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# LABOR MARKET REGULATIONS AND THE DEMAND FOR LABOR IN BRAZIL

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**Abstract**

The main objective of this study is to evaluate the impact of the 1988 changes in labor market regulations prescribed by the new Constitution on the level of employment and on the speed of employment adjustment in Brazil. From the many aspects of labor market regulations, this study concentrates on those that directly influence variable labor and dismissal costs. Evaluating the impact of changes in these costs on the level of employment and speed of adjustment is based on estimates of structural dynamic models for labor demand at different points in time before and after the 1988 constitutional change. The empirical strategy is to estimate such models from micro-longitudinal monthly data for a sample of 5,000 manufacturing establishments, which cover the period from January 1985 to December 1997. To try to isolate the effect of the constitutional change on the parameters of the labor demand function from the effects of the trade liberalization process and from the several stabilization plans that also occurred by the end of the 1980s, we regress our monthly estimates of these parameters on a temporal indicator of the 1988 constitutional change, controlling for a variety of other macroeconomic indicators.

Key words: Labor Demand, Labor Regulations, Manufacturing Establishments in Brazil
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## 1. Introduction

Labor market regulations are invariably introduced with two objectives: to improve the welfare of the labor force, even at the cost of introducing some degree of economic inefficiency, and to improve efficiency, when external factors and other labor market imperfections are present. However, due to an unsuitable original design or unexpected changes in the economic environment, labor market regulations may eventually become inadequate, leading to results contrary to their original goals. Hence, as a general rule, labor market regulations (as any other market regulation) need to be constantly evaluated and updated if their original goals are to be preserved.

Evaluations of the impact of labor market regulations on the level of employment and its speed of adjustment to economic fluctuations are the subject of major current importance in Brazil. Most labor regulations in Brazil date back to the 1930s and 1940s, with very few modifications being introduced up to 1988. Most of these labor regulations are written in the Constitution and are, consequently, very hard to change. In 1988, however, a new National Constitution was enacted as part of the re-democratization process. Labor market regulations underwent considerable changes in this new Constitution. On the whole these changes were made to give the workers more protection.

Many analysts have been very critical about the benefits of these constitutional changes. They claim these changes have not been wisely designed and, consequently, are leading to increasingly poor working conditions and lower wages and a drop in the degree of employability of the labor force in a new economic environment that increasingly requires greater labor flexibility. As a consequence, labor legislation reform has become a central item on the current Congress agenda, particularly after the recent leap in unemployment[1].

Despite the importance of evaluations of the impact of changes in labor legislation on labor market performance, the number of such studies focusing on Brazilian labor markets has been very limited[2]. The relatively small number of studies on the subject are, however, not the result of a lack of proper information or identification devices. In fact, the relative scarcity of studies contrasts sharply with the wealth of information available and promising methodological possibilities for identifying the impact of labor market regulations.

The main objective of this study is to evaluate the impact of the 1988 changes in labor market regulations on the level of employment and on the time required by firms to adjust their employment level to economic fluctuations. From the many aspects of labor market regulations, this study will concentrate on those that directly influence variable labor and dismissal costs.

Evaluating the impact of changes in these costs on the level of employment and speed of adjustment will be based on estimates of structural dynamic labor demand models for every month from January 1985 to December 1997, using micro-longitudinal data on manufacturing establishments.

A comparison of estimates for the short and long-run labor-cost elasticity of employment and of the speed of adjustment for periods before and after the enactment of the 1988 Constitution is the main device used to identify the impact of changes in labor regulations on labor demand.

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[1] Deseasonalized unemployment in the six main Brazilian metropolitan regions increased from around 5,7% in October 1997 to 7,5% in June 1999.

[2] Some examples are Amadeo, E., Barros, R., Camargo, J.M., *et alii.* (1995), Amadeo, E., Camargo, J.M. (1993), Amadeo, E., Camargo, J.M. (1996) and Málaga, G.T. (1992).

The study is organized in eight sections in addition to this introduction. Section 2 provides a description of the effect of the 1988 constitutional change on labor costs, with particular attention to its impact on dismissal costs. The third section describes the theoretical dynamic labor demand model. Section 4 discusses, from a theoretical point of view, the impact of an increase in non-wage variable labor costs and dismissal costs on the level of employment and speed of adjustment. Section 5 presents the assumptions made to obtain an econometrically feasible labor demand specification. Section 6 describes our empirical strategy. Section 7 describes the database. Section 8 presents and discusses the main empirical results. Finally, Section 9 concludes.

## 2. The 1988 constitutional change

A new Brazilian Constitution was enacted in 1988 as part of the process of re-democratization in Brazil during the second half of the 1980s. Traditionally, Brazilian constitutions are very detailed, stipulating not only general rules, but also many specific legal provisions. Most labor regulations, for instance, are written in the Constitution and are, consequently, very difficult to amend. The new Constitution of 1988, in particular, considerably affected labor regulations, causing changes in many labor codes that had remained intact since the 1940s[3]. Most of these changes, in tune with the re-democratization environment, increased the degree of the workers' protection.

These changes, shown in Table 1, affected both individual rights and workers' organizations. The new Constitution gave more freedom and autonomy to unions. The possibilities for government intervention in unions were drastically reduced. In fact, many mechanisms of official interference were eliminated as well as many restrictions of an institutional nature used to limit workers' organizations. Many regulations on union management were also weakened, ensuring more autonomy to unions during elections of their representatives and in their decisions.

From the point of view of individual rights, we can perceive important changes that increase variable labor costs and the level of dismissal penalties. The increase in protection ensured by the new Constitution considerably increased a firm's costs of employment. The maximum number of working hours per week dropped from 48 to 44 hours; the maximum number of hours for a continuous work shift dropped from 8 to 6 hours; the minimum overtime premium increased from 20% to 50%; maternity leave increased from 3 to 4 months; and the value of paid vacations increased from 1 to, at least, 4/3 of the normal monthly wage.

The new Constitution also considerably increased the level of dismissal penalties. It is worth mentioning that the changes altered the level of the penalties but not their nature. Traditionally, Brazilian legislation affects the cost of dismissal through two channels. First, employers must give notice to their employees in the case of dismissal. Moreover, between the notice and actual dismissal workers are granted two hours per day to look for a new job, with no cut in wages. Secondly, the law states that all workers dismissed for no just cause must receive monetary compensation paid by the employer.

Prior to the 1988 Constitution, notice had to be given at least one month in advance. The 1988 Constitution states that the period of notice should be given in proportion to the worker's tenure. However, since no specific law has ever regulated this constitutional device, notice continues to be given, as before 1988, one month prior to dismissal for all workers, independent of their tenure.

[3] One major exception were the rules regulating dismissals that suffered major changes in 1966, when the ***FGTS*** was created.

In principle, the need for notice would increase the cost of dismissal only to the extent that, for a period of one month, 25% of the hours of the dismissed worker would be paid but not worked. In practice, the productivity of a dismissed worker will drop once he/she has been given notice, implying an overall decline of well over 25% in his/her contribution to production. As a result, it is not uncommon for firms to pay a full salary to dismissed workers, without their being required to work a single hour. In other words, the cost of notice is actually between 25% and 100% of one month's salary, being in practice closer to 100% than to 25%. However, it has not yet changed with the 1988 Constitution. Hence, it cannot be used as our source of variation in labor regulations.

With respect to the monetary compensation for dismissed workers, the law states that a fixed percentage of the "*Fundo de Garantia por Tempo de Serviço*" – ***FGTS*** accumulated while the worker was employed by the firm is to be paid to every worker dismissed for no just cause. The ***FGTS*** is a fund created by the military regime in 1966 to serve as an alternative to the job security law prevailing at that time. In practice, all new contracts after 1966 adopted the new system, since both employees and employers preferred it.

***FGTS*** basic characteristics are: (1) each worker in the formal sector has his own fund, in other words, it is a private fund, instead of a single fund for the workers as a group; (2) to build the fund of each individual worker, the employer must contribute every month with the equivalent of 8% of his employee's current monthly wage, consequently, the accumulated *FGTS* of a worker in any given firm is proportional to the worker's tenure and his/her average wage over his/her stay in the firm; (2) the fund is administrated by the government; (3) workers have access to their own fund only if dismissed without just cause or upon retirement[4]; (4) if they resign they are *not* granted access to this fund, (5) on dismissal, workers have access to their entire fund, including all funds accumulated in previous jobs, plus a penalty in proportion to their accumulated fund in the job from which they are being dismissed.

There was a fourfold increase in the value of this penalty as a result of the 1988 Constitutional change. Before 1988, this compensation was equal to 10% of the cumulative contribution of the current employer to the worker's ***FGTS***. After 1988, this penalty was increased to 40% of the employer's cumulative contribution to the worker's ***FGTS***. This change in legislation will be one of the fundamental sources of variation used throughout this study to estimate the impact of firing costs on the long-run level of employment and on the speed of employment adjustment.

Quantitatively, the penalty is approximately 40% (10% prior to 1988) of the worker's current monthly wage per year in the firm, since, at a monthly rate of 8% of the monthly wage, the ***FGTS*** accumulates at a rate of approximately one full monthly salary per year in the job. This compensation was certainly very small prior to 1988. In fact, under the former Constitution, the worker had to be employed in the firm for at least ten years in order for the compensation to reach the magnitude of one monthly salary. Now it takes 2.5 years in the job for the fine to reach the value of a month's salary.

As far as incentives are concerned, it is worth emphasizing that the penalty is paid *by the employer to the employee*, as opposed to the employer's paying into a social fund held for all workers as a group. In other words, the dismissed worker receives the penalty on an individual basis. This characteristic of the law has major negative effects

[4] There are a few exceptions. Workers can use their ***FGTS*** as a part of the payment for acquiring their home. They also can use it to pay for large health expenses.

on the workers' behavior, giving them significant incentives to induce their own dismissal (see Macedo (1985), Amadeo e Camargo (1996)). There are two main reasons for these negative effects. On one hand, we see that the ***FGTS*** penalty is received individually by workers if they are dismissed. Furthermore, being fired is the chief mechanism to achieve access and control over their overall ***FGTS***. On the other hand, there are strong incentives for workers to seek access to their ***FGTS***. First, because the ***government has poorly managed the FGTS***, typically generating negative real returns or returns well below market rates. Secondly, because, due to shortsightedness or credit constraints, workers may be heavily discounting the future. In short, the facts that (a) all dismissal penalties are immediately received individually by the dismissed worker and (b) being dismissed is the chief mechanism for workers to acquire control over their own fund that is poorly managed by the government, give them considerable incentives to induce their own dismissal after a certain time in any job.

Lastly, it is worth mentioning that, despite the 1988 fourfold increase in the ***FGTS*** penalty, it is not clear that, even now, this penalty constitutes a major constraint to dismissals or even a major fraction of overall dismissal costs. For instance, the cost of advance notice may easily reach the value of a full month's salary. Consequently, the costs of advance notice tend to be higher than the dismissal compensation paid to all workers with tenure of less than 2.5 years. Since most employment relationships in Brazil are short, employers may be more sensitive to the cost of advance notice than to the value of the dismissal compensation.

## 3. A structural model for labor demand

In this study we estimate a structural dynamic labor demand model as simple as possible using longitudinal data on establishments. The basic theoretical model assumes that each firm *i*, at each point in time *t*, chooses the level of employment, $n_i(t)$, in order to maximize the expected present value of profits, i.e., each firm chooses $n_i(t)$ in order to maximize

$$E_t\left\{\sum_{r=0}^{\infty} r^r \left[\boldsymbol{R}(n_i(t+r), p_i(t+r), q(t+r), m_i(t+r)) - d(t+r)w_i(t+r)n_i(t+r) - \boldsymbol{C}(\Delta n_i(t+r), h(t+r))\right]\right\} \quad (1)$$

where ***R*** is the revenue function and ***C*** the employment adjustment cost function.

In this equation we are implicitly assuming that labor is the only input undergoing adjustment costs. Hence, at each point in time, the revenue function, ***R***, can be obtained by choosing the level of production and of all non-labor variable inputs that maximize a current profits condition on a given choice for employment, and the state of the technology. As a consequence, the arguments of the revenue function can be divided into three groups: (a) level of employment, $n_i(t)$, (b) price of all other variable inputs relative to the product price, $p_i(t)$, and (c) all factors determining the state of technology. We divide the factors determining the state of technology into two groups: (a) a vector of parameters defining the overall form of technology at each point in time, $\theta(t)$, that is common to all firms, and (b) a certain firm and time-specific technological innovation, $\mu_i(t)$.

