THE RATIONAL BASIS OF WAGE DETERMINATION
IN REGIMES OF HIGH INFLATION

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Summary:

In this paper we address the logics of wage determination in a regime of high and accelerating inflation, and the rational basis of 'overindexation' of wages. In section 2 we present the steady state inflation model which provides the basic relations between the rate of inflation, the indexation period, and the real wage. In sections 3 and 4 we discuss the incentives and costs of overindexation, respectively. In section 5 the determination of the 'optimal' level of wage adjustment is presented. Section 6 examines the role of the degree of centralization of negociations on the incentives and costs of overindexation. Section 7 deals with the relation between uncertainty and overindexation. In section 8 we discuss the dynamic interrelations between the length of the indexation period, overindexation and inflation. Section 9 provides the basic lessons to be drawn from the analysis.

Resumo:

Neste trabalho tratamos da lógica da determinação dos salários em um regime de inflação alta e acelerada, e da base racional da 'sobreindexação' dos salários. Na seção 2 apresentamos o modelo estático de inflação em que se determinam as relações básicas entre a taxa de inflação, o período de indexação e o salário real. Nas seções 3 e 4 discutimos os incentivos e custos da sobreindexação, respectivamente. Na seção 5 a determinação do nível ótimo de ajuste de salários é apresentada. A seção 6 examina o efeito à sobreindexação. A seção 7 lida com a relação entre incerteza e sobreindexação. Na seção 8 discutimos as interrelações dinâmicas entre a duração do período de indexação, da sobreindexação e da inflação. A seção 9 lista as lições básicas a serem traçadas a partir desta análise.

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1. Introduction

The conventional wisdom on the relation between inflationary processes and income distribution is that as inflation accelerates, real wages tend to fall. The reason for this is that money wages are usually indexed to inflation with a lag. This, of course is only a half truth. Some wages are only partially indexed to past inflation and others are fully indexed to past inflation which imply that in both cases (in the first more than in the second) real wages do fall as inflation accelerates. But there are groups of workers whose money wages are 'overindexed' in relation to past inflation, and therefore not only fuel the acceleration of inflation, but also increase in real terms over time.

Where labor unions are combative and workers very militant, money wages may grow ahead of inflation. Unions are said to be 'irresponsible' when trying to overindex wages for what they are actually doing is creating inflationary pressures which eventually will reduce their real wage. If instead wage restrain was the rule, the rate of inflation would fall, and the purchasing power of wages would increase. This, again, is only a half truth. If there was a coordinated process of wage determination, in which all wages were adjusted to inflation simultaneously, and if firms agreed to keep their profit margins constant, the rate of inflation would remain constant, and also real wages wage differentials would remain constant. If, furthermore, firms accepted to reduce their profit margins, inflation would fall, and real wages would increase.

But usually wages are not determined simultaneously (wage bargains are scattered over the year) and firms do not have any commitment with a fixed mark-up. Indeed, uncertainty concerning the outcome of negotiations elsewhere in the economy is an essential feature of wage bargains in decentralized systems. Not only the effect of the indexation of wages in one firm or industry upon the rate of inflation is not usually taken into account by the negotiating union, but even if it was, it would be rational in may circumstances to overindex wages in relation to past inflation. Rational in the sense that it might increase the real wage, or at least protect it from unexpected inflationary shocks.

In this paper we address the logics of wage determination in a regime of high and accelerating inflation, and the rational basis of overindexation. Unions look at the inflationary effects of overindexation of wages only to the extend that it might reduce their real wages. Hence, to assume that unions see inflation as a 'bad' in itself is misleading. Here, we shall assume that unions face incentives and costs to increase the degree of indexation of wages, and that only to the extent to which the marginal benefits are greater than the marginal costs, will the level of indexation increase. If the result of the wage bargain is inflationary, in principle, this should not be seen as a concern of the unions.

There are institutional as well as structural factors accounting for the costs and incentives of overindexation. Given the institutions and the structural factors, it is hopeless trying to impose

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wage restrain on unions. Two important institutions in this respect are the degree of centralization of wage bargains and the length of the indexation period of wages. The organization of unions and the degree of mobilization of workers are also quite important. The structural variables are those which affect the market constraints faced by firms in the goods market such as the level of protection in relation to foreign competitors and the size of barriers to entry in a certain industry.

The paper is organized as follows. In section 2 we present the steady state inflation model which provides the basic relations between the rate of inflation, the indexation period, and the real wage. In sections 3 and 4 we discuss the incentives and costs of overindexation, respectively. In section 5 the determination of the 'optimal' level of wage adjustment is presented. Section 6 examines the role of the degree of centralization of negotiations on the incentives and costs of overindexation. Section 7 deals with the relation between uncertainty and overindexation. In section 8 we discuss the dynamic interrelations between the length of the indexation period, overindexation and inflation. Section 9 provides the basic lessons to be drawn from the analysis.

2. The Basic System

The aim of this section is to laid down the basic relations between the indexation period, wage and price determination and distributive variables. The model assumes that negotiations between unions and firms (or groups of firms) take place once a year in the same day, but separately, so that parties in different bargaining tables do not know what is going on in other negotiations. This is meant to reproduce the case in which negotiations are not synchronized (that is, they are spread over the year). The hypothesis that they take place in the same moment simplifies the model.

Over the year, ie between two negotiations, there are N adjustment periods. At the end of each of them, wages are fully indexed and the real wage recovers the peak value of the first day after the negotiation.[2] Over adjustment periods, firms are assumed to increase prices at a fixed rate in order to recover the peak profit margin at the end of the period. Given these assumptions, real wages fall linearly over the period.

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2. *We assume that there is a wage policy which guarantees that at the end of each indexation period wages are fully adjusted.*

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The steady state inflation environment can be described as follows. At the end of each indexation period, wages in all sectors are fully indexed to the average rate of inflation:

1. $\qquad w_{j,\psi} = p_\psi$

where $w_{j,\psi}$ and p_ψ are wage in sector j and average price level variations over the typical indexation period. Over the indexation period, prices in all sectors change to reestablish the peak profit margin,

2. $\qquad p_{j,\psi} = w_{j,\psi} = p_\psi$

Taking the year as the unit time period, the length of the indexation period is given by ψ = 1/N where N is the number of indexation periods per year. The relation between the rate of inflation in the indexation period and the annual rate of inflation is given by

3. $\qquad 1 + p_t = (1 + p_\psi)^N = (1 + p_\psi)^{1/\psi}$

The annual rate of wage inflation and of prices in all sectors as a function of the average rate of inflation are given by:

1'. $\qquad 1 + w_{j,\psi} = (1 + p_t)^\psi$

and

2'. $\qquad 1 + p_{j,\psi} = (1 + p_t)^\psi$

The average real wage over an indexation period (and the year for that matter) will be given by peak wage deflated by the average rate of inflation of the indexation period:

4. $\qquad \omega_{j,t} = \Omega_{j,t} / (1 + p_\delta)$ where $\delta = \psi/2 = 1/2N$

or in terms of the annual rate of inflation,

4'. $\qquad \omega_{j,t} = \Omega_{j,t} / (1 + p_t)^\delta = \Omega_{j,t} / (1 + p_t)^{\psi/2}$

This equations shows quite clearly that, as noted by Ros (1988), the average real wage depends on the peak wage (as determined during the wage bargain), the annual rate of inflation and the indexation period.

Wage Bargaining and Price Determination

' Wages in each sector j are negotiated once a year, and the new money wage in the first day of year $t+1$ will be indexed to past inflation according to parameter λ, so that:

5. $\qquad W_{j,t+1} = W_{j,t} (1 + \lambda_j p_t) = (1 + \lambda_j p_t) \quad$ making $W_{j,t} = 1$.

