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INSTITUTIONAL RIGIDITIES AND EMPLOYMENT RIGIDITY IN THE  
ITALIAN LARGE INDUSTRIAL FIRMS

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**Abstract**

Many indicators (OECD 1994) show that the Italian labour market is characterised by a strong pro-workers and pro-unions legislation. This is usually interpreted as a high degree of rigidity. It is known that, in response to shocks, firms in rigid labour markets tend to trade workers adjustment off individual working hours adjustment (Abraham-Houseman (1994)). We analyse this trade-off for the Italian large industrial firms, using the Kalman filter to get the impulse-response functions of employment and working hours to permanent and temporary shocks. We find that in the first 80s the terms of the trade off have changed, and employment has become more responsive to shocks. Firms seem thus to have circumvented the regulation: after the pro-workers «institutional push» of the '70s, a process of capital/labour substitution has allowed them to re-form their profit margins and to minimise the labour input. Institutions have tried to incentivate new hirings reducing the bias in favour of workers. Consequently, a deregulation process started in 1983-84 is changing the Italian labour market. Nonetheless, deregulation *per se* is unlikely to cause new hirings in an environment where the labour input has been minimised.

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## 1. Introduction

The unprecedented unemployment growth of the last decade, in spite of substantial wage moderation, has led many economists to focus their attention on labour market institutions. A great deal of literature has been devoted to this subject, and one of the most important results (Nickell, (1978); Bentolila-Bertola, (1990)) is that job protection does not entail *per se* a bad employment performance, its main effect being to smooth the path of the employment over the cycle. For job protection to affect the average employment, other distortions - like wage rigidities - are needed.

Nonetheless, some recent developments in the literature shed new light on the general equilibrium consequences of labour market regulation. This approach emphasizes the importance of putty-clay investments and factors specificity in the determination of the employment performance. In the Caballero and Hammour's definition (1998a), «An asset is specific to a relationship to the extent that its value is greater within the relationship than outside». In this view, the existence of irreversible specificities and/or putty-clay investments generates a «hold-up problem»: when two factors co-operate in production, the factor with the smaller separation costs has an incentive to extract a rent. Since it is not possible to enforce optimal contracts in which factors commit to their ex-ante values, the macroeconomic outcome is likely to be highly inefficient. To make an example, job-protection legislation is supposed to reinforce the specificity of capital with respect to labour. To the extent that this biases the output sharing, giving workers a rent over the competitive wage, the economy will display involuntary unemployment.

This very general theoretical framework fits well to study the macroeconomic consequences of labour market regulation.

The Italian labour market is traditionally one of the most regulated of the world, with very stringent limitations to firing (OECD (1994)). The bulk of the regulation has been set in the 70s, following a period of strong political power in favor of workers and unions.

The theory of putty-clay investments in presence of incomplete contracts and appropriability allows to study the short-term and long-term reaction of the economy to this «institutional imbalance» (Caballero and Hammour 1998a,b). This theory gives us a framework to interpret the pattern followed by employment, investments, and legislation. Starting from 1984, we observe an upturn in the labour market: some important flexibility-oriented reforms, though far from eliminating the existing

regulation, have to some extent reduced the bias in favor of workers.

In short, according to CH, we can interpret this situation as so inefficient that both capital and labour were worse off<sup>3</sup>.

Consequently, limitations to real wage flexibility have been eased, and temporary contracts have been introduced. This process is still in progress, but it has already brought several important innovations into the Italian labour market.

The aim of this paper is to evaluate the impact of the regulation on the behaviour of the large Italian firms over the last 30 years.

According to the theory, we expect the firms to be subject to the increased regulation in the short run, while in the long run they react choosing labour-saving technologies to minimise appropriation. This should be verified on the series of profit and wage shares on aggregate output.

Moreover, we show how the aggregate employment variation is expected to increase when more efficient technologies make it possible to reduce the importance of workers adjustment, and use data on employment and individual working hours to obtain their impulse-response functions before and after the reaction of the firms to the regulation.

The year we have chosen to split the sample is 1982, because in that period Italian firms, after the installation of new capital, have begun large restructuration programs, which have expelled a large share of the labour force, and have substantially increased the capital-labour ratio (Barca and Magnani, 1989).

Some tests we have performed on the employment series confirm the existence of a break in the autoregressive properties of the data in this period. The restructuring of the large firms has preceded - and maybe caused - important institutional innovations: 1984 can be considered as the starting date of a long deregulation process. In that year were the reduction of the wage indexation, which made wages more flexible, the introduction of part-time contracts and the temporary training contracts.

The paper is organised as follows: section two summarises the deregulation process of the Italian labour market, and section three develops a model of the impact of the technological innovation on the dynamics of the aggregate employment; section four is devoted to the empirical estimation. The conclusions and the policy implications are presented in section five.

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<sup>3</sup> Barca and Magnani (1989), pag. 51, argue that already in 1977 the unions accepted wage moderation because they realised that otherwise firms were likely to incur bankruptcies.