The second term in equation (1) is the direct cost of labor. In this equation, $w_i(t)$ is the real wage rate[5] paid by firm *i* at time *t* and $d(t)$ the ratio between the overall

[5] The real wage rate is obtained dividing the nominal wage rate by the product price.

variable cost of labor and the wage rate. We are implicitly assuming that all non-wage variable costs are proportional to wages with the proportionality constant and common to all firms but possibly time-varying due to changes in the legislation.

Finally, the cost of adjustment is assumed to be a function of the net change in employment, $\Delta n_i(t) = n_i(t) - n_i(t\text{-}1)$, and a parameter $h(t)$. This parameter may vary over time to capture changes in the economic environment and in the labor legislation, but it is common to all firms, indicating that all firms face the same adjustment cost.

In short, according to this model the form of technology and labor costs may vary freely over time. However, idiosyncratic shocks of a firm can only affect technology. Labor costs are determined by firm-specific wages and a legislation that is common to all firms.

In order to obtain an explicit solution to this problem of maximization, we introduce a series of simplifying assumptions. Firstly, we assume that the revenue function is separable in the following sense:

$$\boldsymbol{R}(n_i(t), p_i(t), q(t), m_i(t)) = \boldsymbol{F}\left(n_i(t), q^1(t)\right) + \left[\boldsymbol{G}\left(p_i(t), q^2(t)\right) + m_i(t)\right] n_i(t)$$

Under this assumption, the Euler equation associated with maximizing equation (1) is given by[6]:

$$\begin{aligned} &\boldsymbol{F}_n\left(n_i(t), q^1(t)\right) + \boldsymbol{G}\left(p_i(t), q^2(t)\right) + m_i(t) - d(t) w_i(t) \\ &- \boldsymbol{C}_\Delta\left(\Delta n_i(t), h(t)\right) + r E_t\left\{\boldsymbol{C}_\Delta\left(\Delta n_i(t+1), h(t+1)\right)\right\} = 0 \end{aligned} \tag{2}$$

We further simplify this model by assuming that the revenue function is linear-quadratic and the adjustment costs is quadratic, i.e., we assume that

$$\boldsymbol{F}\left(n_i(t), q^1(t)\right) = q^{11}(t) n_i(t) - \frac{q^{12}(t)}{2} n_i(t)^2$$

and

$$\boldsymbol{C}\left(\Delta n_i(t), h(t)\right) = \frac{h(t)}{2} \left(\Delta n_i(t)\right)^2$$

where $q^1(t) = (q^{11}(t), q^{12}(t))$.

Furthermore, we assume that all firms in the same sector undergo the same price of inputs. As a result,

$$\boldsymbol{G}\left(p_i(t), q^2(t)\right) = \sum_{s=1}^{m} j_s(t) I_{is}$$

where $I_{is}$ indicates whether firm $i$ belongs to sector $s$, i.e., $I_{is}$=1 if firm $i$ belongs to sector $s$ and $I_{is}$=0 otherwise. Under these additional assumptions the Euler equation becomes

[6] We use $F_n$ and $C_D$ to denote the derivatives of the $F$ and $C$ functions with respect to their first arguments.

$$\left(q^{11}(t)+m_i(t)+\sum_{s=1}^{m} j_s(t)I_{is}-d(t)w_i(t)\right)-q^{12}(t)n_i(t)-h(t)\Delta n_i(t)+rh(t)\left(E_t\{n_i(t+1)\}-n_i(t)\right)=0$$

Under the assumption that parameters $q^{12}(t)$ and $h(t)$ are time-invariant and that

$$E_t\left(q^{11}(t+1)+m_i(t+1)+\sum_{s=1}^{m} j_s(t+1)I_{is}-d(t+1)w_i(t+1)\right)=\left(q^{11}(t)+m_i(t)+\sum_{s=1}^{m} j_s(t)I_{is}-d(t)w_i(t)\right)$$

the solution of this equation is given by

$$n_i(t)=l\,n_i(t-1)+\frac{(1-l)}{q^{12}}\left(q^{11}(t)+m_i(t)+\sum_{s=1}^{m} j_s(t)I_{is}-d(t)w_i(t)\right)$$

where $l$ is implicitly defined by

$$q^{12}\,l=(1-l)(1-r\,l)h \tag{3}$$

## 4. The impact of an increase in non-wage labor costs and firing costs

In this section we discuss, in the realm of this simple theoretical model, what the impact of an increase in non-wage variable labor costs and firing costs would be on the short and long-run levels of employment, $n_i(t)$ and $\overline{n_i}$, and the speed of adjustment, $l$. In order to get analytical equations for these impacts, it is necessary first to obtain an equation for the level of employment in the long run. If we assume that the state of technology, prices, wages and labor legislation will remain constant at their current level, then employment in the long run would converge to

$$\overline{n_i}=\frac{1}{q^{12}}\left(q^{11}(t)+m_i(t)+\sum_{s=1}^{m} j_s(t)I_{is}-d(t)w_i(t)\right) \tag{4}$$

Under this theoretical formulation, an increase in non-wage variable labor cost at time $t$ is captured by an increase in $d(t)$, the ratio between variable labor costs and the wage rate. An increase in this parameter would increase the response of employment to changes in wages resulting, consequently, in a decline in employment both in the short and long run. More precisely,

$$\frac{\partial n_i}{\partial d(t)}=-\frac{(1-l)}{q^{12}}w_i(t)$$

and

$$\frac{\partial \overline{n_i}}{\partial d(t)}=-\frac{1}{q^{12}}w_i(t)$$

Since the speed of adjustment, $l$, is only a function of technology, through parameter $q^{12}$, and of the adjustment cost function, through parameter $h$, an increase in variable costs, $d(t)$, would have no impact on the speed of adjustment.

An increase in firing costs is captured, in the model, by an increase in the cost of adjustment, more specifically by an increase in parameter $h$. This parameter, however,

does not enter the employment equation directly. It affects employment only through its effect on the speed of adjustment, $l$. Hence, to investigate the impact of an increase in the cost of adjustment, we have to begin by computing its impact on the speed of adjustment. By differentiating equation (3) we obtain

$$\frac{\partial l}{\partial h} = \frac{(1-l)(1-rl)}{q^{12} + (1-2rl+r)h} > 0$$

The inequality holds since both $l$ and $r$ must lie in the unit interval (0,1). This expression shows that as expected an increase in the cost of adjustment increases $l$ and so decreases the speed of adjustment.

The impact on the level of employment can then be obtained by evaluating the impact of an increase in $\lambda$ on the level of employment in the short and long run. In the long run the level of employment is given by equation (4) that does not depend on $l$. Hence, in the context of this simple theoretical model, an increase in the cost of adjustment has no effect on the level of employment in the long run.

In the short run, however, an increase in the cost of adjustment may have a positive or negative impact on the level of employment. The sign will depend on whether the level of employment is increasing or declining. In fact,

$$\frac{\partial n_i(t)}{\partial l} = -\frac{\Delta n_i(t)}{1-l}$$

Since an increase in the cost of adjustment would decrease the speed of adjustment and so increase $l$, the level of employment would increase (reduce) in the short run whenever employment is declining (growing).

## 5. Econometric specification

To obtain an empirically feasible econometric labor demand specification, one must be more specific about the firm-time technological innovation, $m_i(t)$. We assume that this innovation consists of three underlying components, i.e., we assume that

$$m_i(t) = b_i + g(t) + U_t(t)$$

where $b_i$ captures a firm-specific time invariant technological component, $g(t)$ an aggregated time-specific technological shock and $U_i(t)$ captures all other technological shocks.

The presence of the first two components allows us to assume, without any loss of generality, that the average of $U_i(t)$ over time and across firms is always zero. However, since the econometric model will also include sectorial indicators, $I_{is}$, we must assume that the average of $U_i(t)$ within each sector is also zero, i.e., we assume that for every $s$, $E[U_i(t) \mid I_{is}=1]=0$.

To identify the parameters of the model, additional assumptions are required. Probably the simplest route to obtain identification is to assume that $U_i(t)$ is an exogenous moving average process. Accordingly, we assume that

$$E[U_i(t)U_i(t-p)]=0$$

for all $p>k^1$. We also assume that although these technological shocks may be correlated with the recent evolution wages, they are uncorrelated with the evolution of wages in the past, i.e.,

$$E[U_i(t)w_i(t-p)]=0$$

for all $p>k^2$. Notice that if $U$ were an exogenous moving average process of order $k=max(k^1,k^2)$, then these two assumptions would be immediately satisfied.

Given this specification for the technological innovation, equation (2) may be rewritten as

$$n_i(t)=a(t)+b_i^*+\sum_{s=1}^{m}j_s^*(t)I_{is}-d^*(t)w_i(t)+ln_i(t-1)+U_i^*(t) \qquad (5)$$

where

$$a(t)=\frac{1-l}{q^{12}}\left(q^{11}(t)+g(t)\right)$$

$$b_i^*(t)=\frac{1-l}{q^{12}}b_i$$

$$d^*(t)=\frac{1-l}{q^{12}}d(t)$$

$$j_s^*(t)=\frac{1-l}{q^{12}}j_s(t)$$

$$U_i^*(t)=\frac{1-l}{q^{12}}U_i(t)$$

The presence of $a(t)$ and $b_i^*$ in equation (5) poses some drawbacks for estimation. The presence of $a(t)$ makes estimation of the other parameters unfeasible in a pure time series context, unless some function form for $a(t)$ is imposed.

In a cross-section environment the difficulty is imposed by the natural correlation between $b_i^*$ and $n_i(t\text{-}1)$. To solve this problem we must rely on longitudinal information. When this type of information is available we can take first differences to obtain

$$\Delta n_i(t)=\Delta a(t)+\sum_{s=1}^{m}\Delta j_s^*(t)I_{is}-d^*(t)\Delta w_i(t)+l\Delta n_i(t-1)+\Delta U_i^*(t)$$

as long as the ratio between the overall variable cost of labor and the wage rate $d(t)$ is time-invariant. This equation has the advantage of eliminating the idiosyncratic component $b_i^*$. Nevertheless, it still cannot be estimated as a multiple regression since

$$E[\Delta n_i(t-1)\Delta U_i^*(t)]\neq 0$$

However, it follows from the assumptions made previously about $U_i(t)$ that

$$E[n_i(t-p)\Delta U_i^*(t)]=0$$

and

$$E\left[w_i(t-p)\Delta U_i^*(t)\right]=0$$

for all $p>k+1$. Hence, the model can be estimated if we use past values of employment and wages as instruments. This is the procedure we use in our empirical analysis. In the estimation we use two alternative values for $k$ (1 month and 10 months).

Under the assumptions made on $U_i(t)$, all values of employment and wages lagged at least $k+2$ periods would be valid instruments. However, from a practical point of view it is necessary to limit the number of instruments. In this study we use as instruments 6 lags for employment and 6 lags for wages, i.e., we use as instruments employment and wages lagged, $k+2,...,\ k+7$ months. Hence, to implement this econometric procedure it is necessary to count with panel information at least $k+7$ long on firm-specific employment and wages.

Based on this econometric model, it is possible to estimate $a(t)$, $l$ , $d^*$ and $j_s(t)$. To obtain the other parameters of the production function, $q^{12}$, and of the cost function, $h$, some additional information is required. In this study, to recover these original parameters we assume that the discount rate, $r$, and the ratio between the unit cost of labor and the wage, $d$, are known and equal to 0.95 and 1.8 respectively. Given the knowledge of these two parameters and estimates for $l$ and $d^*$, estimates for the underlying parameters $q^{12}$ and $h$ can be obtained via

$$\hat{q}^{12}=\frac{1-\hat{l}}{\hat{d}^*}d$$

and

$$\hat{h}=\frac{\hat{l}d}{\hat{d}^*\left(1-r\,\hat{l}\right)}$$

## 6. Empirical strategy

In this study, to estimate the linear dynamic model for labor demand specified in the sections above, we use monthly longitudinal information for a sample of 5,000 manufacturing establishments. Since the main goal is to find evidence of the impact of the 1988 constitutional change on the parameters of the labor demand function, the strategy could not be to estimate a single model for the entire period.

One possibility would be to estimate two sets of parameters, first using data from the years before 1988 and then data from recent years. If the 1988 constitutional change had important effects on labor costs, we should find a considerable decline in the speed of adjustment (i.e., an increase in $l$) and an increase in the response of employment to changes in wages, $d^*$.