Equation 5 implies that the annual variation in the wage is

5'. $\qquad w_{j,t} = \lambda_j p_t$

The indexation parameter λ_j is at least equal to 1 given the assumption that wages are at least fully adjusted to past inflation. Firms are assumed to wait until the negotiation is over to start changing prices in face of the change in their costs. Accordingly, they alter the rate of inflation over the first indexation period after the wage bargaining. At the end of the first indexation period in year $t+1$ (that is, at $t+1+\psi$), the price level in sector j will be given by:

6. $\qquad P_{j,t+1+\psi} = P_{j,t+\psi} (1 + \varepsilon_j w_{j,t}) = (1 + \varepsilon_j \lambda_j p_t)$

making $P_{j,t+\psi} = 1$, where ε_j is the indexation parameter of the price in relation to variations in the wage. The annual variation of the price level in sector j by the end of the first indexation aperiod in $t+1$ is

7. $\qquad p_{j,t+1+\psi} = \varepsilon_j \lambda_j p_t$

The average price level, assuming there are two sectors in the economy, is a weigthed average of the price level in sectors 1 and 2:

8. $\qquad P = P^{\alpha}_1 * P^{\beta}_2 \qquad\qquad \alpha + \beta = 1$

The annual average rate of inflation at $(t+1)+\psi$ is given by:

9. $\qquad p_{t+1+\psi} = (\alpha \, \varepsilon_1 \, \lambda_1 + \beta \, \varepsilon_2 \, \lambda_2) \, p_t$

By the end of the first indexation period, wages will have been eroded according to the ratio

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between the price level in $(t+1)+\psi$ and the price level at the end of year t. The assumption of full indexation of wages hence imply:

10. $\qquad 1 + w_{j,\psi} = P_{t+1+\psi} / P_{t+1} = 1 + p_{t+1+\psi}$

and, the assumption of full recovery of the profit margin at the end of each indexation period imply that

11. $\qquad 1 + p_{j,\psi} = 1 + p_{t+1+\psi}$

After the first indexation period, the system is reproduced according to the steady state inflation model described above. Indeed, equations 10 and 11 apply not only to the first indexation period but to all such periods over the year. Accordingly, the annual rate of inflation will be given by

12. $\qquad 1 + p_{t+1} = [\alpha (1 + p_{1,\psi}) + \beta (1 + p_{2,\psi})]^{1/\psi} = (1 + p_\psi)^{1/\psi} = (P_{t+1+\psi} / P_{t+1})^{1/\psi}$

The annual rate of inflation can be decomposed in two factors: one expressing the annual rate of inflation at the end of the first indexation period -- $1+p+\psi$ -- and another expressing the rate of inflation over the first indexation period of year $t+1$:

13. $\qquad P_{t+1+\psi} / P_{t+1} = (P_{t+1+\psi}/P_{t+\psi}) * (P_{t+\psi}/P_{t+1}) = (1 + p_{t+1+\psi})(P_{t+\psi}/P_{t+1})$

As a result of the relation between the rates of inflation over the year and indexation periods under the assumption of constant inflation, the following equation ensues:

14. $\qquad P_{t+\psi}/P_{t+1} = (1 + p_{t,\psi})^{\psi-1}$

Equations 10 to 14 give rise to the following equation for the annual rate of inflation in year $t+1$:

15. $\qquad 1 + p_{t+1} = \{[1 + (\alpha\varepsilon_1\lambda_1 + \beta\varepsilon_2\lambda_2)p_t] * [(1 + p_{t,\psi})^{\psi-1}]\}^{1/\psi}$

It seems clear from this equation that the rate of inflation will accelerate between years t and $t+1$ when $(\alpha\varepsilon_1\lambda_1 + \beta\varepsilon_2\lambda_2) > 1$.

The average rate of inflation over $t+1$ depends on the peak real wage, the average rate of inflation over a typical indexation period and the length of the indexation period. The peak real wage in sector j is given by:

16. $\Omega_{j,t+1} = (1 + \lambda_j p_t)/(1 + p_t)$

since wages in the first day of the year are adjusted to past inflation according to parameter λ_j and prices did not yet adjust to the changes in wage costs. Based on equations 3 and 15, the average rate of inflation over a typical indexation period $t+1$ becomes:

17. $1 + p_\delta = \{[1 + (\alpha \varepsilon_1 \lambda_1 + \beta \varepsilon_2 \lambda_2)p_t] (1 + p_t)_{\bullet-1} \}^{1/2}$

Equations 15 to 17 give rise to the equation of the average real wage over year $t+1$ under the assumption of constant inflation:

18. $\omega_{j,t+1} = (1 + p_t)^{-\delta-(1/2)} (1 + \lambda_1 p_t) [1 + (\alpha \varepsilon_1 \lambda_1 + \beta \varepsilon_2 \lambda_2)p_t]^{-1/2}$

It seems quite clear that the average real wage of workers in sector j depend not only on the peak wage but also on the rate of inflation both function of the the indexation parameter negotiated between the union and the firm (or firms) in sector j.

< <Figure 1> >

In figure 1 we depict the movement of the log of the real wage over time. Steady annual inflation implies that the log of the real wage falls linearly over indexation periods. At the end of each indexation period the wage recovers its peak value. Once a year, the wage bargain defines a new peak real wage, and after that, depending on the indexation paramenters of wages and prices, a new rate of inflation is determined. For a given length of the indexation period, the average real wage will depend on the peak wage and the rate of inflation. The real wage in year $t+1$ in figure 1 is greater than in the previous year: the peak real wage is greater than in year t, and although inflation accelerated, it offset the increase in the peak wage only partially.

3. The Incentives for Overindexation

In order to understand de incentives of a union to increase the indexation parameter, we will concentrate on the negotiations between the firm (or firms) and the union in sector 1. We assume that the union in sector 1 will look at the other negotiating unions and firms as an homogeneous group. Accordingly, the union will form an expectation of the size of the indexation parameters ε_2 and λ_2, and their product will be represented in what follows by $\varepsilon_2^e * \lambda_2^e = \phi$.

The union also has to form an expectation of the indexation parameter to be applied to wage changes by the firm or firms with which it is negotiating as well. The union recognizes that a smaller indexation parameter increases the real wage, and depending on certain costs and incentives associated with the bargaining process, will impose conflict costs on firms in order to reduce the

indexation of prices. However, the union cannot be expected to know what the indexation parameter ε_1 will actually be, and therefore, will be assumed to form a point estimate of it to which we will refer as ε_1^e.

Given the estimated values of ε_2 and λ_2 and ε_1, and the length of the indexation period, the incentive to increase the indexation parameter of wages in sector j will depend on the effect of changes in λ_1 on the average real wage. Both the peak wage and the rate of inflation are positively affected by an increase in λ_1. However, it is possible to show that after a certain level of λ_1, the effect of an increase in it will have a positive effect on the average real wage. This is so because the effect over the peak after a certain point dominates the negative effect through the rate of inflation.

The effect of changes in the indexation paramenter over the average wage is given by the partial derivative of the latter in relation to the former:

18. $\quad \partial \omega_{1,t+1}/\partial \lambda_1 = [(1 + p_t)^{-\delta-(1/2)} (1 + p_{t+1+\psi}) p_t]$ * $\{1 - [\frac{1}{2} (1 + \lambda_1 p_t) \alpha \varepsilon_1^e] / [(1 + p_{t+1+\psi}]\}$

This expression will be positive for λ_1 greater than

19. $\quad \lambda_1^* = [\frac{1}{2} \alpha \varepsilon_1^e - 1 - \beta \phi p_t] / [\frac{1}{2} \alpha \varepsilon_1^e p_t]$

The critical vaue λ^* will in general be smaller than 1.[3] The second derivative of the real wage in respect to the indexation parameter shows that the relation is concave for λ_1 larger than:[4]

20. $\quad \{1.5 \alpha \varepsilon_1^e - 2 [1 + (1 - \alpha) \phi p_t] / [\frac{1}{2} \alpha \varepsilon_1^e p_t] = \lambda_1^{**}$

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[3]. *The condition for $\lambda_1^* < 1$ is that*

$\quad \alpha \leq (1 + \phi p_t)/([\frac{1}{2} \varepsilon_1^e (1 - p_t) + \phi p_t]$

which, remembering that $\alpha < 1$, will hold if $\varepsilon_1^e (1 - p_t) \geq 2$. This condition will be satisfied in general. Only if $p_t < 1$ and ε_1^e is exceptionaly large, the condition will not hold.