## 2. Regulation and deregulation of the Italian labour market

As we can see in table 1, the Italian labour market is traditionally heavily regulated. Since 1960 the public administration had the monopoly of workers placement: private intermediation in the labour supply has been strictly forbidden. In 1962 severe limitations have been introduced for temporary contracts, and, four years later, a law prohibited «unfair» dismissals, making it very difficult to fire. The 70s are characterised by the introduction of further restrictions: the law n. 300/1970 (*Statuto dei Lavoratori*) has been defined as «the most comprehensive attempt to introduce rigidities and regulations in the labour market» (Bertola and Ichino (1995)). It regulated the hiring and firing procedures, the working environment and the workers' mobility inside the firms, the use of overtime, and even the wage schedule with respect to the workers' seniority. Moreover, it established the reinstatement obligation<sup>4</sup> for workers subject to unfair dismissals, which is still the most important limit to individual firing.

In 1974 the appeal procedure for unfair dismissal was made easier, and in 1975, the «*Scala Mobile*», a wage indexation system that gave every worker the same compensation for inflation, irrespective of her wage, was introduced<sup>5</sup>. This mechanism has frozen the evolution of the relative wages until the late '80s. For more than 20 years the main source of flexibility has been the «*Cassa Integrazione Guadagni*» (CIG), a lay-off device (introduced in 1969) that allowed firms to stop the workers for a temporary period, without termination of the employment contract. The CIG provides for a subsidy to inactive workers equal to 80% of the wage at the beginning, subject to reduction after a year. The benefits are funded using both a tax levied on firms and public funds. Originally conceived to accommodate transitory fluctuations in production, in 1975 the CIG has begun its transformation into a form of «shadow firing», with indeterminate prolongation of the benefits.

**Table 1. Main innovations in labour market regulation\***

Year

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<sup>4</sup> It is important to stress that the reinstatement is different from a simple re-hiring because in the former case the employer has to repay the wage for the whole period of unfair firing.

<sup>5</sup> To be more precise, the scala mobile indexation was higher for low wages. This, in a period of high inflation, has strongly compressed wage differentials (Erickson and Ichino (1993)).

1960 Prohibition of intermediation in hiring (law 1369)  
 1962 Restriction on temporary labour contracts (l. 230)  
 1966 Regulation of firing procedures (l. 604)  
 1969 Introduction of Cassa Integrazione Guadagni  
 1970 Charter of worker's rights (Statuto dei Lavoratori) (l. 300)  
 1972 Removal of temporal limits to CIG programme  
 1974 Reform of procedures for labour litigations (l. 533)  
 1975 Wage indexation system (Scala Mobile)  
 1975 Reform of the CIG programme (l. 164)  
 1977 First introduction of CFL (l. 285)  
 1977 Possibility of fixed-term contracts in tourism  
 1978 More freedom of access to CIG programme  
 1978 Restrictions on workers' mobility across firms  
 1980 Payroll tax reduction (Fiscalizzazione degli oneri Sociali)  
 1983 Reduction of wage indexation  
 1984 Temporary training contracts (CFL) (l. 863)  
 1984 Solidarity contracts and Part-time contracts (l. 863)  
 1984 Freedom of choice in hiring procedures (l. 863)  
 1985 Extension of CIG benefits  
 1986 Reform of the indexation system  
 1987 More possibilities of temporary contracts (l. 56)  
 1990 Reform of firing regulations for small firms (l. 108)  
 1991 Restrictive reform of access to CIG (l. 223)  
 1991 Reform of layoff procedures (l. 223)  
 1992 Elimination of indexation  
 1993 Relaxation of the constraints to CIG access (l. 236)  
 1993 Collective wage bargaining (Giugni agreement)  
 1994 More possibilities of using CFL (l. 451)  
 1997 Introduction of temporary-job agencies (l. 196)  
 1997 Extensions of training contracts (l. 196)  
 1997 Annualization of working hours (l. 196)  
 1998 Job-Sharing  
 1998 Compulsory preventive arbitration for individual dismissals

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\* *Part of this table is taken from Bertola and Ichino (1995).*

The first step toward a slackening of the regulation has been the 1983 agreement, which allowed the firms to hire without using the list of the public employment agencies (*Uffici di collocamento*). This has repealed the severe prohibition of nominative hiring, considered one of the most

restrictive laws: before 1983 firms were compelled to hire new workers from the list given by the *Uffici di collocamento*.

In 1984, the regulation has been substantially weakened both on wages and labour contracts. First, the government decided to reduce by 15% the wage indexation (the *Scala Mobile*), then it introduced the «atypical» contracts: part-time and training contracts (*Contratti di Formazione e Lavoro, CFL*). The part-time work simply was not present in the Italian law until 1984. Its regulation has been designed so as to give the part-time workers the right to choose a full-time contract if the employer proceeds to new hirings. The part-time contracts allow a large flexibility in the use of labour time: they can be «horizontal» (reduced working hours over the entire year) or «vertical» (full-time working hours but for few months). The law provides for a seasonal part-time, too.