The available data, however, allows us to do much better. Instead of being restricted to estimating just two labor demand functions for a pre-1988 and a post-1988 period, the available data allows for demand functions to be estimated for a variety of periods in time. In fact, it is possible to obtain monthly estimates of the parameters of the demand function.

This strategy has at least two advantages over the strategy of estimating just two models for a period before and after 1988. First, it is easier to implement since, the econometric model is essentially estimated in a cross-section. This feature of the estimation procedure makes estimating the standard errors much easier since, in this case, it is not necessary to estimate the temporal correlation patterns of the technological shocks.

Secondly and more importantly, the estimation of a model for every month has the great advantage of allowing a precise identification of the exact point in time where the parameters have changed. A precise identification of the moment when the parameters changed can provide important insights in the question of whether the constitutional change is the real force behind the changes in the demand for labor. For instance, if the parameters began to change long before or long after 1988, we would become suspicious about the causal link between the 1988 constitutional change and those in the demand for labor. For these reasons, we use the available information to obtain monthly estimates of the parameters of the labor demand function. [7]

The longitudinal data available covers the period from January 1985 to December 1997. Our first task was to obtain monthly estimates of the parameters of the demand function covering most of this period. The need for valid instruments determines that parameter estimates could only be obtained from mid-1986, i.e., 18 months after the actual sample information begins.

The monthly estimate of demand functions was, however, just the first step in our econometric strategy. Since the Brazilian economy underwent a process of trade liberalization and was subject to a series of stabilization plans at the same time as the change in the Constitution, changes in the parameters of the labor demand function that may have occurred over this period cannot be immediately attributed to the constitutional change.

To isolate the effect of the constitutional change on the parameters of the demand function, we regress our monthly estimates of these parameters on a temporal indicator for the 1988 constitutional change, $D_t$, controlling for a variety of other macroeconomic indicators, $M_t$. Since the precision of estimates varies considerably over time, to control for this source of variation we use as our dependent variable the parameter estimate divided by its corresponding standard error. More specifically, we estimate the following regressions

$$\frac{\hat{l}(t)}{s_l(t)} = a_1 + b_1 D(t) + c_1 M(t) + e_1(t)$$

and

$$\frac{\hat{d}^*(t)}{s_d(t)} = a_2 + b_2 D(t) + c_2 M(t) + e_2(t)$$

where $s_l(t)$ and $s_d(t)$ are the standard errors of $\hat{l}(t)$ and $\hat{d}^*(t)$, and $D(t) = 0$ if $t$ refers to a period prior to 1988 and $D(t) = 1$ otherwise. We include the following as macroeconomic indicators: (a) the real GDP growth rate; (b) degree of openness measured by the ratio of total trade (exports plus imports) to the GDP; (c) inflation rate; and (d) inflation volatility measured by the inflation standard deviation. Monthly dummies and a linear trend were included in all regressions[8]. These regressions are estimated by ordinary least squares using monthly data covering the period June 1986 to December 1997. Positive and statistically significant estimates for $b_1$ and $b_2$ would then be taken as evidence that the 1988 constitutional change had an important effect on the

[7] At this point it is worthwhile mentioning that, although the demand for labor is estimated for every month, in the estimation procedure the parameters $q^{12}$, $h$ and $d$ must be at least locally time invariant. The estimated parameters are consistent only if this assumption is valid. If the parameters $q^{12}$ and $h$ change over time equation (2) would not be the solution of the Euler equation. Moreover, if $d$ varies from one month to the next, the first difference made to eliminate the firm-specific time invariant technological component, $b_i^*$, would still work, but will generate a different function form to be estimated, since in this case $d^*$ would not factor out.

[8] The source of the GDP data is the IBGE. The data for exports and imports was calculated in joint FUNCEX/IPEA work. Lastly, we used the official inflation index to measure inflation.

demand for labor and consequently on the level of employment and the speed of adjustment.

## 7. The database: Pesquisa Industrial Mensal – PIM

In this study we estimate the demand for labor using monthly longitudinal information from the Pesquisa Industrial Mensal (*PIM*). *PIM* is a monthly industrial establishment survey conducted by IBGE (Brazilian Census Bureau) covering the entire country. It is a longitudinal survey of a stratified sample of approximately 5,000 manufacturing establishments employing five workers or more. The original panel was selected in mid-1984 jointly with a supplementary sample used to replace establishments in the original panel when they eventually close. The panel covers the period from January 1985 to the present. The sample was designed to allow most statistical analyses to be conducted separately for six geographical regions and 22 manufacturing sectors.

The survey collects information on labor inputs, labor costs, turnover, the value of production and some others. The data on labor inputs includes both employment and the total number of hours paid. The survey has three major limitations in terms of measuring labor inputs. First, the information covers the total number of hours paid, but not the actual number of hours worked. Secondly, all data refers only to the personnel directly involved in production. Finally, there is no information on the qualification of the labor force employed.

In relation to labor costs, two types of information are available: (a) total value of contractual wages (i.e., value of wages and salaries as specified in labor contracts) and (b) total value of payroll. For the purposes of this study, the payroll data seem to be more informative since it includes, in addition to contractual wages, the payment for overtime, commissions and other incentive schemes, such as a productivity premium. It also includes all fringe benefits, paid vacations, and any additional payments for hazardous activities, night shifts, and other compensating schemes.[9]

Despite the fact that the payroll data covers a wide variety of labor costs, it does not include all of them. Major exceptions are the employer's contributions to social security, training programs and other social programs. Fortunately, however, these contributions as fractions of contractual wages have been fairly constant over time, except for a significant change at the end of the 1980s.

Hence, for each establishment in the survey we use essentially three pieces of information: (a) employment level, (b) total number of hours paid, (c) total payroll. Based on these three variables we construct two measures for variable labor cost. These two measures are obtained by dividing total payroll by the level of employment and the total number of hours paid, respectively. For labor input we use both available measures: employment and hours paid. As a result, each demand model is actually estimated twice depending on whether labor inputs are measured by employment or hours paid. We will refer to the one based on employment level as model 1 and as model 2 to the one based on hours paid.

In the first step of the regression analysis we aggregate some macroeconomic indicators mentioned on last section. The source of the GDP data is the IBGE. The data

[9] In this study, all information on contractual wages and payroll has been deflated using the sector's specific wholesale price index, except for pharmaceutical, plastics, textiles, and perfumes, soap and candles sectors. All monetary values referred to constant Reais at December 1997.

for exports and imports was calculated in joint FUNCEX/IPEA work. Lastly, we used the official inflation index to measure inflation.

Before we move to the labor demand estimates, we present some basic statistics from our sample of establishments. Figures 1a-b present the monthly evolution of the average level of the two measures of labor input used in the study. These figures reveal that firms in our sample employ 200 to 300 workers who are paid a total of 45,000 to 70,000 hours per month along the period analyzed. The average number of hours paid per month per worker in our sample is around 230 hours. Notice that a fraction of the hours paid are not actually worked. For instance, included in the hours paid is at least one day off per week (usually Sunday), which is paid but not worked.

All these figures reveal that, over the 1985-97 period, employment and hours paid per manufacturing firm declined considerably, with the total decline concentrated in the first two years of the 1990s. The main goal of this study is precisely to determine to what extent this decline can be associated to the 1988 constitutional change or to other macroeconomic changes that marked the performance of Brazilian economy over this period.

Figures 1c-d show the monthly evolution of our two measures for labor costs. These figures reveal that average wages for production workers in Brazilian manufacturing were, most of the time, between R$600 and R$800 per month, leading to an hourly wage rate between R$2,50 and R$3,50[10].These figures reveal an overall upward trend in wages over the period coupled with at least four cyclical fluctuations. These cycles very closely match a series of stabilization plans that marked the period 1985-1994 (see Figure 1e).

## 8. Empirical results

The 1988 constitutional change brought an increase in labor costs, in particular, in firing costs. To the extent that this change was of substantial importance, it would lead to an increase in the response of employment to wages, $d^*$ and $f$, and to a reduction in the speed of adjustment (i.e., an increase in the coefficient on lag employment, $l$).

We estimate labor demand models for each month, from June 1986 to December 1997. Although we have information since January 1985, the need for valid instruments determines that parameter estimates could only be obtained from mid-1986, i.e., 17 months after the actual sample information begins.

As already mentioned in the previous sections, two labor demand models were estimated, depending on the choices of measures for labor inputs. Moreover, two estimates are obtained for each model, depending on how far in the past we select the instruments. In total, four estimates for the labor demand function are obtained. In each case we directly estimate two basic parameters: (a) the coefficient on lag employment, $l$, and (b) the coefficient on current wages, $d^*$. We also obtain estimates for the long-run impact of change in wages on employment ($\phi$) and other structural parameters ($q^{12}$ and $h$).

Figures 2.1a to 2.2b provide estimates of the monthly evolution of the short-run impact of changes in wages on employment, $d_t^*$. Figures 3.1a to 3.2b show corresponding estimates for the coefficient on lag employment, $l_t$. Since the estimates vary considerably from month to month we also compute a trimmed 12 months moving

[10] The exchange rate was 1,11 R$/US$ in December of 1997.

average. We adopted a two-step procedure to calculate this moving average. First, we eliminate all values in the lowest and highest tenths of the distribution. Secondly, we calculate 12 months moving averages with the remaining estimates. The averages are weighted, using the inverse of the standard errors of each estimate as weights. Based on these moving average estimates for the basic parameters of the model ($l_t$ and $d_t$*), we obtain estimates for the long-run effect of wages on employment, $f_t$. These estimates are presented in Figures 4.1a to 4.2b.

Based on three-year averages of the temporal evolution of these parameters and the values chosen for $r$ and $d$, we obtain estimates for some important remaining structural parameters of the model: $q^{12}$ and $h$. These estimates are presented in Figures 5.1a-6.2b.

Figures 2 and 4 provide clear evidence that both employment and hours paid decline as labor costs rise. These figures, however, provide no clear evidence that either the short or long-run response of employment to labor costs increased as a consequence of the 1988 constitutional change[11].

Figure 3 gives no evidence that the speed of adjustment was significantly affected by the 1988 constitutional change. In fact, Figure 3 reveals a modest continuous increase in the speed of adjustment, contrary to what would be expected from a discrete increase in firing costs. It is worth mentioning, however, that the estimates for $l$ have the correct signed and are statistically significant, at least when we use the number of employed workers as a measure of the labor input. These estimates, however, are considerably smaller (estimates for $l$ are around 0.5) than what is commonly obtained from time-series studies. Although the same pattern is observed when we use the number of hours paid, some point estimates became negative and it becomes considerably less precise. Finally, Figure 3 reveals that, as we choose instruments further into the past (i.e., as $k$ increases), the estimated values for $l$ declines, indicating that serial correlation among technological shocks may seriously bias $l$ upwards.

The interpretation of the basic parameters would be much easier if all variables were in logs. The specification with all variables in logs is also more close related to the tradition in labor demand models. For these reasons, we re-estimate all previous models changing all variables from levels to logs. Figures 7.1a-9.2b shows that the main results are robust to the log specification.

As in the basic model, these Figures provide no clear evidence that the 1988 constitutional change had any significant impact on either the magnitude or the speed of the response of labor inputs to labor costs. These Figures deserve a few additional comments. First, they show that the short and long term wage elasticities are around -0.2 and -0.4, respectively. Secondly, it is worth mentioning that the estimates for the coefficient on lag of employment remains very close to 0.5, as the case in the basic model. Thirdly, it should be noted that the further the instruments are in the past, the smaller the estimated coefficients on lag employment, another pattern common to the basic model.

To summarize the evidence about the effect of the 1988 constitutional change on labor demand, we regress monthly estimates of the parameters $l$ and $d^*$ on an indicator for the constitutional change and controls for a set of basic macroeconomic variables.

[11] The extremely high values reported when we use hours paid as the employment variable are due to the definition of this variable, that is, the total amount of hours, or in another way, the number of hours worked in a month by each employee times the number of employees. So this figure reflects how many of the total hours are changed in response to a change in the wage variable.

These regressions also include monthly dummies and a linear trend. The results are presented in Tables 2 and 3.

If the constitutional change actually increases labor costs and, as a consequence, has an important effect on the demand for labor, then the estimated coefficients for the indicator of constitutional change would be positive and statistically significant in the regressions involving both parameters. This would be the case, since an increase in variable labor costs would increase $d$ and hence $d^*$, whereas an increase in firing costs would increase the cost of adjustment and reduce the speed of adjustment leading to an increase in $l$.