[4]. *The second derivative is given by:*

$$\partial^2 \omega/\partial \lambda_1^2 = \frac{1}{2}\alpha \varepsilon_1^e p_t (1 + p_t)^{-\delta-(1/2)} (1 + p_{t+1+\psi})^{-(3/2)} *$$

$$* \{1.5 \alpha \varepsilon_1^e (1 + \lambda_1 p_t) - 2[1 + (\alpha \varepsilon_1^e \lambda_1) + (1 - \alpha)\varepsilon_1^e] p_t]\}$$

and that $\lambda_1^{**} < \lambda_1^*$ for the relevant values of the parameters. [5]

Figures 2a and 2b show the relation between the average real wage and the indexation paramenter in sector 1 for the cases in which $\lambda_1^{**} < \lambda_1^*$ and $\lambda_1^{**} > \lambda_1^*$, respectively. In what follows we assume that the former case is the realevant one.

< <Figures 2a and 2b> >

As noted already we assume that wages are at least fully adjusted to past inflation which implies that the $\lambda_1 > 1$. We are interested in the incentives to the unions to negotiate an increase in the indexation parameter above 1. It seems obvious that, in general, the incentives exist. In what follows we discuss the factors which would qualify this general conclusion.

4. The Limits of Overindexation

Unions will face costs in order to increase the indexation paramenter above 1. These costs will be greater or smaller depending on the effect such an increase would have on the profit margin of the firm (firms) with which the union negotiates and on the support of workers or the level of militancy during negotiation periods.

The basic constraint faced by the firm when negotiating with the union is its capacity to mark-up increases in costs. We assume that in order to maintain its share of the market, the firm (or firms) cannot increase its (their) price above a certain limit. Of course, if the price grows less than the 'limit rate of inflation', the firm's share of the market will increase. We represent the contraint faced by the firm with the following relation:

$$p_{1,t+1} = \varepsilon_1 \, \lambda_1 \, p_t \leq p^*$$

where p^* is the limit rate of inflation. This equation implies

21. $\qquad \varepsilon_1 \, \lambda_1 \leq k = p^*/p_t$

5. $\lambda_1^{**} < \lambda_1^*$ when

$\alpha < (1 + \phi p_t) / (\varepsilon_1^e + \phi p_t)$

which again will hold except when ε_1^e assumes exceptionally large values.

The size of the constraint is essentially affected by two variables. One is the degree of centralization of negotiations. It is assumed that the higher the level of aggregation of negotiations within the industry, the smaller the constraint. The reason for this is that when firms operating in a same industry negotiate side by side with an union, their costs rise equally, and threfore the risks of losing market shares associated with different cost conditions become smaller. Also, the elasticity of demand of a set of goods which are substitutes is smaller than the elasticity of individual goods. It is reasonable to assume that the constraint falls until negotiations reach the industry or branch level. As represented in Figure 3, k would increase until the share of the negotiating group in the economy's output reaches α^*, the share of the industry 1 in the formation of the aggregate price level.

< <Figures 3 and 4> >

The other variable affecting the constraint is the aggregate excess demand conditions of the economy. It is assumed that if the economy is in a recession, the limits to increase the market share of an individual firm become greater.

Thus, constraint k is really a function of the level of negotiations (α) and the average degree of capacity utilization of the economy (U). Equation 21 can be re-written to consider these effects:

21'. $\qquad \varepsilon_1 \leq k(\alpha, U) / \lambda_1$

We will take the k constraint exogenously, and assume that firms have full knowledge of the trade-off between the parameters ε_1 and λ_1. Figure 4 depicts this trade-off. The maximum level of ε_1 associated with a certain value of λ_1 is given by the curve $\varepsilon_1 = k/\lambda_1$ but the firm may chose to operate at a point inside the shaded area, such as point A, in order to increase its share of the market. If the market constraint falls (due to an increase in the level of wage bargain or an increase in capacity utilization), the k frontier shifts to the right, and the trade-off between ε_1 and λ_1 becomes less stringent.

The average profit margin of firm j in year t+1, as defined by the ratio of its price to the wage, is given by the product of the peak profit margin and the average rate of inflation of the price of goods produced in the firm over a typical indexation period:

22. $\qquad p_{1,t+1} = [(1 + p_t) / (1 + \lambda_1 p_t)] \{1 + \varepsilon_1(\lambda_1)p_t] (1 + p_t)^{\Psi-1}\}^{1/2}$

$\qquad\qquad\qquad\qquad$ peak profit $\qquad$ average inflation
$\qquad\qquad\qquad\qquad$ margin

The indexation parameter of the price is inversely related to the indexation paramenter of the wage if we assume that firms operate on the k curve in figure 4, that is if we assume that the equality holds in equation 21'. Indeed, under this assumption, $d\varepsilon_1 / d\lambda_1 = - \varepsilon_1 / \lambda_1$. Hence the derivative of the profit margin with respect to the indexation parameter of the wage, λ, is given by:

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23. $\quad dp_j/d\lambda_1 = -\rho j,t+1p_t \{\frac{1}{2}(\varepsilon_1/\lambda_1)(1 + \varepsilon_1\lambda_1 \ p_t)_{-1} + (1 + \lambda_1 p_t)_{-1}\} < 0$

In figure 5 we depict the curve relating the profit margin to the indexation parameter of the wage (panel A) and the realtion between the indexation parameters of the wage and the price (panel B). An increase in the wage indexation parameter is associated with a lower price parameter and a lower profir margin. If the market constraint becomes stronger (lower k), the profit margin associated with a given wage indexation parameter becomes smaller.

< <Figure 5> >

If the union wants to increase the indexation parameter of wages it will obviously face the opposition of the firm (firms). If we assume there exists a profit margin which the firm considers 'normal' (say, from a long run perspective), attempts by the union to increase money wages will face an increasing willingness of the firm to impose conflict costs on the union. The willingness to impose conflic costs of the firm can therefore be seen as a function of the gap between the 'normal profit margin' ($\rho*$) and the margin associated with different levels of the wage indexation parameter and the market constraint:

24. $\quad C_F = G[\rho* - \rho_{j,t+1} (\lambda_1, k)] \quad$ with $G_\lambda > 0$ and $G_k < 0$

On the side of the union, its capacity to impose conflict costs on the firm depends on the support it has from the workers. If there are reasons for the latter to be disatisfied with their real wage or the prospects of their real wage over the year after the bargain takes place, they will tend to back up the union's conflicting attitudes. In some circumstances they may even push the union into a more conflicting attitude.

The real wage curve based on which the incentives to increase the indexation parameter of wages are determined take as given certain expected or estimated values for the indexation parameters of wages and prices in other sectors (ϕ), the indexation parameter of the firm (ε_1^e) and the length of the indexation period (δ). Of course, once the idexation parameter of wages is fixed, any unexpected change in the values of ϕ, ε_1 or δ will lead to a real wage different from the expected. In particular, as shown by the partial derivatives which follows, an increase in the value of any of the three variables will lead to a reduction of the real wage as compared with the planned wage:

25. $\quad \partial\omega_{j,t+1}/\partial\delta = - \omega_{j,t+1} \ln (1 + p_t) > 0$

26. $\quad \partial\omega_{j,t+1}/\partial\varepsilon_1^e = - \frac{1}{2} \omega_{j,t+1} \alpha\lambda_1 p_t (1 + p_{t+1+\psi})^{-1} < 0$

27. $\quad \partial\omega_{j,t+1}/\partial\phi = - \frac{1}{2} \omega_{j,t+1} \beta p_t (1 + p_{t+1+\psi})^{-1} < 0$

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In face of a greater probability that the indexation parameters of wages and prices elsewhere in the economy will be greater than expected ($\lambda_2 \varepsilon_2 > \phi$), and/or that the length of the indexation period may increase, the workers' disatisfaction will increase, as will their support for an more agressive attitude of the union.