The CFL were conceived as a form of apprenticeship inside the firms, to make easier the acquisition of labour skills by young workers. Indeed, the CFL has been the keystone of the labour market deregulation, and it has opened the legislation to innovation. Moreover, with marginal reforms, its use has been made possible in a wide range of situations.

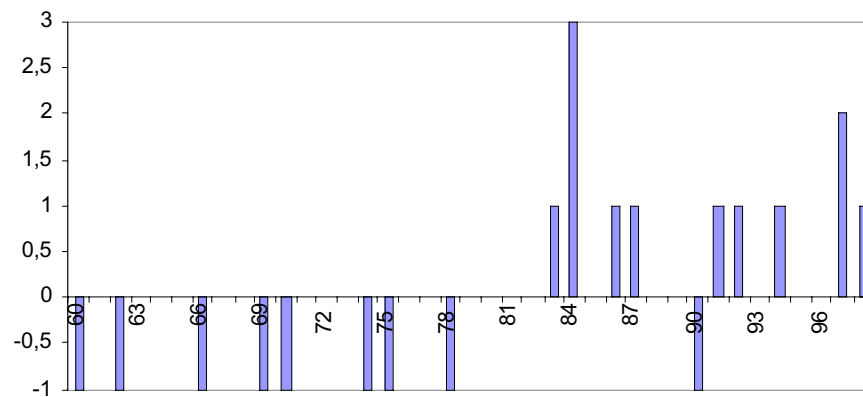
Originally, the CFL was to be applied to young workers aged from 15 to 29. The duration of the contract was up to 24 months, and after the employer had the choice whether to hire the worker permanently or not. Moreover, the law granted a series of fiscal benefits that reduced the labour cost for the firms. The transformation of the CFL into a permanent contract is still incentivated with an extension of the fiscal benefits. Thus, we have in the same year three innovations of crucial importance: the first has increased real wage flexibility -and has been the first step toward the abolition of the *scala mobile* - and the others have given the firms the possibility to hire young workers temporarily at a lower cost, and to organise more efficiently the working time.

After 1984, we see other institutional reforms of major importance: in 1986 a referendum succeeded in further reducing the wage indexation, making it almost negligible. This has definitively made easier the flexibility of the relative wages. The following year a new law reforming the 1962 regulation of the temporary contracts has been approved. Differently from the existing legislation, which specified very strictly the situations in which temporary contracts were allowed, it delegated to the collective bargaining the power to indicate new areas of admissibility.

Thus, after 1984, firms have been given many previously unknown flexibility margins. In figure 1, we show the «sign» of the most important institutional innovations over time: the minus corresponds to restrictive laws, and the plus to «deregulating» reforms. The number on the vertical

axis is the number of reforms approved in the same year. The change toward flexibility is evident.

**Figure 1 Restrictive and flexibility-oriented reforms**



In the 90s, a second wave of innovations has strengthened the deregulation process. In 1991 a new law has specified the procedures for collective firing, and it has set new limits to the use of the Cassa Integrazione Guadagni. The following year the Scala Mobile has been definitively abolished. In 1993 an agreement between the government, the unions and the industrialists' representatives has set up an income policy committed to the reduction of inflation. In 1994 the use of the CFL has been allowed for a much wider range of situations. Moreover, the age of the workers entitled to it has been extended (from 29 to 32). Further fiscal benefits have been granted for employers to incentivate the hiring of young workers (the social security contributions have been reduced to the 25%, and almost cancelled in Southern Italy)<sup>6</sup>.

Finally, firms have been allowed to pay a lower wage to the workers hired with CFL. These reforms have further eased the constraints for the use of flexible contracts introduced in 1984. One of the most important innovation, in 1998, has been the introduction of the temporary work agencies. Its importance has been historical, because the temporary work agencies have broken the public monopoly of public employment agencies. The first data available confirm that the temporary jobs are being used extensively.

<sup>6</sup> The benefits are confirmed up to a year in case of the conversion of a CFL into a permanent contract.

### **3. Institutionally-driven technological change and employment fluctuations**

The present work investigates the aggregate change in employment based on microeconomic foundations. Our main theoretical reference is given by Caballero and Hammour (1998a,b), henceforth CH. They show how, in the short run, an «institutional push» in favor of a production factor gives it a rent over its competitive price. In the long run, however, the appropriated factor will react, and will try to exclude the other through technological adaptation.

In our case, the institutional imbalance is supposed to be toward labour. Following CH, we should first observe an increase in the worker's share of output, then, as technology evolves and the old capital is replaced, an increase in the capital-labour ratio and a recovering of profits. CH (1998b) find evidence of this pattern for France, while this does not happen in the US, where institutions have not changed and the capital-labour ratio, as well as the output shares for capital and labour, have been constant. In the figures above we report some macroeconomic indicators for Italy<sup>7</sup>. The pattern of the series is analogous to that of the French ones (see CH 1998b).