Contrary to these expected results, in none of the regressions presented in Tables 2 and 3 did we find any evidence indicating that the 1988 constitution change had any significant effect on the labor demand function. All estimates of the constitution indicator coefficient are not statistically significant, despite the regression $R^2$ reach values close to 0.4.

## 9. Summary and conclusions

In 1988, a new Constitution was enacted as a central part of the Brazilian re-democratization process. This new Constitution brought significant changes in labor legislation. Overall, the changes were made to increase the amount of protection to workers, resulting, in particular, to significant increments in dismissal penalties.

This study is an attempt to estimate the impact of these changes in variable labor costs and dismissal costs brought by the 1988 constitutional change. We investigate the impact of these changes on the parameters of the demand for labor. In particular, we investigate the impact of these changes on the short and long run wage elasticity and on the speed of adjustment.

From a theoretical point of view we expect that an increase in variable non-wage labor cost would increase the response of employment to wages and reduce the overall level of employment. With respect to the impact of an increase in dismissal costs, a reduction was expected in the speed of adjustment with the impact on the level of employment in the short run depending on whether employment was rising or declining. If employment were to decline, an increase in dismissal costs should slow down the decline in employment in the short run.

To verify these hypotheses empirically we estimate a dynamic labor demand model using longitudinal information from a survey of 5,000 Brazilian manufacturing establishments. To evaluate the impact of the 1988 constitutional change on the parameters of the demand for labor, we use micro-dimension of our panel data to obtain monthly estimates for all parameters of the labor demand function.

The estimated parameters were consistent with the theory. The short and long-run wage elasticities are around –0.2 and –0.4, respectively. The estimated speed of adjustment is, however, much faster than traditionally estimated from time series data. In fact, the coefficient on lag employment is close to 0.5 in our monthly model. Typical estimates from time series would indicate figures closer to 0.8 or even 0.9.

If the constitutional change had a major impact, we should observe an important change in these parameters around 1988. The estimates presented in Figures 2 and 3, however, provide no evidence at all that the constitutional change had any effect. Nonetheless, these figures reveal considerable temporal fluctuations in the coefficients that could be explained by macroeconomic events. These macroeconomic events could

offset a hypothetical constitution effect. To verify this possibility we regress our monthly estimates for the parameters of the demand function on a indicator for the constitution change and a series of macroeconomic indicators. The results presented in Tables 2 and 3 indicate that the 1988 constitution change does not seem to have any significant effect on the labor demand function.

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**Table 1: Changes introduced by the new Constitution promulgated in October 1988**

| Pre-Constitution | Post-Constitution |
|---|---|
| **Individual Rights** | |
| 1- Maximum working hours per week = 48 hours | 1- Maximum working hours per week = 44 hours. |
| 2 - Maximum daily journey for continuous work shift = 8 hours. | 2- Maximum daily journey for continuous work shift = 6 hours. |
| 3 - Minimum over-time remuneration = 1,2 of the normal wage rate. | 3- Minimum over-time remuneration = 1,5 of the normal wage rate. |
| 4 - Paid vacations = at least the normal monthly wage. | 4- Paid vacations = at least 4/3 of the normal monthly wage. |
| 5 - Maternity license = 3 months (1 before and 2 after the birth). | 5- Maternity license = 120 days. |
| 6 - Previous notification of dismissal = one month. | 6- Previous notification of dismissal = proportional to seniority (to be regulated by a future law). |
| 7 - Fine for non-justified dismissal = 10% of Fundo de Garantia por Tempo de Serviço (FGTS). | 7- Fine for non-justified dismissal = 40% of Fundo de Garantia por Tempo de Serviço (FGTS). |
| | 8- Creation of paternity license of 5 days. |
| | 9- Profit-sharing (regulated by a 1996/97 law). |
| **Unions Organization** | |
| A) The Ministry of Labor had the right to intervene in the unions and depose their board of directors. | A) The Ministry of Labor is forbidden to intervene in the unions. |
| B) Every union had to be registered and approved at the Ministry of Labor. | B) Unions do not need to be registered and approved at the Ministry of Labor. |
| C) National representation of unions was allowed only in exceptional cases. | C) National representation of unions is allowed. |
| D) Union's representatives were elected by a minimum quorum of 2/3 of the members in the first balloting, ½ in the second balloting and 2/5 in the third balloting. In the case of no minimum quorum for the election, the Ministry of Labor could chose union's directors and call another election. | D) Union's representatives are elected following union's own rules. |
| E) Workers (employers) unions were allowed to be formed by only one type occupational (economic) category. | E) Workers (employers) unions are allowed to be formed by different types of occupational (economic) categories. |
| F) Union's decision to go on strike had to be approved by a minimum quorum of 2/3 of union's members in the first calling and 1/3 in the second calling. | F) Union's decision to go on strike follows union's own criterias. |
| G) In case of strike, notification to the employer had to be done 5 days in advance. | G) In case of strike, notification to the employer has to be done 48 hours in advance. |
| H) Strikes were forbidden in activities considered fundamental (e.g. energy and gas services, hospitals, pharmacies, funeral services); public servants were not allowed to go on strike. | H) There are not any more sectors in which strikes are forbidden: in essential activities, workers and employers are responsible for the provision of minimum services; public servants (excluding military personnel) are allowed to go on strike. |

Source: CAMARGO, José Marcio, AMADEO, Edward J. Labour legislation and institutional aspects of the brazilian labour market. Rio de Janeiro:PUC, 1990.
NASCIMENTO, Amauri Mascaro. Iniciação ao Direito do Trabalho. Editora LTr. São Paulo, 1993.

## Table 2: Regression results - k=1

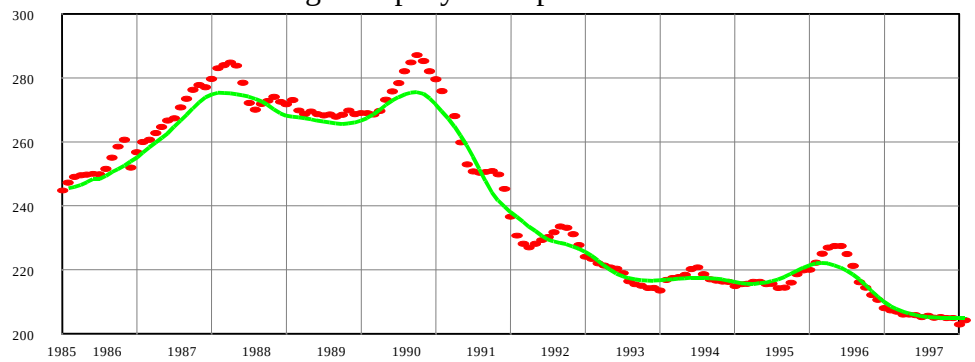
| | | Dependent variable | | | |
|---|---|---|---|---|---|
| | | Lagged employment ($\lambda$) | | Labor cost ($\delta^*$) | |
| | | Coefficient | P-value | Coefficient | P-value |
| **Model 1** | Indicator for the constitutional change | -1.542 | 0.771 | -1.861 | 0.583 |
| | GDP growth rate | -0.081 | 0.840 | -0.069 | 0.788 |
| | Degree of openness | 8.617 | 0.225 | -3.998 | 0.379 |
| | Inflation rate | 11.377 | 0.291 | -8.461 | 0.221 |
| | Inflation volatility | 2.491 | 0.156 | 1.460 | 0.194 |
| | *Adjusted* $R^2$ | 0.358 | | 0.026 | |
| **Model 2** | Indicator for the constitutional change | -5.578 | 0.393 | 2.320 | 0.433 |
| | GDP growth rate | 0.743 | 0.136 | -0.177 | 0.432 |
| | Degree of openness | -1.499 | 0.864 | -2.111 | 0.594 |
| | Inflation rate | 20.985 | 0.115 | 9.474 | 0.117 |
| | Inflation volatility | -0.329 | 0.879 | -0.807 | 0.410 |
| | *Adjusted* $R^2$ | 0.135 | | 0.065 | |

## Table 3: Regression results - k=10

| | | Dependent variable | | | |
|---|---|---|---|---|---|
| | | Lagged employment ($\lambda$) | | Labor cost ($\delta^*$) | |
| | | Coefficient | P-value | Coefficient | P-value |
| **Model 1** | Indicator for the constitutional change | 10.597 | 0.771 | -3.750 | 0.583 |
| | GDP growth rate | 0.049 | 0.840 | -0.248 | 0.788 |
| | Degree of openness | -5.272 | 0.225 | 1.961 | 0.379 |
| | Inflation rate | -8.950 | 0.291 | -5.417 | 0.221 |
| | Inflation volatility | -2.192 | 0.156 | 0.849 | 0.194 |
| | *Adjusted* $R^2$ | 0.213 | | 0.057 | |
| **Model 2** | Indicator for the constitutional change | -3.242 | 0.393 | 1.526 | 0.433 |
| | GDP growth rate | 0.247 | 0.136 | -0.030 | 0.432 |
| | Degree of openness | 3.200 | 0.864 | -7.195 | 0.594 |
| | Inflation rate | 16.996 | 0.115 | 14.988 | 0.117 |
| | Inflation volatility | -0.701 | 0.879 | 1.363 | 0.410 |
| | *Adjusted* $R^2$ | 0.194 | | 0.133 | |