The relation between the actual real wage and the planned real wage over year $t+1$ depends on the relation between the actual and expected rates of inflation. If we assume that the actual rate of inflation is a random variable with normal distribution, mean $(1 + p_{t+1})$ and a standard deviation (σ); and that the union has rational expectations, in the sense that it assumes that the average rate of inflation will prevail when bargaining with firms, the relation between the actual and expected rates of inflation then becomes a random variable, normally distributed, with mean 1 and fixed standard deviation:

28. $$(1 + p_{t+1}) / (1 + p_{t+1}^e) = \tau (1, \sigma)$$

where p_{t+1}^e is the expected average rate of inflation. Given all the the information available to it, we may assume that, on average, the union will correctly predict the rate of inflation, and the expected and actual real wage will coincide.

When the actual value of variable τ is different from one, the actual and real wages will differ. Given the indexation parameter of wages in sector 1, the ratio of the planned real wage (based on an expected value of $\lambda_2 \varepsilon_2$ and ε_1) to the actual real wage (based on the actual values of the same variables) will be a positive function of the value assumed by τ and the length of the indexation period:

29. $$\omega(\phi, \varepsilon_1^e) / \omega^a(\lambda_2 \varepsilon_2, \varepsilon_1) = f[\tau(1, \sigma), \delta] \quad \text{with } f_\tau, f_\delta > 0$$

When $\tau > 1$, the actual real wage (ω^a) will be smaller than the expected wage. The longer the indexation period, the greater the difference. It is a consensual stylized fact concerning inflationary processes, that the variance of the rate of inflation increases with the rate of inflation, that is, that σ is a positive function of $p_t p$. If this is indeed the case, then it becomes quite reasonable to expect that the probability of forming mistaken expectations of the rate of inflation on the part of the union would increase as inflation accelerates.

The greater the variance of the rate of inflation, the higher the probability of an unexpected gap between the actual and the estimated real wage, and the greater the likelyhood of workers being willing to support preempive actions on the part of the union. These actions would aim a reduction in the profit margin of the firm or firms, or in other words, a change in the sharing out of the level of indexation of wages and prices consistent with the market constraint. Workers will not have any guarantee that the firm will in fact reduce its margin, but might be prepared to increase the confict costs for the firm in order to force it to share the admissible level of indexation of wages and prices.

In face of these consideranda, it will be assumed that the willingness of workers to impose conflicting costs on the firm (C_W) is positively related to the gap between the expected and the

actual real wage -- a gap which is likely to be different from zero when the variance of the rate of inflation is positive, and to increase as the variance increases and the length of the indexation period becomes longer:

30. $$C_W = H[\omega_{1,t+1} - \omega_{1,t+1}^a] = H\{\omega_{1,t+1}[1 - 1/f(\sigma, \delta)]\}$$

with H_σ, $H_\delta > 0$. The combination of the workers' and firm's willingness to impose costs on each other gives rise to a 'net cost function' of increasing money wages (or λ_1) for the union. The greater the likelyhood of an acceleration of inflation over the year and the longer the length of the indexation period, the greater the incentives to workers to impose conflict costs on the firm in an attempt to force the latter to reduce its profit margin. But the greater the increase in money wages, given the market constraint, the smaller the profit margin. The net cost for the union to increase the indexation parameter of the wage will therefore be positive function of the difference between the willingness of firms to impose costs on workers and the willingness of workers to impose costs on the firms:

31. $$\mu = \mu[C_F(\lambda_1, k) - C_W(\sigma, \delta)]$$

Equation 31 gives rise to a positive relation between the net cost and the wage indexation parameter, as depicted in figure 6.

< <Figure 6> >

The curve will shift upwards the greater the market constraint, and the smaller the variance of inflation or the shorter the length of the indexation period.

5. The Optimal Indexation of Wages

The union in sector 1 will consider the incentives and costs to increase the indexation of wages in order to decide on the optimal level of indexation. On the one hand, it will consider the effect of changes in the indexation parameter on the real wage based on estimated values of the indexation parameters of wages and prices elsewhere in the economy, the indexation parameter of the price in sector 1 and the length of the indexation period. On the other hand, it will consider the costs of increasing wages based on the net effect of the willingness of firms to impose conflict costs on workers (an increasing function of the indexation of wages and the goods market constraint), and the willingnes of workers to impose conflict costs on the firm (an increasing function of the variance of inflation and the length of the indexation period).

The union will, in short, maximize the difference between the benefits (or incentives) of increasing the indexation of the wage (as measured by the increase in the expected real wage associated with the increase in the money wage) and the costs associated with it, that is:

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32. $\quad$ Max $\quad \omega(\lambda, \varepsilon_1^e, \phi, \alpha, \delta) - \mu(\lambda_1, k, \sigma, \delta)$
$\quad\quad\quad \lambda_1$

The optimal level of the indexation parameter must satisfy the following condition:

33. $\quad \partial\omega(\lambda_1)/\partial\lambda_1 = \partial\mu(\lambda 1)/\partial\lambda_1$

< <Figure 7> >

The equilibrium configuration is depicted in figure 7. The exogenous variables of the system are: the expected values of indexation parameters of wages and prices (including the parameter of price indexation in sector 1), the length of the indexation period, the goods market constraint, the variance of the rate of inflation, and the share of sector 1 in the economy's output and labor force. The endogenous variables are the indexation parameters of the wage and the price in sector 1 and the profit margin in sector 1. The actual real wage will of course depend on the actual values of the indexation parameters and the actual length of the indexation period.

It should be noted that wages are at least fully indexed to the rate of inflation and that, therefore, we should refer to the optimal level of 'overindexation' rather than indexation.

6. The Degree of Centralization of Negotiations

How does the level of centralization of negociations affect the optimal level of indexation of wages? To answer this question we must consider the way it affects the benefits and net costs of overindexation. An increase in the level of negotiations reduces the goods market constraint and hence reduces the net costs of overindexation of wages. The cost curve shifts downward as shown in figures 8a and 8b.

In order to evaluate the effect of an increase in the size of sector 1 on the incentive for overindexation we look at the derivative of the real wage (as estimated by the union) in relation to the size of the sector:

34. $\quad \partial\omega/\partial\alpha = -\Omega_{1,t+1} [\tfrac{1}{2}(\varepsilon_1^e\lambda_1 - \phi)p_t (1 + p_t)^{\psi-1} (1 + p_{t+1})^{-(3/2)}]$

This expression is positive for $\varepsilon_1^e\lambda_1 < \phi$, and vice-versa. This implies that for $\lambda_1 < \phi$ $/\varepsilon_1^e$, an increase in the size of sector 1 will lead to a higher real wage. Because we know that the ω (λ_1) function is concave, the fact that the real wage curve associated with a larger size of sector

1 intercepts the curve associated with a smaller size of the sector from above implies that the incentive to overindex will always be smaller the larger the size of the sector. That is, it implies that $\partial(\partial\omega/\partial\lambda_1)/\partial\alpha < 0$.

The net result of an increase in the size of sector 1 will depend on the relative reduction of costs and incentives. In figures 8a and 8b we depict two alternative cases. If the costs fall more than the incentives, the optimal level of indexation will increase, and vice-versa.