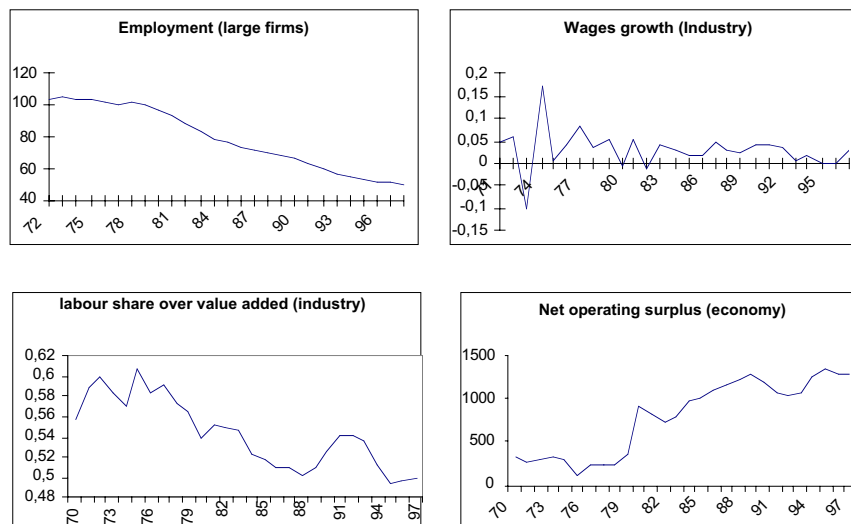
Barca and Magnani (1989) report evidence both on profits and technological evolution in the Italian industry. They document a sharp fall in profits during the seventies, followed by a strong recovery in the following decade. Obviously, wages show the opposite pattern. More interestingly, they find at the end of the seventies - thus after a period of strong political power for the unions - a dramatic increase in technological restructuring: the average life of a plant is substantially reduced between 1978 and 1981. This seems to depict the situation described in CH, in which the firms substitute capital to labour, shed workers and re-form their profit margins. We can indeed observe in figure 2 an increase in net operating surplus, which we suppose to mirror increased profits<sup>8</sup>.

#### ***Figure 2 Some macro's evolutions***

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<sup>7</sup> Our data are taken from «Conti Economici Nazionali 1970-97», Istat, Rome (1998).

<sup>8</sup> Note that these data concern the whole economy but the financial sector.



The subsequent labour market deregulation fits with the predictions of CH, too: When institutions become too inefficient, both capital and labour are worse off, and the institutions are likely to react to correct the imbalance. Indeed, as we can see from figure 2, the fall in large firms' employment since 1981 is apparent.

Thus, the CH theory seems to explain well the developments in the Italian industry.

In what follows, we argue that the pro-workers regulation of the seventies has driven the firms to adopt labour-saving technologies to reform their profits and reduce the appropriability. We show how the response of aggregate employment changes when new, more productive capital is installed to minimise the effects of regulation.

Our starting point is the optimal employment policy of a firm in presence of linear adjustment costs<sup>9</sup>. Since the seminal Bentolila and Bertola's 1990 paper, a large amount of literature has shown that the solution to the dynamic optimization problem of the firm generates an «inaction interval»: the existence of linear adjustment costs drives a wedge between the worker's marginal productivity and her wage. This defines an interval in which the marginal revenue fluctuates without causing the firm to change its employment level.

We start from the optimal policy rule for an infinitely lived firm in

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<sup>9</sup> We have preferred a specification with linear adjustment costs because it fits better the behaviour of the firms (Hamermesh-Pfann (1996)).

presence of uncertainty and adjustment costs. We consider an economy composed of  $m$  competitive firms, producing the same good with different technologies. The firm  $i$  is endowed with a technology

$$\vartheta_{it} \in \left[ \vartheta_{it}^-, \vartheta_{it}^+ \right], \quad (1)$$

where the lower bar indicates the less efficient technology and the upper bar the most efficient one<sup>10</sup>. The technology is distributed among firms according to

$$f(\vartheta_{it}), \quad (2)$$

which is a continuous single-peaked function such that

$$\int_{\vartheta^-}^{\vartheta^+} f(\vartheta) d\vartheta = m \quad (3)$$

The present expected value of the firm  $i$  at time  $t$  is

$$V_{it} = E \left[ \int_0^\infty \left[ R(n_{it}, Z_t, \vartheta_{it}) - wn_{it} - A\Delta n_{it} \right] e^{-rt} dt \right]. \quad (4)$$

Where  $R(\dots)$  is a strictly concave revenue function,  $w$  is the exogenous wage,  $Z_t$ <sup>11</sup> a normally distributed exogenous shock, and  $A$  is the cost of adjusting the workforce:

$$\begin{aligned} A &= +h & \text{if } \Delta n_{it} > 0 & \quad (h > 0) \\ A &= -f & \text{if } \Delta n_{it} < 0 & \quad (f < 0) \\ A &= 0 & \text{if } \Delta n_{it} = 0 & \end{aligned} \quad (5)$$

The hiring ( $h$ ) and firing ( $f$ ) costs are supposed constant and exogenous, since they are mainly due to labour market regulation. They

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<sup>10</sup> The technological parameter is always positive.