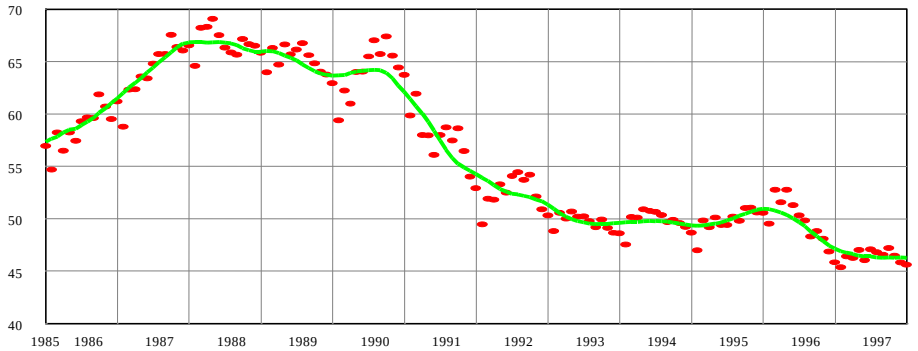
# Basic Statistics

Figure 1A
Average Employment per Establishment



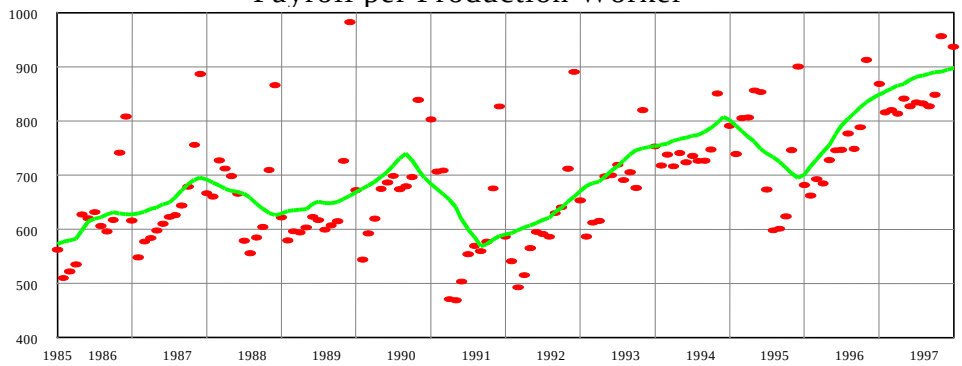

*Source: Based on "Pesquisa Industrial Mensal" (PIM).*

Figure 1B
Average Number of Hours Paid per Month per Establishment



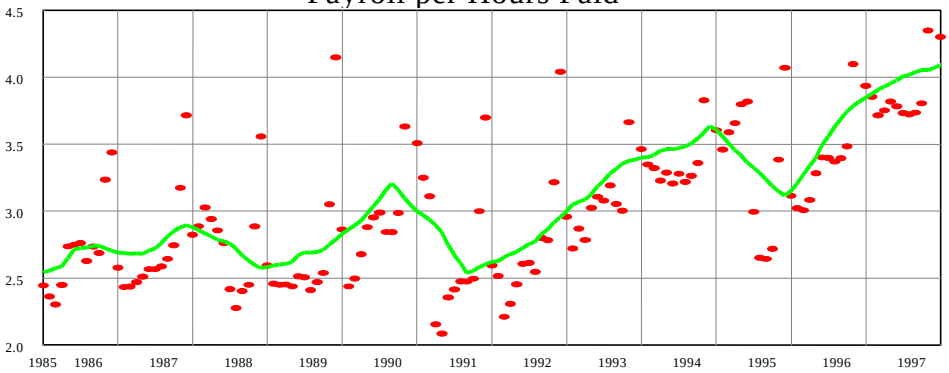

*Source: Based on "Pesquisa Industrial Mensal" (PIM).*

Figure 1C
Payroll per Production Worker



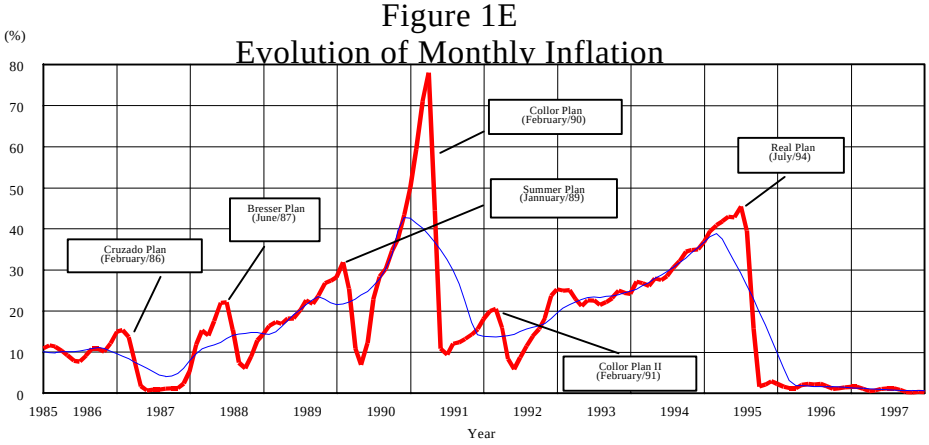

*Source: Based on "Pesquisa Industrial Mensal" (PIM).*

Figure 1D
Payroll per Hours Paid




*Source: Based on "Pesquisa Industrial Mensal" (PIM).*

Figure 1E
Evolution of Monthly Inflation

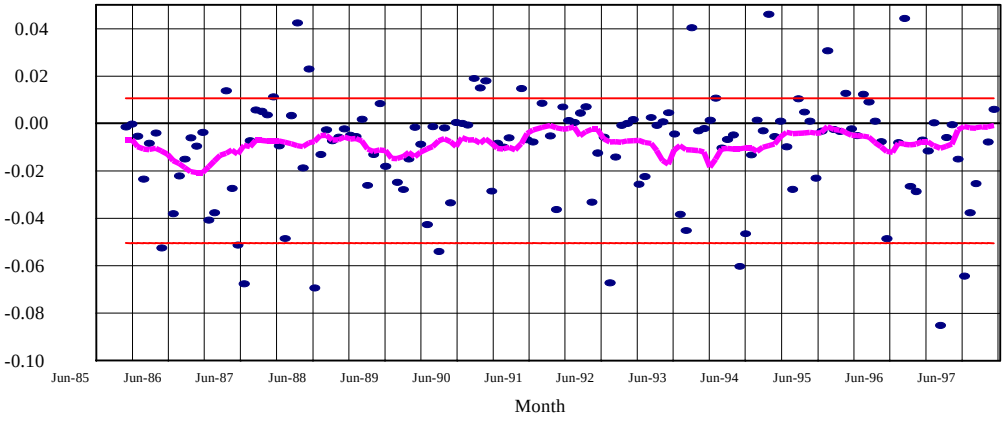



*1. Data source: IBGE. 2. Inflation measured by the variation in INPC-R from 15 of one month to 15 of the subsequent month.*

**Temporal Evolution of the Short Run Response of Employment to Labor Costs Variable**
(δ*)
Variable in Level

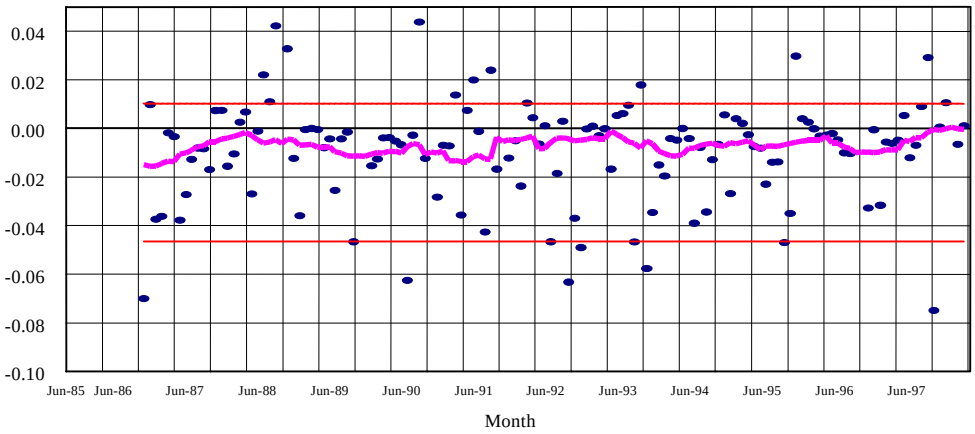
## Model 1

Figure 2.1A
*k* = 1




*Source : Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

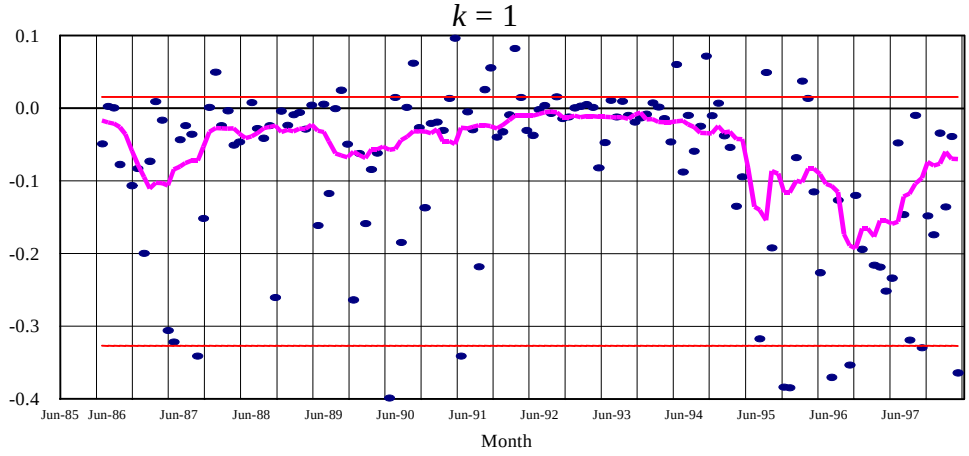
Figure 2.1B
*k* = 10




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Figure 2.2A

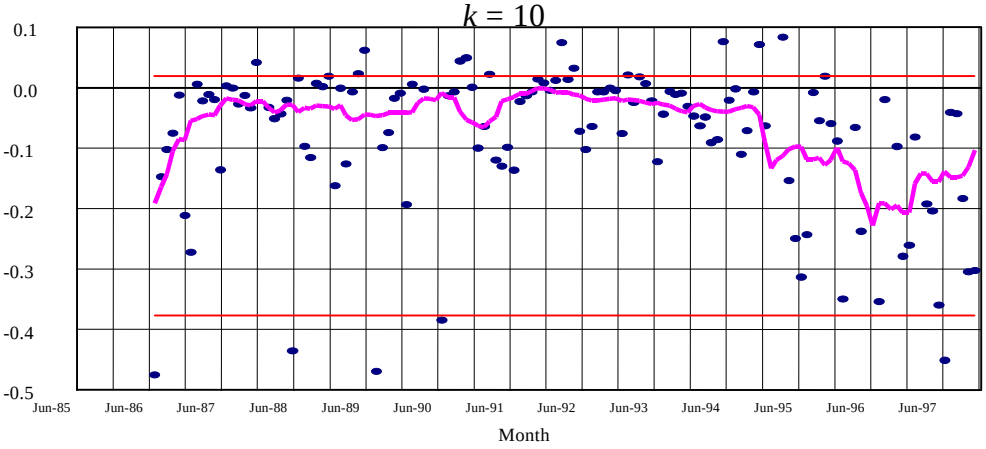
$k = 1$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Figure 2.2B

