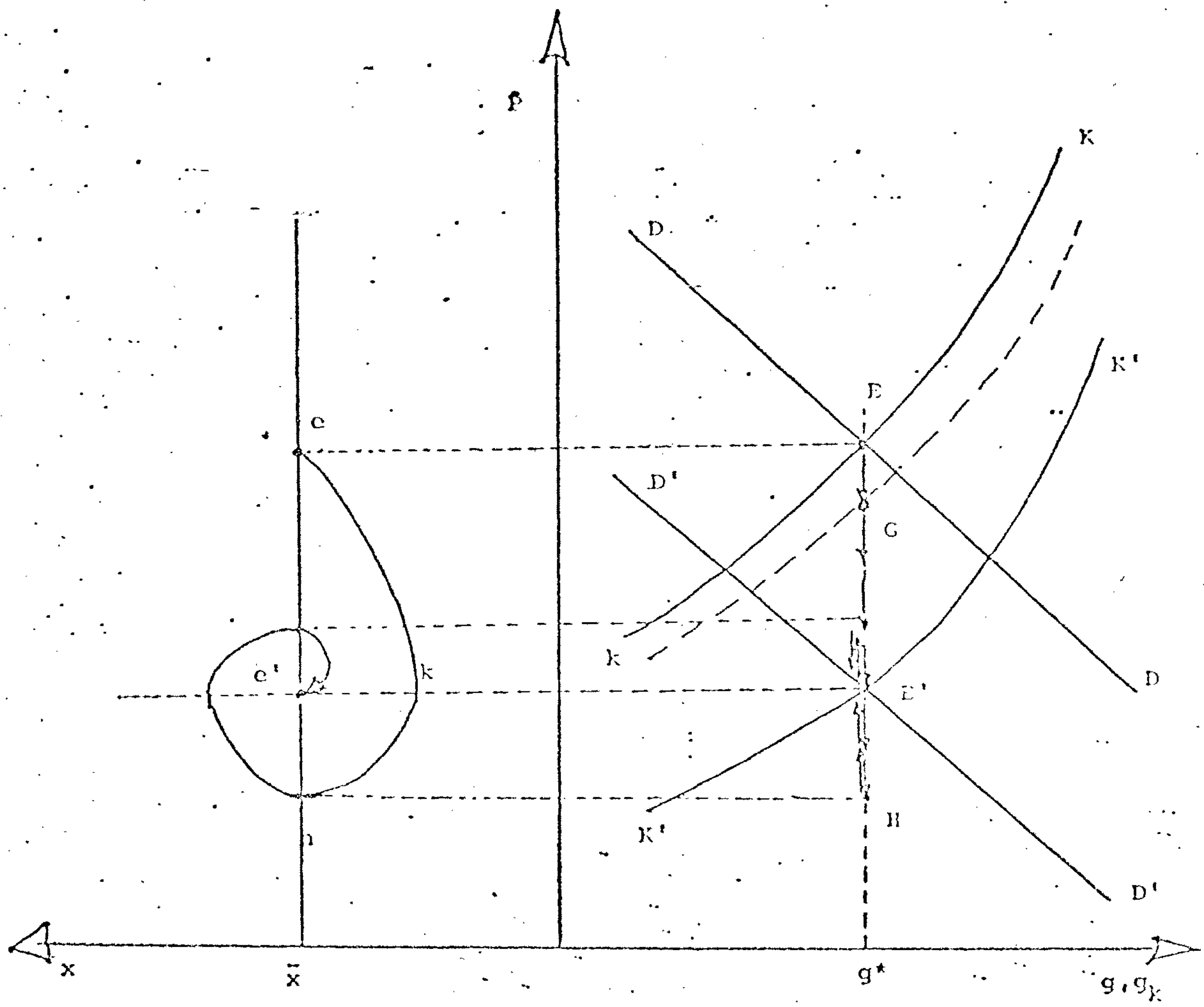


FIGURE 7

Think now of a policy action that shifts the KK curve to the right. This could be obtained by a fiscal reform that increases government savings relative to aggregate income (Ø goes up in the capacity growth equation 18) or by policies that increase productivity of capital (a fall in k) or labor (a fall in b).

Hence capacity growth rate increases (as measured by point f) while actual output growth remains, by virtue of the passive monetary policy, at its original level g*. The consequence is a continuous fall in the capacity utilization index which produces a fall in the rate of inflation. The economy will move to a new steady-state equilibrium position E' through a convergent spiral. As inflation goes down the economy will eventually reach point E' for a first time, but since capacity utilization will still be below normal at this stage (as shown by point k in the lefthand side of figure 7), it will not stay there but rather will go on falling until point H is reached, at which point the capacity utilization index will have been restored to its normal value. After this point, the rate of inflation will go up, again past E' and so on over time through a process of damped oscillations.

The new equilibrium position of the economy is given by the intersection of the new KK curve with the vertical line above the growth rate level g*. Since monetary policy is passive the DD curve will simply adjust itself to the dynamic process described above. The rate of growth of real output is maintained at its original level (hence the output path in Figure 6b will be a straight line without any recession bubble), while the rate of inflation is reduced as a consequence of the increased rate of growth of capacity which forces the capacity utilization index down. Since the KK curve is probably very steep in the real world (see footnote 5, page 23), any small rightwards displacement of it will produce a large reduction in the rate of inflation without any real output loss.

This surprising result is a logical consequence of two basic assumptions of our model: first, that the inflation process is affected by deviations of capacity utilization from its normal value and, second, that by contrast investment and capacity growth are unaffected by the degree of capacity utilization. What looks queer in the story told by Figure 7 is that the rate of investment and capacity growth stay at high levels in the transition period in spite of a continuously decreasing rate of capacity utilization.

We can circumvent this unrealistic feature of our model without losing its stability properties introducing the additional hypothesis that the savings rate out of profits change in response to deviations of actual from capacity growth, that is:

(28) $\Lambda s_L = \lambda(g-g_k)$ , $\lambda>0$

Savings out of profits are mainly in the form of retained earnings. Firms retain profits in order to finance part of the equity share of new investments, thereby increasing their capacity of production. If, however, capacity is growing ahead of effective demand, new investments will be less profitable, and firms will want to accumulate less and consequently the rate of savings out of profits will be reduced.

Including equation (28) in our growth-inflation model produces less optimistic results from the exercise examined in Figure 7, because now the initial rightwards displacement of the KK curve will tend to be neutralized over time by the depressing effect on the savings rate of the excessive growth in capacity. Hence the final equilibrium position for this exercise would be a point such as G rather than E', that is, the rate of inflation would still be reduced by policies that increase the rate of growth of capacity but the magnitude of this effect could be small. 6/

6/ With the hypothesis of equation (28) the output cost of an orthodox stabilization plan would also be dramatically increased.

## 7 - Conclusion

We conclude that conventional Phillips curve analysis may be inadequate to study stabilization problems in the Brazilian economy, characterized by a system of wage indexation that largely determines the actual wage dynamics. In this sense the paper is very similar to Modigliani-Schioppa, although their argument is framed in more static terms than ours.

Besides this negative conclusion, the paper builds on previous work of Brazilian economists to propose a tentative outline of an alternative macroeconomic paradigm for the study of stabilization policies in Brazil.

We argue that a "stabilization crisis" (Simonsen) is not necessarily the main cost of an orthodox anti-inflation program: the potential output growth rate may be permanently reduced as a consequence of such policies. Barring the adoption of a wage squeeze to avoid the growth reducing consequences of a monetary control program, we study the idea of promoting stabilization through full wage indexation, and also consider businessmen's favorite prescription of fighting inflation through capacity expansion.

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