<sup>11</sup> There are many possible interpretations for  $Z_t$ . For example, it can be a productivity shock as well as a price shock. For our purposes, we only need to assume that it is an aggregate Gaussian shock.

do not need to be symmetrical<sup>12</sup>.

Bentolila-Bertola (1990) show that in each period the firm will change its workforce only if the present value of the expected returns will be equal to the marginal cost of hiring/firing. This means that, if we define the present value of expected marginal returns as

$$E_t[R(n_{it}, Z_t, \vartheta_{it})] \quad (6)$$

we get

$$\begin{aligned} \Delta n_{it} > 0 & \quad \text{if} \quad E_t[R(n_{it}, Z_t, \vartheta_{it})] \geq w + h \\ \Delta n_{it} < 0 & \quad \text{if} \quad E_t[R(n_{it}, Z_t, \vartheta_{it})] \leq w - f \\ \Delta n_{it} = 0 & \quad \text{if} \quad -f \leq E_t[R(n_{it}, Z_t, \vartheta_{it})] \leq h \end{aligned} \quad (7)$$

These are the first-order conditions in presence of linear adjustment costs. This rule can be summarised as follows: each firm, when deciding whether changing its workforce, compares the expected present value of the marginal returns with the adjustment cost. The firm will then hire or fire only if the expected marginal returns are equal to the cost of adjusting its employment level. This defines an «inaction interval», in which the marginal output fluctuates, and the firm finds it optimal to keep its workforce constant.

Differently from the rule generated by quadratic adjustment costs, the firm faces in each period a discrete choice<sup>13</sup>.

We are considering  $m$  firms differing only in their technology, and we assume that the marginal returns are monotonically increasing in  $_$  ; the other assumption is that adjustment costs are not so high as to prevent any change in the workforce:

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<sup>12</sup>Indeed, many authors show that in Europe firing costs are larger than hiring costs, while in the U.S. the opposite is true (see Hamermesh and Pfann (1996)).

<sup>13</sup>With quadratic adjustment costs (see for example Lucchetti and Staffolani (1996)), the firm will always choose an optimal time interval to adjust its workforce to the new level, while with linear adjustment costs the it has only to decide whether to adjust immediately or not.

$$\begin{aligned} \frac{\partial R(n_{it}, Z_t, \vartheta_{it})}{\partial \vartheta} &> 0 \\ E[R(n_{it}, Z_t, \vartheta_{it}^*)] &> A \end{aligned} \quad (8)$$

Thus, in each period  $t$  there exists  $\vartheta_{it}^*$  such that  $E[R(\cdot, \vartheta_{it}^*)] = w + A$ , so the firm endowed with  $\vartheta_{it}^*$  is indifferent between changing its workforce and keeping it constant. With respect to the other firms, we have

$$\begin{aligned} \Delta n_{it} &= 0 & \text{if } \vartheta_{it} < \vartheta_{it}^* \\ \Delta n_{it} &\neq 0 & \text{if } \vartheta_{it} > \vartheta_{it}^* \end{aligned} \quad (9)$$

The sign of  $\Delta n_{it}$  will depend on the sign of the aggregate shock  $Z_t$ . Now, we have to aggregate the individual  $\Delta n_{it}$  to obtain the aggregate change in employment. In aggregating the shock realizations, the values different from its mean will cancel out, and there will be no aggregate uncertainty. The aggregation is given by

$$\Delta N_t = \int_M \Delta n_{it} di = \int_L \Delta n_{it} di + \int_{L^*} \Delta n_{it} di \quad (10)$$

where  $M$  is the set containing all the firms,

$$\begin{aligned} |M| &= m, & \text{and} \\ L &= \{i \in M \text{ such that } \vartheta_{it} \geq \vartheta_{it}^*\}, \\ M &= L \cup L^*; & L \cap L^* \text{ is empty} \end{aligned} \quad (11)$$

Thus,  $L^*$  is the set of firms which do not change their workforce; consequently the aggregate employment change is given by

$$\begin{aligned} \Delta N_t &= \int_M \Delta n_{it} di = \int_L \Delta n_{it} di \\ |L| &= l = \int_{\vartheta^*}^{\vartheta} f(\vartheta) d\vartheta \end{aligned} \quad (12)$$

To compute  $l$ , the average realisation of the shock  $Z_t$  has to be substituted into the first-order conditions above, and solving for  $\vartheta_{it}^*$  we find the lower bound of the integral.