< < Figures 8a and 8b > >

It is important to have in mind that what matters in the decision to fix the optimal level of indexation is not the actual real wage but the real wage as estimated by the union. This is particularly important in the case of increases in the relative size of the negotiating sector. If it is small and increasing, it may happen that the reduction in costs will be clearly perceived by the union (for firms will become more tolerant), but that the negative effect on the incentives will not be perceived. In this case, the level of indexation may well increase in a situation when it would be optimal for workers to reduce it.

Figure 9 depicts the case in which the union perceives the reduction in costs but do not realize that the incentives curve has also shifted. Therefore the pseudo-optimal indexation parameter is greater than what it would be had the unions perceived the change in incentives. As depicted in the figure, the indexation would have fallen if unions had noticed the reduction in incentives, but it actually increases.

< < Figure 9 > >

What matters therefore is the extent to which the unions and the workers become aware of the actual effect of overindexation on the rate of inflation. It is reasonable to assume that after a certain size of the negotiating sector is reached, it becomes more likely that the union will take notice of the inflationary effects of increasing the indexation parameter.

Begining at very low levels of aggregation of negotiations, as the size of the negotiating sectors increases, the perceived costs will fall more than the perceived incentives, and therefore the level of indexation will increase. For very low levels of aggregation, unions may simply not see any effect of an increasing level of aggregation on the real wage. Only when a certain level of aggregation is reached it is reasonable to assume that unions will become aware of the effects of their actions over the rate of inflation, and therefore the real wage.

In a system in which negotiations are completely centralized, not only the effects of overindexation of wages on inflation will be immediately perceived but also the effect of the overindexation of prices. In such circumstances, therefore, the limits of overindexation of both wages and prices become very clear, and the result will probably be a reduction in the level of indexation as compared with situations in which the level of negotiations is smaller.

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7. Uncertainty and Overindexation

When discussing the costs to the union of overindexation, we noted that they might react to changes in the variance of the rate of inflation. In situations when the rate of inflation is accelerating very fast --as it did in many Latin American economies over the 1980's -- the uncertainty concerning the path of inflation in the future (even the near future) becomes quite great. It becomes difficult for agents to anticipate the likely trajectory of inflation. For agents whose indexation periods are flexible (as in the case of firms), the danger of unexpected changes in relative prices are not so important. But in the case of unions, because wage bargains only take place one (or at most two or three) time(s) a year, the growing uncertainty concening the future rate of inflation implies an increasing risk of unexpected reductions in real wages.

In regimes of high and accelerating inflation, workers know by experience that, in general, wages fall more than what they expected at the time of the last negotiation. It is just rational therefore to take preempive measures. We know from the last section that if the negotiation sector is large enough, the effects of overindexation are likely to be taken into account by the unions; but that in the case of small negotiating sectors, these effects might be completely overlooked. In the latter case, workers and unions migth see the effect of their wage bargain on the peak real wage only. If this is indeed the case in point, the disincentives associated with overindexation are underestimated, and the only relevant limits to overindexation are the conflict costs of increasing the indexation parameter.

< <Figure 10> >

In fact, the assumption that workers do not see the actual effects of overindexation is not required to show that the optimal level of indexation will increase when uncertainty increases. In section 4 we argued that the willingness of workers to impose conflict costs on firms increases when the variance of inflation increases, and that this would reduce the net costs of overindexation for the union. Hence, an increase in the variance of inflation would tend to reduce the costs of overindexation but would not affect the incentives function. As shown in figure 10 this would be enough to imply an increase in the indexation parameter. If in addition we assume that workers overlook the desincentives of overindexation, the indexation parameter will be still greater.

8. The Dynamics of Inflation, Indexation and the Indexation Period

As noted in section 4, the longer the indexation period, the greater the reduction of the real wage associated with any inflationary shock. As inflation accelerates, unions tend to demand reductions in the indexation period in order to reduce the negative impact of shocks on the real wage. Indeed, a stylized fact of inflationary processes is the reduction of the indexation period as the rate of inflation increases.

When the prospects of shocks become greater -- and they usually do when inflation accelerates -- and the indexation period is long, the willingnes of workers to impose conflict costs on firms becomes greater. In fact, there is very little that unions can do individually to protect the purchasing power of the real wage. They do not have any influence over the levels of indexation of wages and prices in other sectors of the economy. However, they do have some influence on the

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profit margin of the firms negotiating with them. The unions do not know the actual level of profit margins to be practiced by firms, but they know that given the goods market constrainst, firms will be sensitive to increasing conflicting costs.

The greater the negotiating sector, and the smaller the goods market constraint, the greater will be the overindexation levels of wages and prices consistent with a given share of the market. Hence, unions in these circumstances will have an incentive to force firms to reduce their profit margins, in order ot increase their real wage.

The effect of a reduction in the indexation period is,'ceteris paribus, to reduce the willingness of workers to impose conflict costs on firms, and therefore to increase the net costs for the union of increasing the indexation parameter of wages. On the other hand, the effect on the incentive to overindex is positive, as the following equation attests:

35. $\partial[\partial\omega/\partial\lambda_1]/\partial\delta = -(\delta + \frac{1}{2})(\partial\omega/\partial\lambda_1)\ln(1 + p_t) < 0$

Incentives increase because the impact of an increase in the indexation parameter on inflation becomes smaller with a shorter indexation period. Hence, in principle at least, the net effect of a reduction in the indexation period is ambiguous. The final result of a reduction in the length of the indexation period will depnd on the net effect of the increase in costs and incentives. Figure 11 depicts the case in which the increase in costs dominates the increased in incentives.

< <Figure 11> >

The increase in incentives may not be perceived at all (especially in the case of small negotiating sectors) in which case the likelyhood of the effects of increasing costs being dominant will increase. In fact, unions usually look at the length of the indexation period as a measure of the potential costs asociated with shocks. Even if the positive effect on the incentives actually exists, it would seem very unlikely that the unions would take notice of them.

The dynamic interelation of the rate of inflation of prices with the indexation period and the indexation parameters is given by the following equation derived from eqution 22:

36. $p_{1,t+1} = \varepsilon_1 \lambda_1(k, \delta)(p_{1,t}/p^*)^{1/\delta}$

If we assume that firms always operate at the limit of the market constraint so that $\varepsilon_1 = k/\lambda_1$, then the rate of inflation will certainly accelerate as the period of adjustment shortens. Given the market constraint, and hence $\varepsilon_1\lambda_1 = k$, and the average and peak profit margins in period t, the rate of inflation in period t+1 would accelerate if δ were to fall.

However, if we assume that the indexation parameter of wages tends to fall with reductions in the indexation period the picture migth be different. If firms, in face of the overindexation slack which would result from the reduction in the indexation of wages were to decide to use this oportunity to increase their market shares, the effect on inflation of a shortening of the indexation

period would, at least in principle, be ambiguous. Indeed, if starting from a situation in which $\epsilon_1\lambda_1 = k$, $\epsilon_1\lambda_1$ becomes smaller than k as the indexation period shortens, the effect on inflation of a reduction in may become negative.

This result may have important consequences for stabilization policies. One of the most frequent elements of stabilization policies is an attempt to increase in the indexation period. The aim is to force a reduction in the inflationary memory of the system, or the inertial factor. However, depending on the response of the agents the policy may backfire. If indeed, workers feel more vulnerable to shocks with a longer indexation period, their rational response will be to force an increase in the indexation parameter of their 'money wages, hence increasing the inflationary pressures.

The shortening of the indexation period is an important element in the reduction of the inertial componenets of inflation. This is not under dispute. However, the shortening process should be slow enough to keep agents reasonably secure in face of shocks. If, over the stabilization program, inflationary expectations fall, it becomes easier to speed up the shortening of the the indexation period.