$k = 10$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

**Temporal Evolution of the Short Run Response of Employment to Lagged Employment Variable**

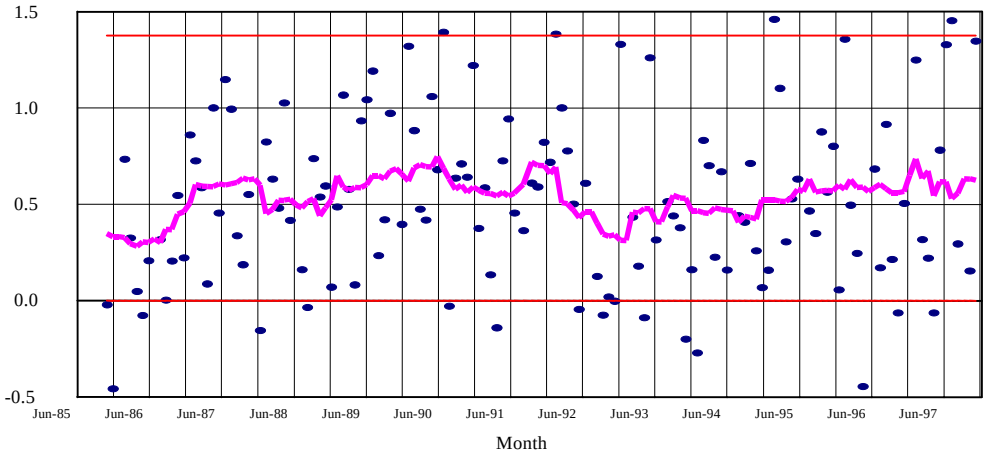
**($\lambda$)**

**Variable in Level**

## Model 1

Figure 3.1A

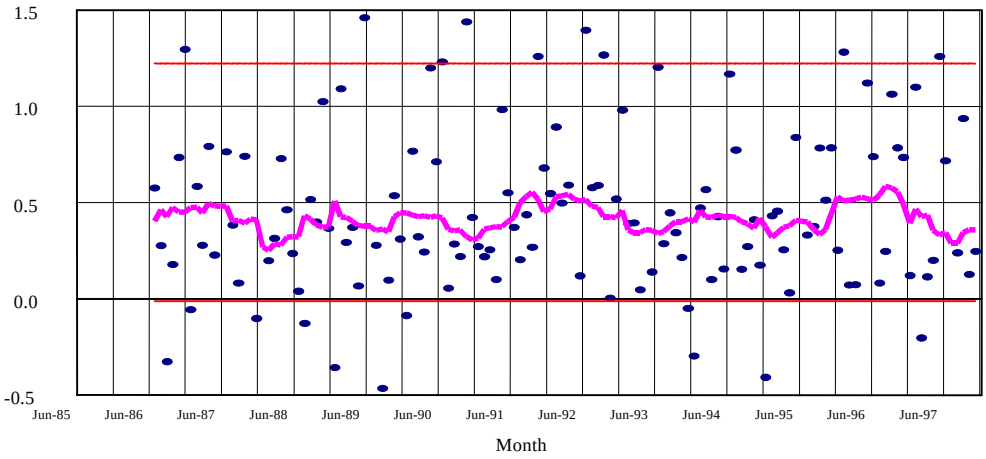
$k$ = 1




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Figure 3.1B

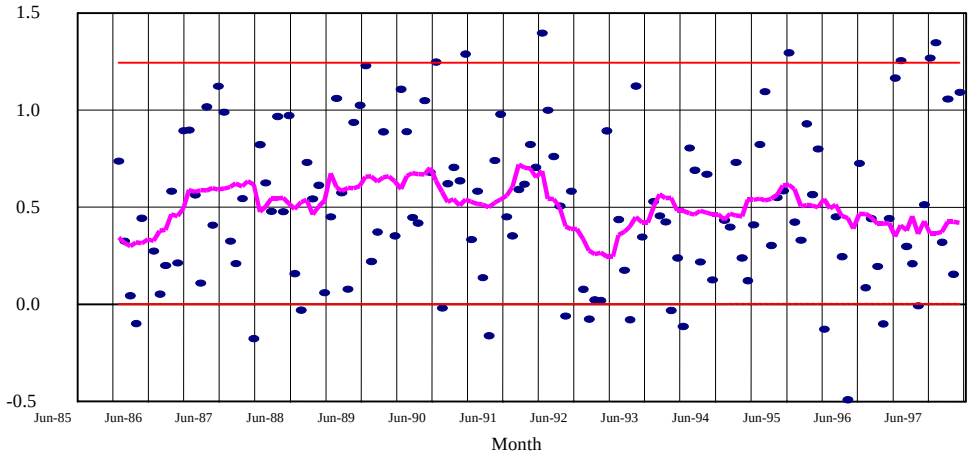
$k$ = 10




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

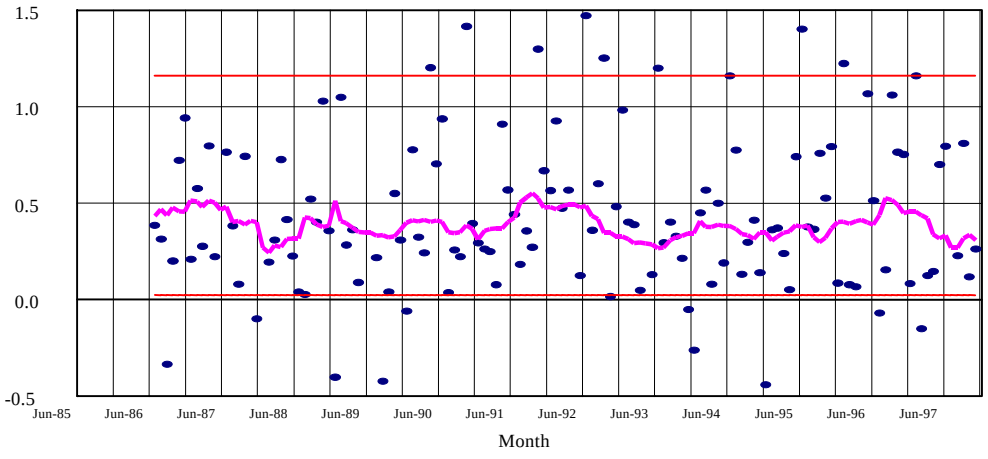
**Model 2**

Figure 3.2A
$k = 1$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Figure 3.2B
$k = 10$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

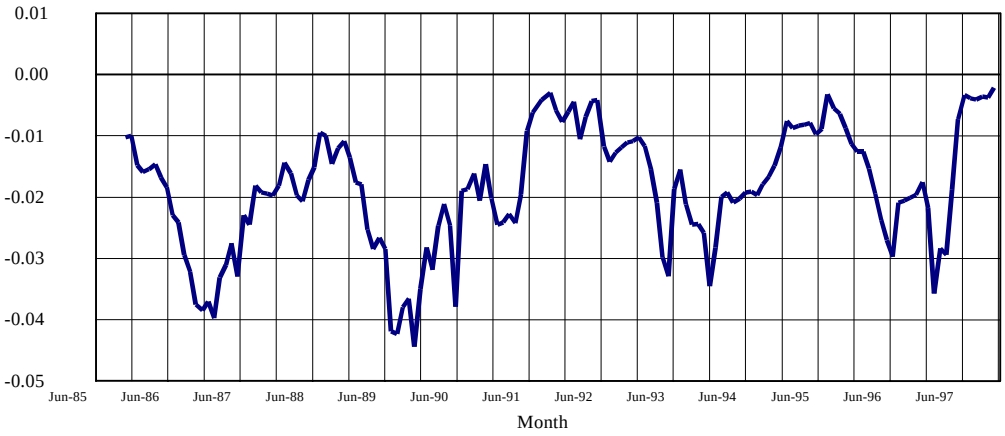
**Temporal Evolution of the Long Run Response of Employment to Labor Costs Variable**

**($\phi$)**

**Variable in Level**

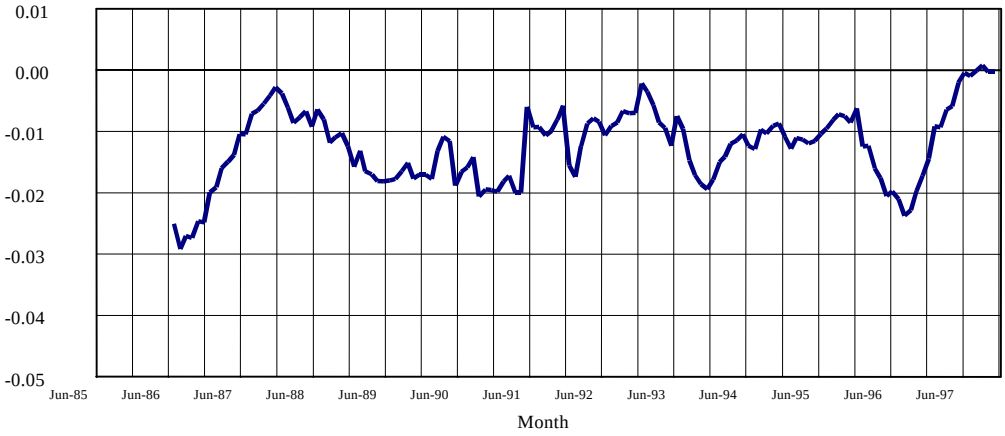
## Model 1

Figure 4.1A
$k$ = 1




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

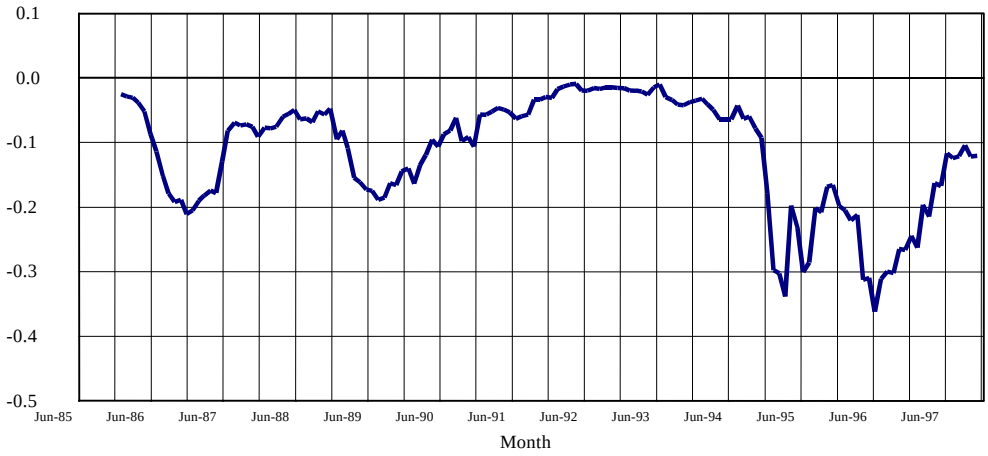
Figure 4.1B
$k$ = 10




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

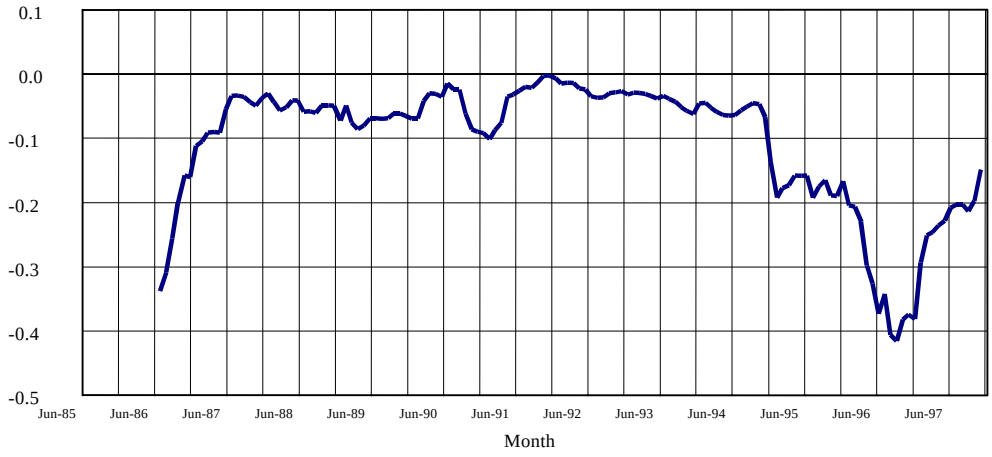
**Model 2**

Figure 4.2A
$k = 1$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Figure 4.2B
$k = 10$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

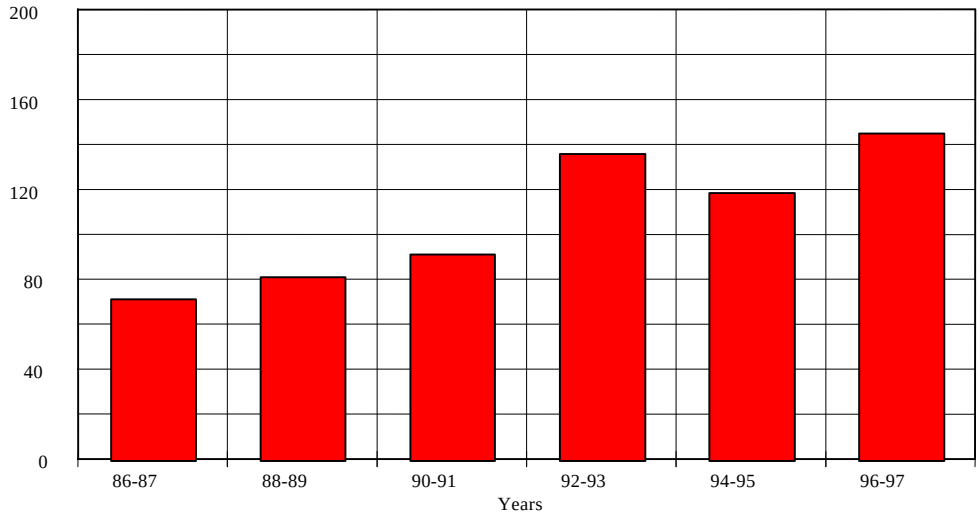
**Temporal Averages of the Short Run Evolution of the Production Function**

**Structural Parameter**

**(θ)**
**Variable in Level**

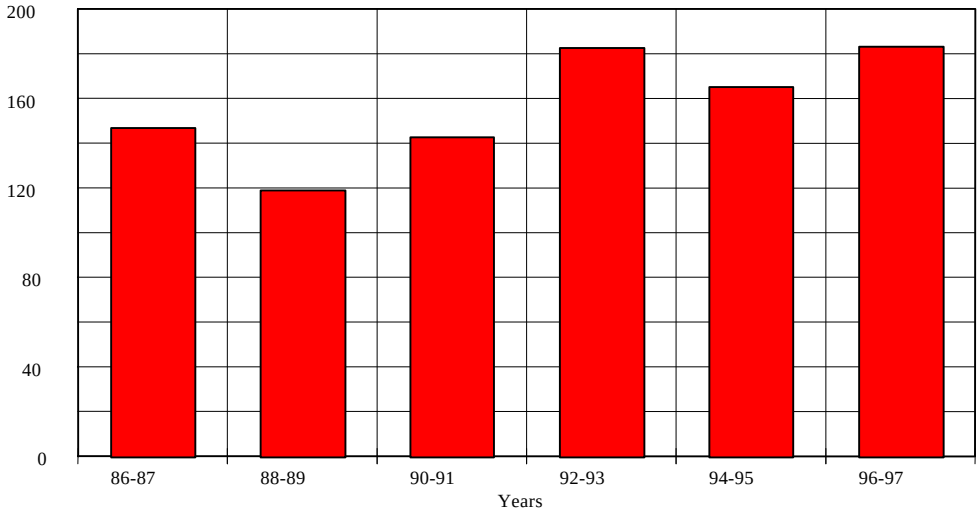
**Model 1**

Figure 5.1A
$k = 1$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

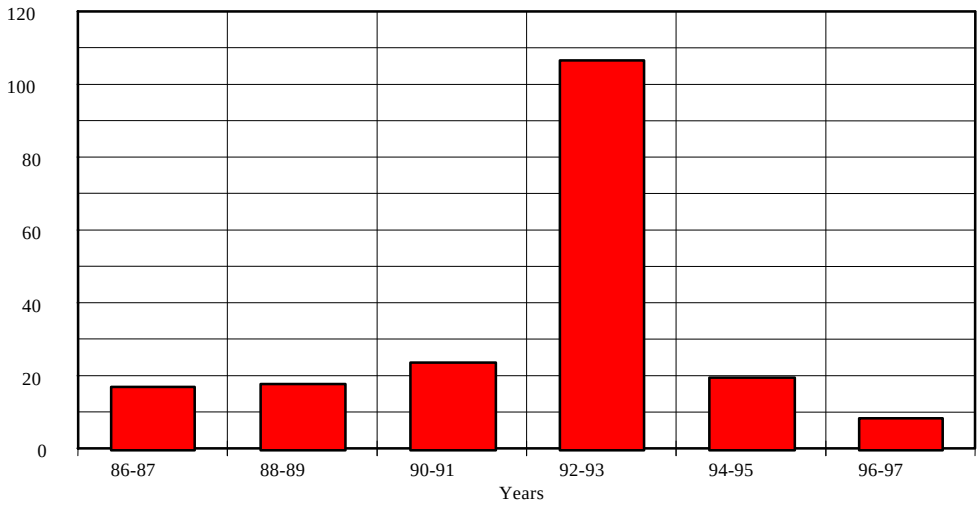
Figure 5.1B
$k = 10$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