The technical innovation can be represented by an increase in both

the lower and upper bounds of the efficiency parameter: we can suppose that, starting from period  $t + j$ , we have

$$\vartheta_{t+j} \in [\underline{\vartheta_{t+j}}, \overline{\vartheta_{t+j}}] \quad \underline{\vartheta_{t+j}} > \underline{\vartheta_t}; \quad \overline{\vartheta_{t+j}} > \overline{\vartheta_t} \quad (13)$$

Now, if we consider  $m$  constant (in steady-state the firms which quit the market equal the new entrant firms), and if  $A$  does not increase significantly<sup>14</sup>, the value of  $l$  will increase, and so the integral of the individual  $\Delta n_{it}$

Thus, the integral showing the aggregate change in the employment will increase in response to the exogenous shock<sup>15</sup>.

Summarising, the intensive technological restructuring (explained in detail in Barca and Magnani (1989)) can be seen as a generalised shift in productivity, and its consequence will be an increase in the number of firms which find it optimal to change the employment level. The aggregate change in employment after a shock will then be larger.

We expect to find evidence of this behaviour in the impulse-response function of the aggregate employment. In the present work, we consider the total labour input as the product of the workers times the individual working hours. In the model above, the substitution between workers and hours is not explicitly taken in account for simplicity. Piccirilli (1998) shows that the solution to this problem does not change the optimal decision rule of the firm. The only difference is that the inaction interval is defined with respect to a value of the total labour input: when it becomes too costly to adjust the individual working time, the firm has to hire or fire some workers. Thus, there is an inaction interval in which the firm only accomodates the shocks using the working time.

This is the basis for the empirical analysis of the next section.

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<sup>14</sup>Indeed, since part of the adjustment costs is made of severance payments, which are based on the wage perceived by the worker,  $A$  tends to increase as a consequence of the higher wages entailed by the higher productivity. Nonetheless, we argue that the most important component of the adjustment cost is made of fixed costs (litigation costs, strikes, legal procedures). For our argument to be true, we only need that adjustment costs do not increase as much as to offset the productivity gains. In that case, firms had no incentive to replace the old capital.

<sup>15</sup>Our conclusion relies on the function  $f(\sigma)$  being constant over time. However, we argue that, if anything, this «distribution» of the firms with respect to technology may shift towards the more efficient technologies, reinforcing our argument.

#### 4. The estimation

For the estimation we have used data from the large firm survey (*«Indagine sulla Grande Industria»*) by the Italian Institute of Statistics (Istat). The data are the monthly employment and individual working hours indexes from 1972 to 1998. Since they concern only the firms with more than 500 employees, which are the most subject to regulation, our sample should be well suited to evaluate the effect of the institutionally driven technological change. The individual working hours concern the effective numbers of working hours, so they include overtime and exclude labour hoarding. We have two series of the employment index: the first one goes from 1972 to 1998, and the second from 1989 to 1998. The first series includes the workers subject to the *Cassa Integrazione Guadagni*, while the second does not. Including these workers is certainly a drawback, because the use of the CIG as a shadow unemployment benefit tends to alter the real number of employed workers. However, we argue that, since firms had access to the use of the CIG over both the periods, the effect of the restructuring - if any - should be pointed out as well. Indexes net of CIG are available from 1989; thus we have compared the impulse response functions of the two series over this period to evaluate the differences.

We use the Kalman Filter to get the impulse-response functions of both employment and individual working hours to a permanent shock. It has been introduced in physics, where it is used to extract the different signals getting rid of the noise. The Kalman filter has been widely used in all fields of economics for computing the latent factors (unobserved variables) that have been previously determined in the space state representation. Additionally it can also compute the parameter set, sometimes called hyper parameters. The estimated parameters, although not efficient, are consistent. The approach we use has been developed in Lucchetti and Staffolani (1996). With respect to other techniques, (i.e. Blanchard and Quah (1989)), it has the advantage of explicitly dealing with seasonality.

In our estimation, we consider the total labour input, given by the product of employment and individual working hours:

$$L_t = N_t H_t \quad (14)$$

In logs, we get

$$l_t = n_t + h_t \quad (15)$$

The economy is subject in each period to both permanent and temporary shocks. The model specified above allows us to predict the change in the impulse-response function of the aggregate employment index. The equations we estimate with the Kalman filter are the following:

$$\begin{aligned} \Delta n_t &= \mu_t + B(L)\eta_t + \gamma_t \\ h_t &= H + A(L)\eta_t + \gamma_t + \varepsilon_t \end{aligned} \quad (16)$$

where  $B(L)$  and  $A(L)$  are normalized polynomials, i.e.