9. The Distributive Aspects of Overindexation

There are three aspects of the distributive side effects of inflationary processes which are associated with the logics of wage overindexation. An obvious one is that the path of relative wages over time will depend on the indexation parameters of wages in different sectors. That is, at any point in time, the relative wages of workers in sectors i and j will be given by:

37. $$\omega_{j,t+1} /\omega_{i,t+1} = (1 + \lambda_j p_t)/(1 + \lambda_i p_t)$$

The second aspect refers to the relation between the path of relative wages and prices. In sectors in which the goods market constraints are smaller (as a result of barriers to entry, protencion from international competitors, or centralized bargaining), the level of overindexation of wages and prices consistent with the stability of market shares, is greater. Hence, it would be reasonable to expect that relative wages and prices in respect to the average in the same sector would move in the same direction; in other words, that the correlation over time between the movement of the relative wage and the relative price of a certain sector would be positive.

The last aspect refers to the movement of relative wages if and as the indexation period of wages becomes shorter. If we assume that full indexation is the minimum level of indexation in the economy, and that the indexation parameters in sectors in which unions are able to overindex wages fall as the indexation period shortens, it would be reasonable to expect a reduction in the dispersion of indexation parameters and real wages over time.

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10. Concluding Remarks

There are seven lessons to be drawn from the foregoing analysis:

1. The overindexation of wages can be seen as the result of a rational decision of unions, and therefore should not be seen as a cultural phenomenon of economies with high inflation, or as a desperate but irrational behaviour of workers.

2. There are congenial circumstances for the occurence of overindexation. In closed economies, or in sectors in which the barriers to entry are important or in which wage bargains are centralized, and threfore the goods market constraints are negligible, overindexation is likely to prevail.

3. The degree of overindexation is likely to increase as negotiations become more centralized at the industry level. Not only because costs may fall more than indentives fall, but also because workers may not see the reduction in incentives. The higher the level of negotiations the greater becomes the likelyhood of unions perceiving the reduction in incentives to overindex wages as the degre of centralization increases.

4. Increasing uncertainty over the future path of inflation, or the increase in the variance of the rate of inflation, tends to increase the willingness of workers to impose conflict costs on firms and hence reduce the costs to increase the indexation parameter for unions. The longer the indexation period, the greater the reduction in costs.

5. The shortening of the indexation period may reduce the optimal level of overindexation not only because it tends to increase the net costs for the unions to increase the indexation parameter, but also because workers may not perceive the increase in incentives which results from a shortening of the period of indexation.

6. Relative wages and prices tend to move in the same direction as a result of the effect of the goods market constraint in the willingness of firms to impose conflict costs on the union.

7. The shortening of the indexation period may have a dampening effect on the rate of acceleration of inflation and also in relative wage dispersion.

References:

Amadeo, E. 1990. "Bargaining Power, Mark-up Power and the Acceleration of Inflation in Brazil (1975-85)", Mimeo, Department of Economics, PUC-RJ.

Amadeo, E. and Camargo, J. M. 1989. "A Structuralist Model of Inflation and Stabilization", Discussion Paper n 212, Department of Economics, PUC-RJ.

Calmfors, L. and Driffill, J. 1988. Centralization of Wage Bargaining", Economic Policy, vol 6.

Canavese, A. 1982. "The Structuralist Explanation in the Theory of Inflation", World Development, vol. 10, n 7, pp. 523-529.

Dutt, A. 1987. "Alternative Closures Again-- a comment on 'Growth, Distribution and Inflation", Cambridge Journal of Economics, vol 11, n 1.

Freeman, R. 1988. "Labour Market Institutions and Economic Performance", Economic Policy, vol. 6.

Frenkel, R. 1979. "Decisiones de Precio en alta Inflacion",
Estudios Cedes, v. 2, n 3.

Lopes, F. 1986. O Choque Heterodoxo, Campus, rio de Janeiro.

Ros, J. 1989. "A Review of the Literature of Inflation and Stabilization", Mimeo, WIDER/UNU.

Taranteli, E. 1983. "The Regulation of Inflation in Western Countries and the Degree of Neocorporatism", Economia, vol. vii, n 2.

Taylor, L. 1991. Income Distribution, Inflation and Growth: lectures on structuralist macroeconomic theory, Mimeo, MIT.
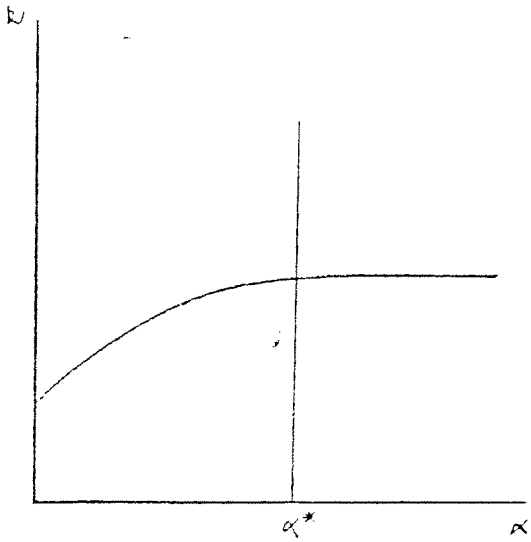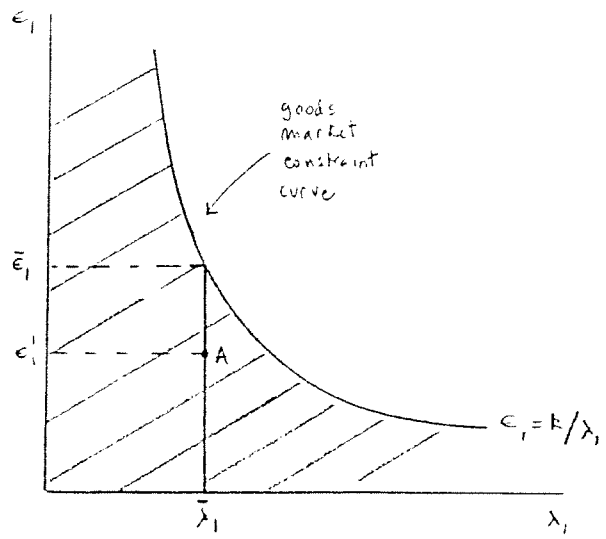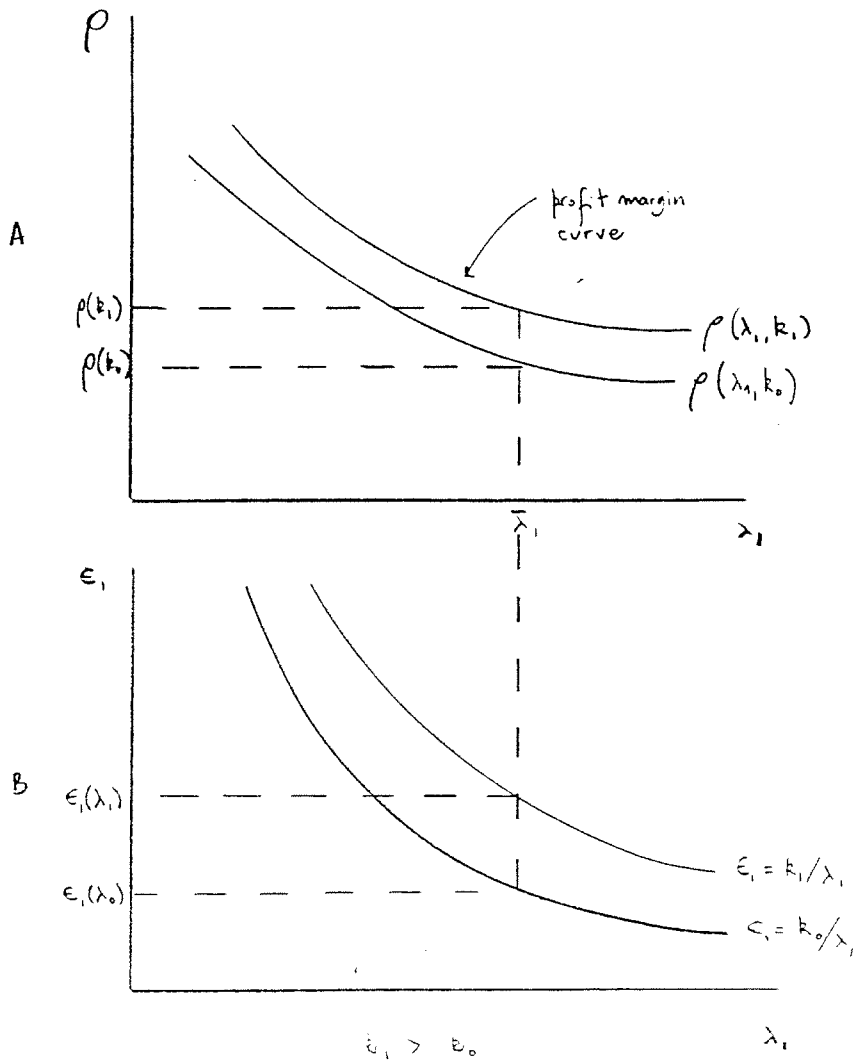
Figure 3