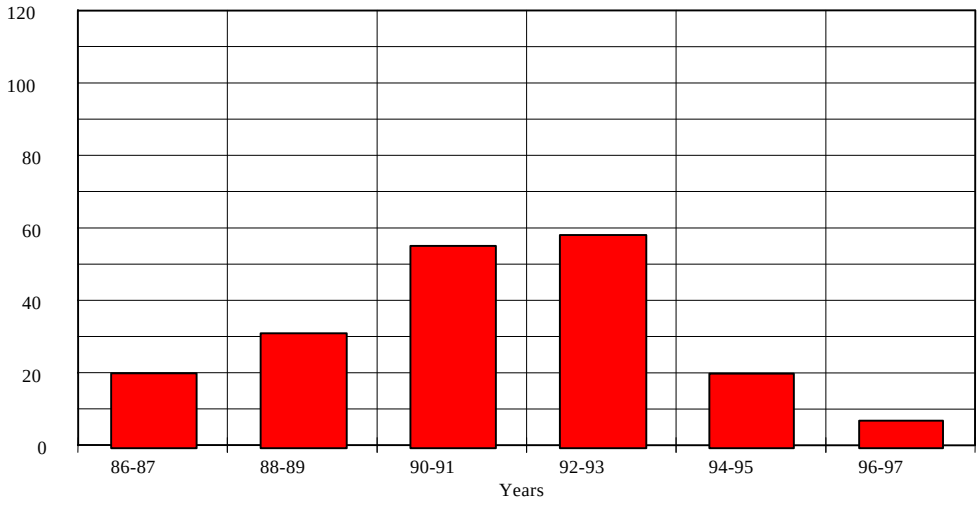
**Model 2**

Figure 5.2A
$k = 1$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Figure 5.2B
$k = 10$



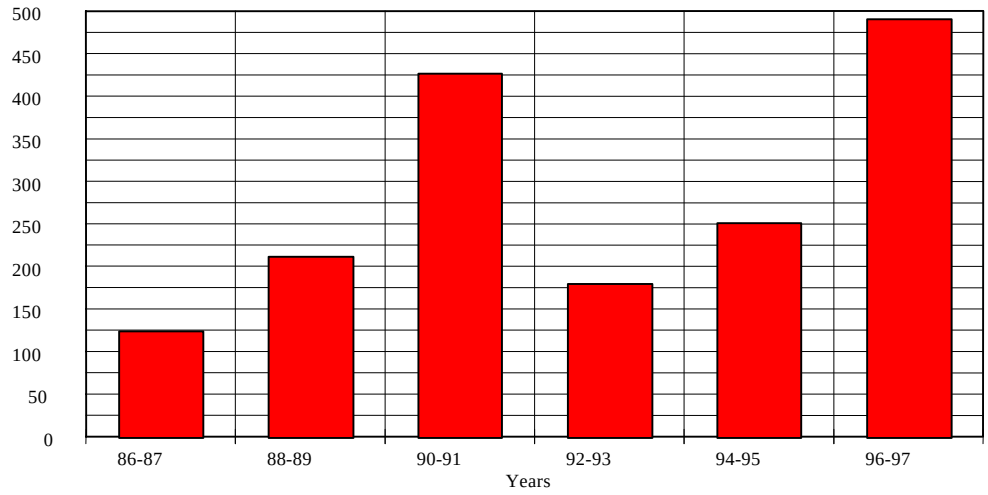

*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

**Temporal Averages of the Short Run Evolution of the Cost Function Structural Parameter**

**(η)**
**Variable in Level**

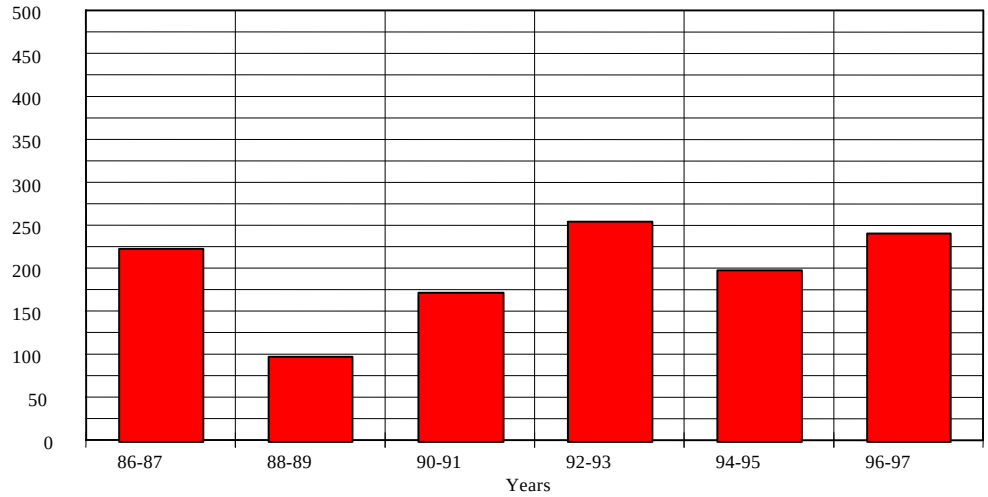
**Model 1**

Figure 5.3A
$k = 1$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Figure 5.3B
$k = 10$



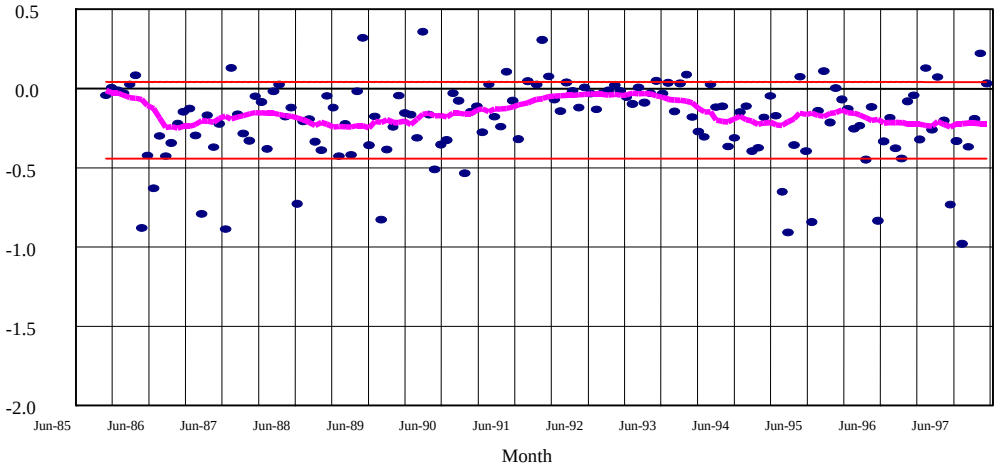

*Source : Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997*

**Temporal Evolution of the Short Run Response of Employment to Labor Costs Variable**

**(δ*)**
**Variable in Log**

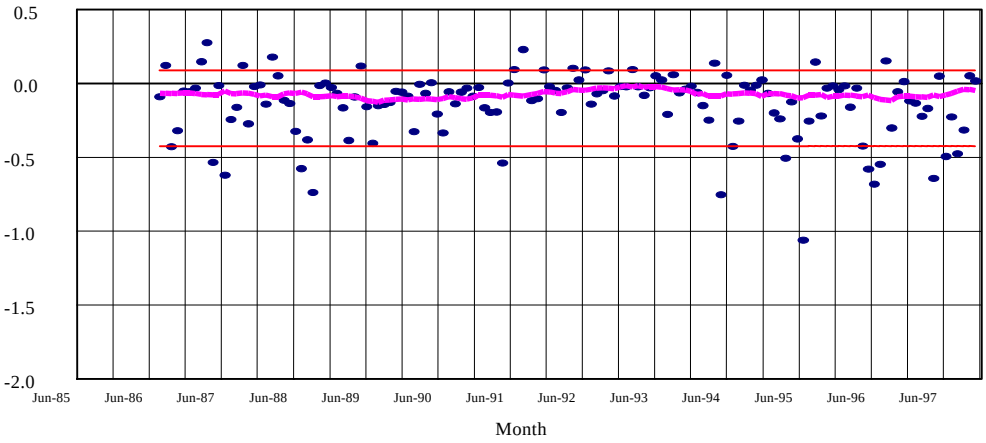
**Model 1**

Figure 6.1A
*k* = 1




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

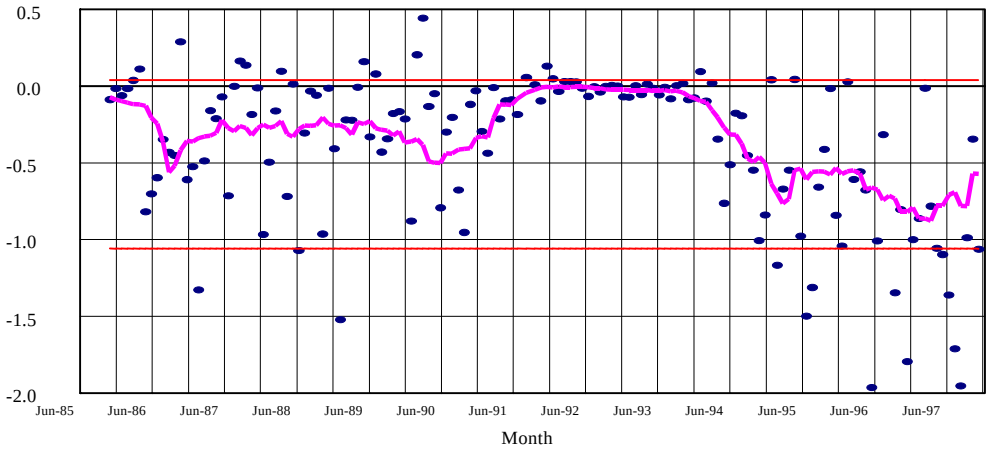
Figure 6.1B
*k* = 10




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

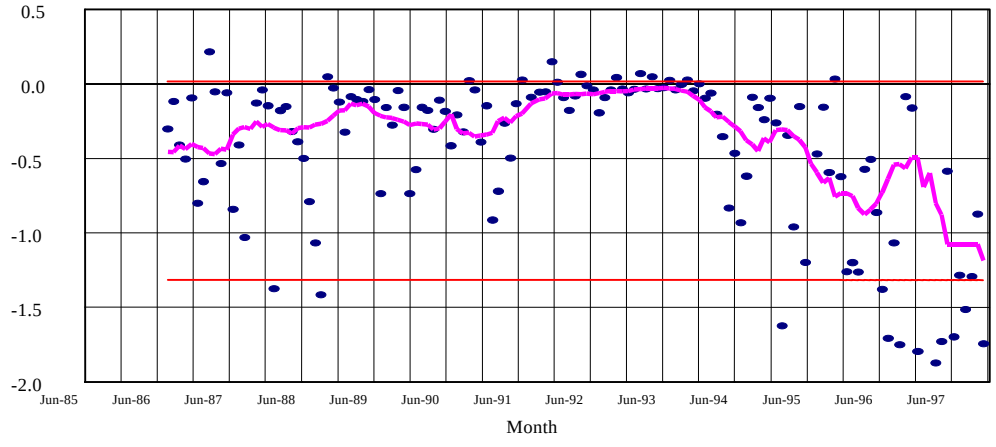
**Model 2**

Figure 6.2A
$k = 1$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Figure 6.2B
$k = 10$