$$A(L) = (a_0 + a_1L + a_2L^2 + \dots a_pL^p) \quad (17)$$

The latent factors to be estimated are the local level  $\mu_t$ , the seasonal effects  $\gamma_t$ , and the permanent shocks  $\eta_t$ . The transitory shock is represented by  $\varepsilon_t$ , which is a normal random variable with zero mean and constant variance  $\sigma^2$ . To complete the space state model we need to specify a functional form of the local level and the seasonal effects. For the local level we assume that it is a random walk:

$$\mu_t = \mu_{t-1} + u_t \quad (18)$$

where  $u$  is a white noise. To model the seasonal effects, we follow the methodology of Harvey (1989) letting

$$\gamma_t = -\sum_{i=1}^{s-1} \gamma_{t-i} + \omega_t \quad (19)$$

where  $\omega$  is again white noise. To consider the trade-off between hours and workers adjustment, we have to restrict the polynomials as follows:

$$B(L) = 1 - A(L); \quad B(1) = 1; \quad A_p = 0 \quad (20)$$

where  $p$  is the order of the polynomials. Thus, the coefficients of  $B(L)$  are the part of the shock accommodated through the employment adjustment in a certain period, while the coefficients of  $A(L)$  are the part of the shock accommodated through hours adjustment in the same period. These constraints imply

$$a_i = a_{i-1} - b_i, \quad (21)$$

so, once we get the estimates of a polynomial, we are able to derive the values of the other. To proceed with the estimation, we have to specify the state-space representation of our equations. The general state-space form is

$$\begin{aligned} y_t &= Z_t \alpha_t + d_t + S_t \varepsilon_t \\ \alpha_t &= T_t \alpha_{t-1} + c_t + R_t \varepsilon_t \end{aligned} \quad (22)$$

This model is composed by two equations. The first one is called «measurement equation» and it relates the observed variables  $y_t$  with the latent factors  $\eta_t$ . The second one is the «transition equation», that relates the present latent factors with their past values by means of a first order Markov chain. Additionally we can add some exogenous variables  $d_t$  and  $c_t$ . The two errors terms are not necessarily normally distributed (as it is suggested usually), but they are assumed to be serially uncorrelated disturbances with mean zero and covariance matrices  $H_t$  and  $Q_t$  respectively. Notice that  $Z$ ,  $S$ ,  $T$  and  $R$  are time varying matrices.

Given the equations (12) to be estimated, their state-space representation is the following:

$$\begin{bmatrix} \Delta n_t \\ h_t - H \end{bmatrix} = \begin{bmatrix} 1 & B & e' & 0 \\ 0 & A & 0 & e' \end{bmatrix} \begin{bmatrix} \mu_t \\ \eta_t \\ \underline{\gamma_t} \\ \gamma_t \end{bmatrix} + \begin{bmatrix} 0 \\ \varepsilon_t \end{bmatrix} \quad (23)$$

$$\begin{bmatrix} \mu_t \\ \eta_t \\ \underline{\gamma_t} \\ \gamma_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & C & 0 & 0 \\ 0 & 0 & D & 0 \\ 0 & 0 & 0 & D \end{bmatrix} \begin{bmatrix} \mu_{t-1} \\ \eta_{t-1} \\ \underline{\gamma_{t-1}} \\ \gamma_{t-1} \end{bmatrix} + \begin{bmatrix} u_t \\ \eta_t \\ 0 \\ \omega_t \\ 0 \\ 0 \end{bmatrix}$$

where  $A$  and  $B$  are the row vectors of dimensions  $1 \times (p + 1)$  with the

parameter of the polynomials  $A(L)$  and  $B(L)$ . The matrices  $C$  and  $D$  are

$$\begin{aligned} C &= \begin{bmatrix} 0 & 0 \\ I & 0 \end{bmatrix} \\ D &= \begin{bmatrix} -1 & -1 \\ I & 0 \end{bmatrix} \end{aligned} \tag{24}$$

the first for modelling the shock and the second for modelling the two seasonal effects. Finally the shock  $\eta_t$  and the seasonal effects  $\gamma_{t-1}$  and  $\tilde{\gamma}_{t-1}$  are vectors being  $\eta_t = (\eta_t, \eta_{t-1}, \dots, \eta_{t-p})$  and  $\gamma_t = (\gamma_t, \gamma_{t-1}, \dots, \gamma_{t-s+2})$  respectively.

Therefore the latent factors to be computed are  $\mu_t, \eta_t, \gamma_t$  and  $\tilde{\gamma}_t$ . In total, they are  $1 + p + 2(s - 1)$ . The vector of hyper parameters to be estimated has a dimension  $2(p + 1) + 5$ , where  $p + 1$  is the column dimension of  $A$  and  $B$  and 5 is the number of variances. Given the slow dynamics of the system and the high number of significant lags, we have averaged the data to quarterly to reduce the number of parameters to be estimated. In order to get the optimal lag number for each sample, we used a log-likelihood ratio test.

As explained above, we have estimated the two equations for two periods: the first from 1972 to 1981, and the second from 1982 on. For comparison purposes, we also have estimated the same equations over the whole sample. Once the parameters and the factors are estimated using the Kalman filter, it is possible to check whether the restructuring process has had an effect on the response of the series.