goods market constraint curve

$\bar{\epsilon}_1$

ϵ_1^1 A

$c_1 = k/\lambda_1$

$\bar{\lambda}_1$

Figure 4

ρ

A

profit margin curve

$\rho(k_1)$

$\rho(k_0)$

$\rho(\lambda_1, k_1)$

$\rho(\lambda_1, k_0)$

$\bar{\lambda}_1$

λ_1

ϵ_1

B

$\epsilon_1(\lambda_1)$

$\epsilon_1(\lambda_0)$

$\epsilon_1 = k_1/\lambda_1$

$c_1 = k_0/\lambda_1$

$k_1 > k_0$

λ_1
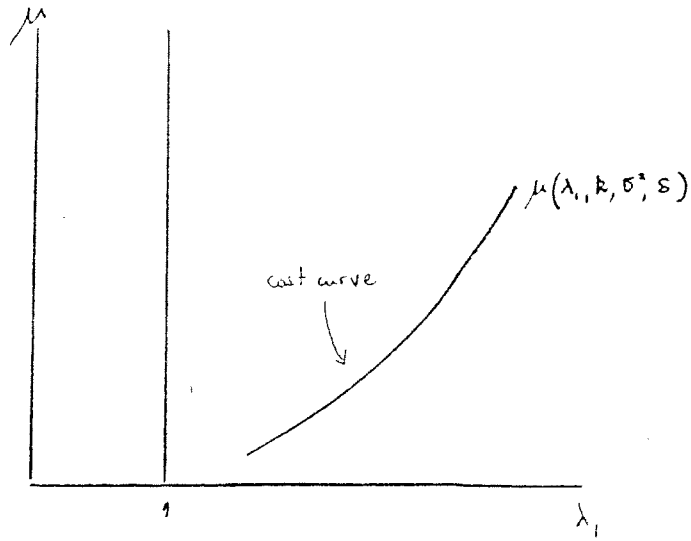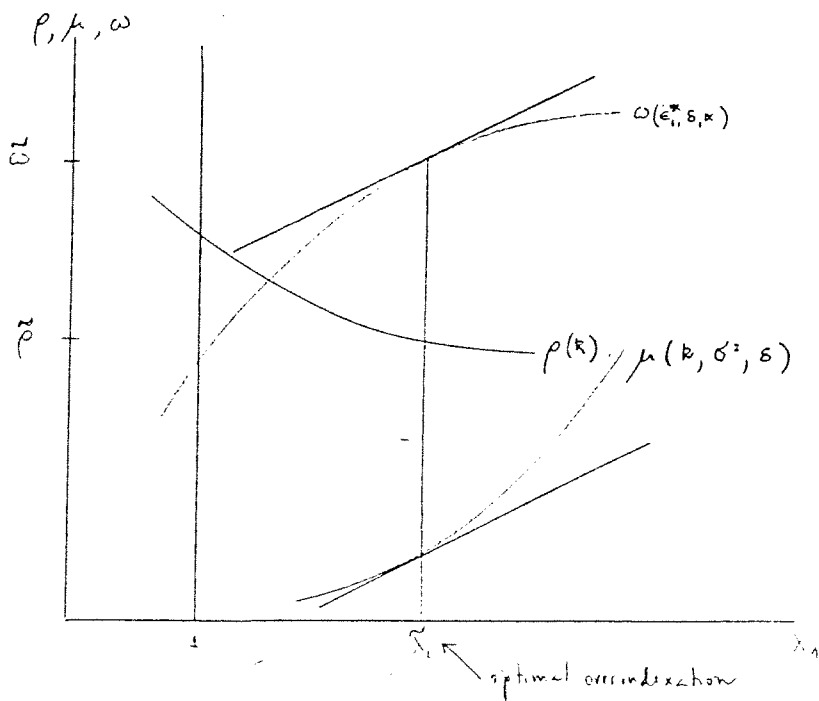
Figure 5