**Sourc**

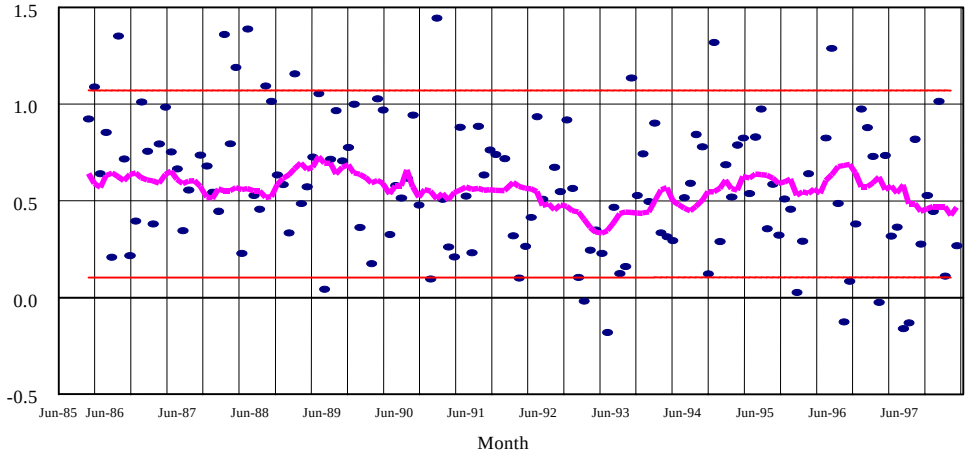
**e: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.**

**Temporal Evolution of the Short Run Response of Employment to Lagged Employment Variable**

($\lambda$)
Variable in Log

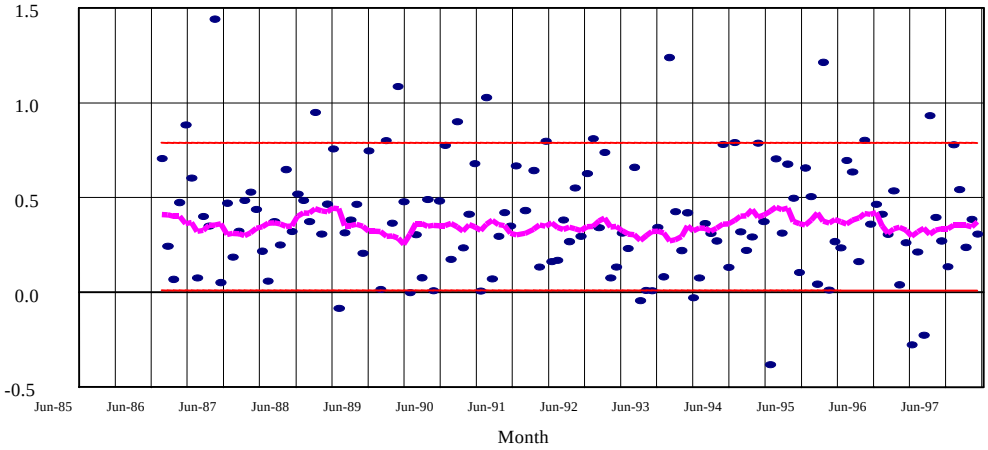
**Model 1**

Figure 7.1A
*k* = 1




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

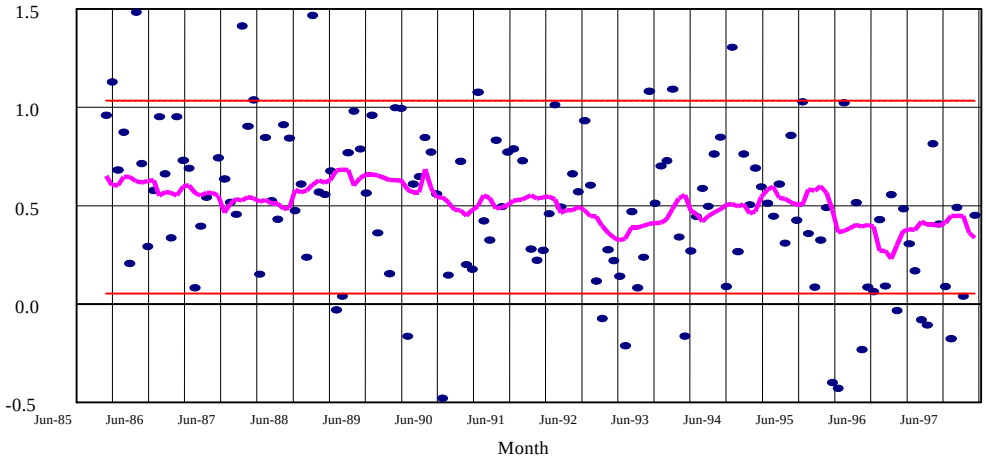
Figure 7.1B
*k* = 10




*Source : Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

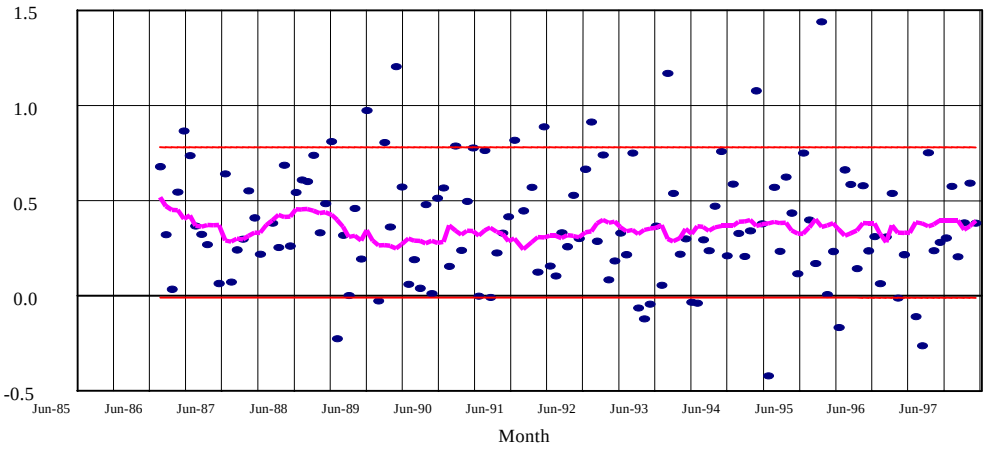
**Model 2**

Figure 7.2A
$k = 1$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Figure 7.2B
$k = 10$



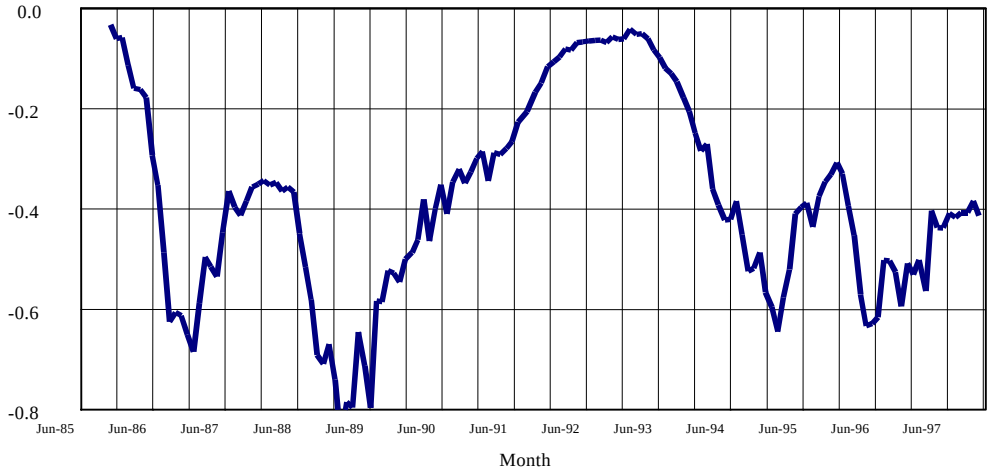

*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Temporal Evolution of the Long Run Response of Employment to Labor Costs Variable

($\phi$)
Variable in Log

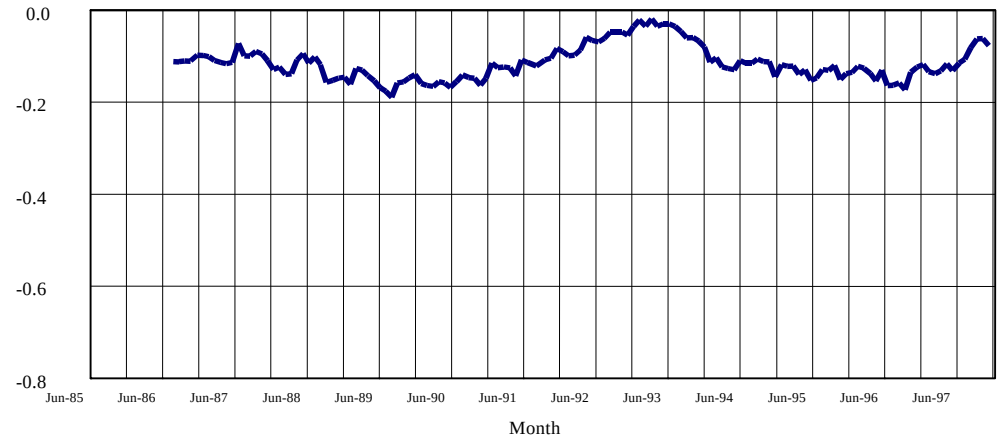
**Model 1**

Figure 8.1A
$k$ = 1




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

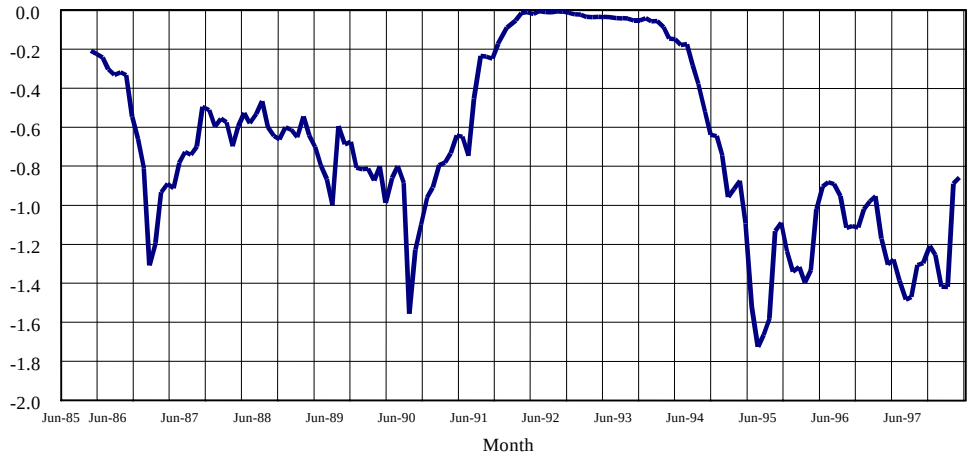
Figure 8.1B
$k$ = 10




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

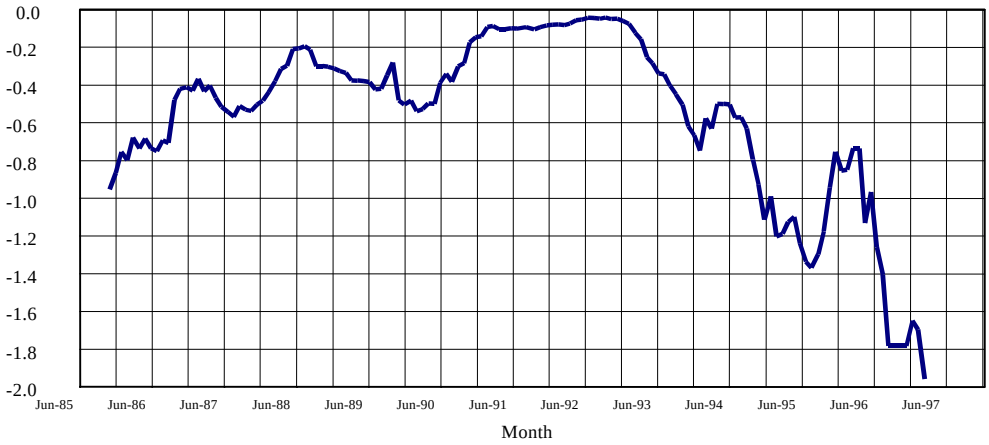
**Model 2**

Figure 8.2A
$k = 1$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*

Figure 8.2B
$k = 10$




*Source: Based on "Pesquisa Industrial Mensal " (PIM) from 1985 to 1997.*