Figure 6

Figure 7
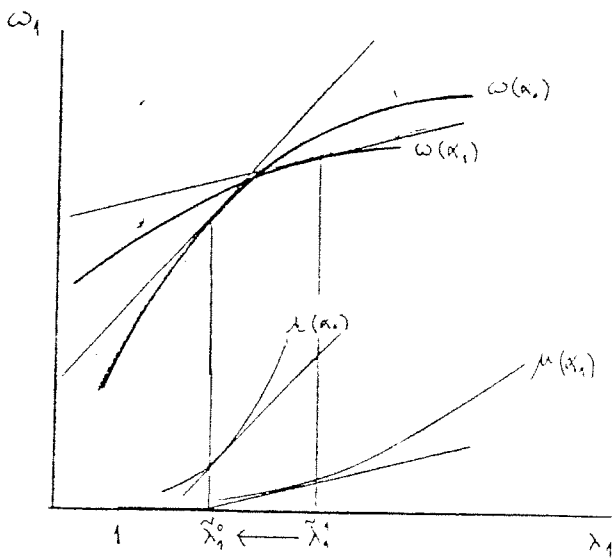
Figure 8a

$\alpha_1 > \alpha_0$

Figure 8b

$\alpha_1 > \alpha_0$

Figure 9

$$\delta_1^2 > \delta_0^2$$
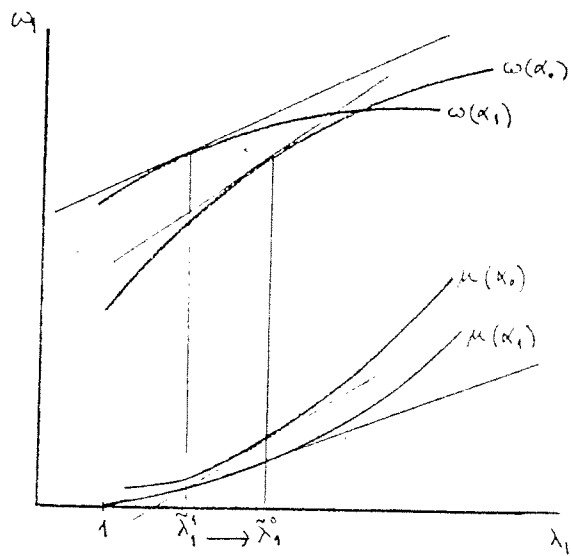
Figure 10

$$\delta_1 < \delta_0$$
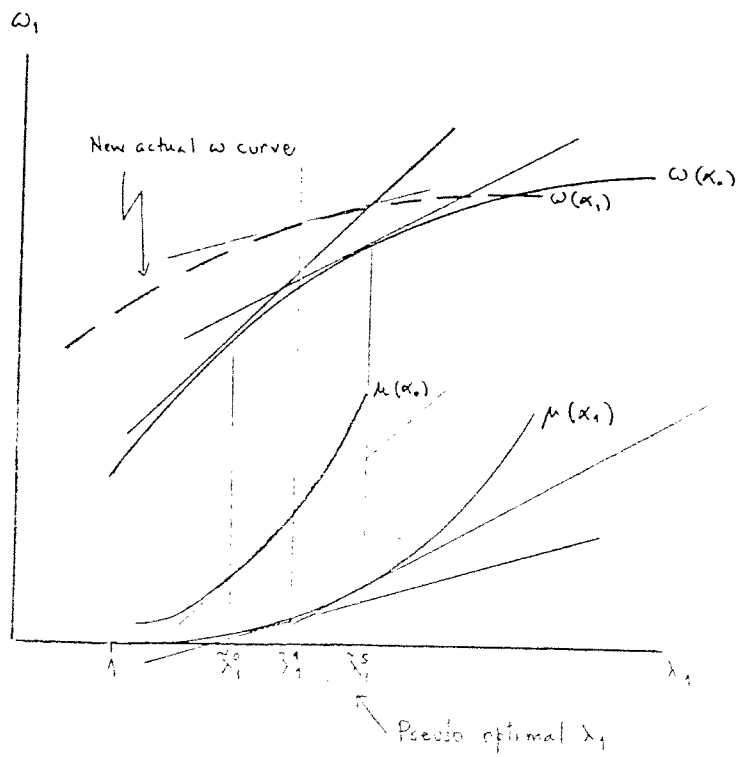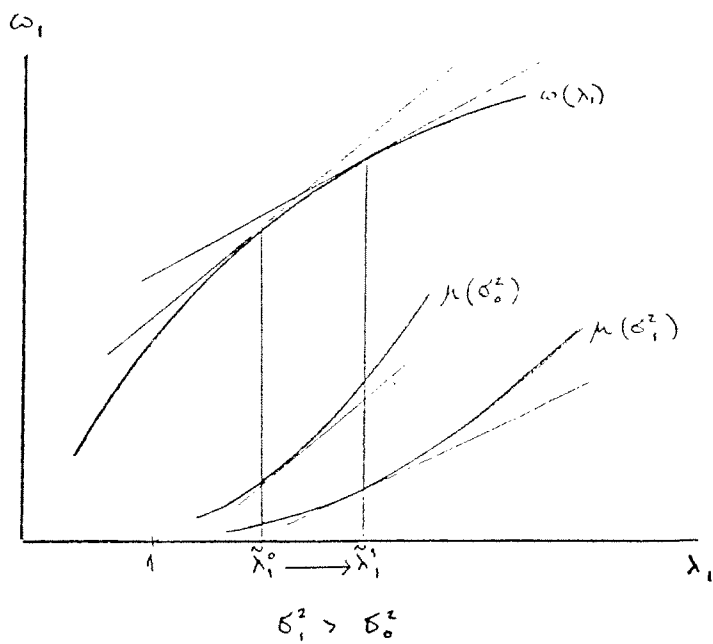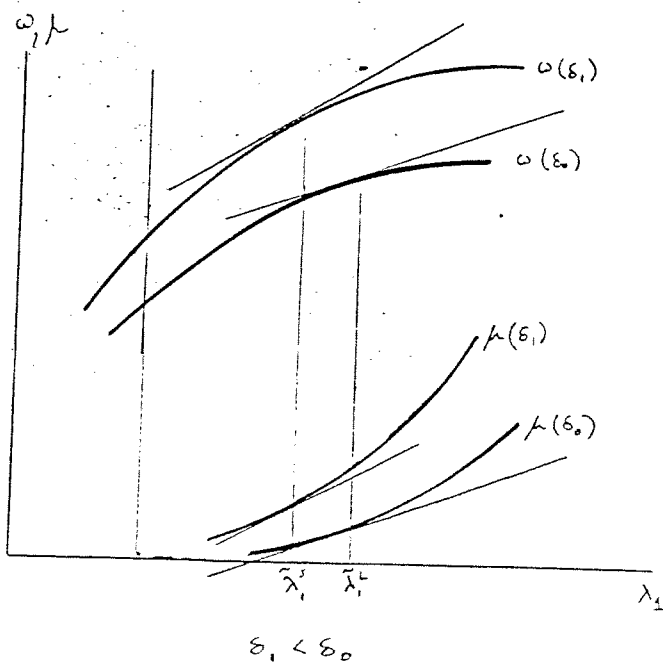
Figure 11

TEXTOS PARA DISCUSSÃO

230. Fritsch, W. e G.H.B. Franco, "Trade Policy, MNCs and the Evolving Pattern of Brazilian Trade, 1970-85".

231. Amadeo, E.J., "Desemprego: Teorias e Evidências sobre a Experiência Recente na OECD".

232. Amadeo, E.J. e J.M. Camargo, "Brazilian Labour Market in an Era of Adjustment".

233. Amadeo, E.J. e J.M. Camargo, " 'New Unionism' and the Relation Between Capital, Labour and the State in Brazil".

234. Marques M.S.B. e S.P.C. Werlang, "Deságio das LFTs e a Probabilidade Implicíta de Moratória".

235. Lago, L.A.C., "Uma Revisão do Período do "Milagre" Política Econômica e Crescimento, 1967-1973".

236. Carneiro, D.D. e I. Goldfajn, "Reforma Moneratória: Prós e Contras do Mercado Secundário".

237. Carneiro, D.D. e R.L.F. Werneck, "Public Savings, Private Investment and Growth Resumption in Brazil".

238. Carneiro, D.D. e R.L.F. Werneck, "Brazil: Medium-Term Development and Growth Resumption in Brazil".

239. Franco, G.H.B., "Liberalização: Cuidados a Tomar".

240. Abreu, M. de P., "The Rewards of Good Behaviour: Foreign Debt and Economic Growth in South America, 1929 - 1945".

241. Moraes, P.B., "Foreign Banks In The Brazilian Economy in the 1980s".

242. Amadeo, E.J. e P.V. Pereira, "Variáveis Distributivas e Ciclo Econômico: Exame da Indústria Brasileira (1976/1985)".

243. Amadeo, E.J. e J.M. Camargo, "Relações Entre Capital e Trabalho no Brasil: Percepção e Atuação dos Atores Sociais".

244. Camargo, J.M., "Salários e Negociações Coletivas".

245. Amadeo, E.J., "Desemprego: Teoria e Evidência sobre a Experiência Recente na OECD".

246. Franco, G.H.B., "A Regulação do Capital Estrangeiro no Brasil: Análise da Legislação e Propostas de Reforma".

247. Amadeo, E.J., J.M. Camargo, e C. C. de Moura, "The Political Economy of Budget Cuts: a suggested scheme of analysis".

248. Amadeo, E.J., "Keynes, Kalecki e abordagem neoclássica sobre a 'causalidade' entre emprego e distribuição".

249. Franco, G.H.B. e C. Parcias Jr.(BNDES), "Inflação, Clientelas e Preços relativos".

250. Amadeo, E.J. e G.H.B. Franco, "Inflação e Preços Relativos no Plano Collor - Avaliação e Perspectivas".

251. Bonelli, R. e E. Landau, "Do Ajuste à Abertura: a Economia Brasileira em Transição para os Anos 90".

252. Camargo, J.M. e E. Amadeo, "Labour Legislation and Institutional Aspects of the Brazilian Labour Market".

253. Cunha, L.R.A., "Congelamento e Preços Relativos: a Experiência Brasileira".

254. Amadeo, E.J. e E.K. Bastos, "Malthus e Ricardo sobre a Determinação da Taxa de Lucro".

255. Fritsch, W. e G.H.B. Franco, "Trade Policy, Trade Performance and Structural Change in Four Latin American Countries, 1970-1985".

256. Fritsch, W., "Latin America in a Changing Global Environment".

257. Bacha, E., "The Brady Plan and Beyond: New Debt Management Options for Latin America".

258. Bonelli, R., "Growth and Productivity in Brazilian Industries: Impacts of Trade Orientation.