To look for this effect, notice that the coefficients  $B$  and  $A$  can be considered as impulse response weights, because they are the link between the response variables ( $n_t$  and  $h_t - H$ ) and an impulse in the permanent shock. These weights provide a measure of how the shock affects the employment and working hours, and the weight given to each time lag. Thus, to obtain the impulse-response functions, we simply have to plot the polynomial coefficients<sup>16</sup>.

If technological innovation has been successful in reducing the effect of the adjustment costs, and the labour market has become more responsive, more firms should change their workforce in response to

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<sup>16</sup>To proceed with the estimation, we have to assume that the system being modelled is stable. This implies that the input and output series are stationary and that the sum of the coefficients  $B$  and  $A$  is finite.

exogenous shocks. The aggregate response of the employment is then supposed to increase in the second part of our sample. On the other hand, the adjustment has to rely less on the role of individual working hours.

## 5. Results

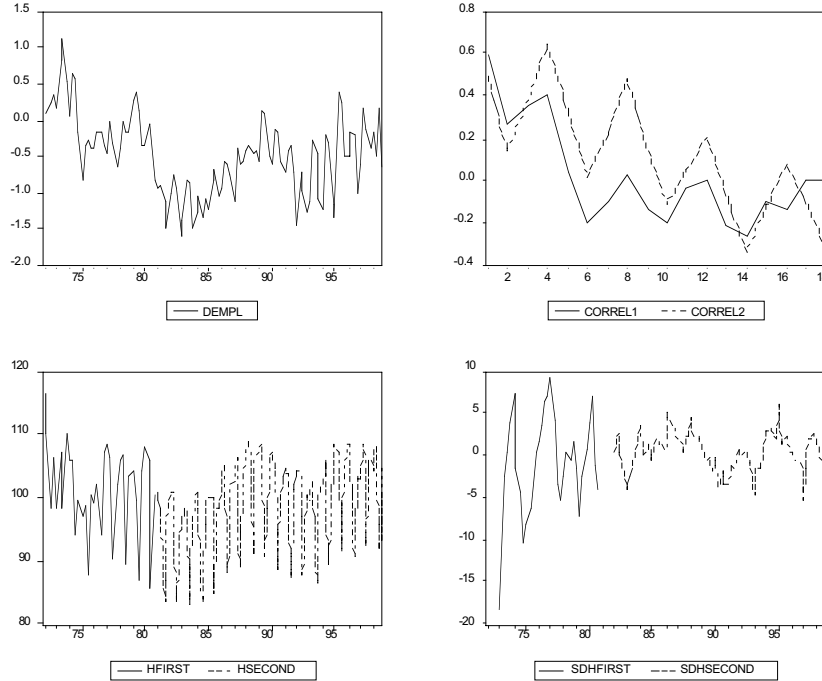
Previously to the estimation of the latent factor and the coefficients, it is useful to present a preliminary analysis of the data. As we have explained above, the analysis will be done splitting our sample. The first part of the sample goes from the first quarter of 1972 to the last quarter of 1981, and the second goes until last quarter of 1998.

In Figure 3 we can see the first difference of the employment and the correlogram of the two sub periods. Figure 3 reports the individual working hours and their seasonal differences, too.

The basic findings emerging from the figures are the following:

1. From the fourth panel, we can see that in the first sub period the individual working hours are more volatile than in the second. This is evidence in favour of our hypothesis of a reduced importance of the individual working hours adjustment.
2. The employment level has a clear regular unit root hiding the seasonal component, and thus, to achieve stationarity, we take the first differences. The seasonal component, showing as well an unit root, appears clearly in the differences, though it is not so strong as in the case of the working hours.

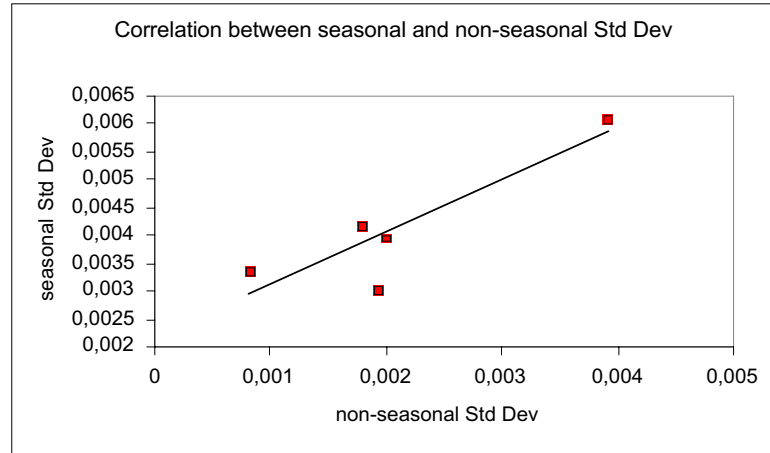
***Figure 3 Series and autocorrelograms***



3. Examining the correlogram of the employment first differences ( $\Delta n_t$ ), we see that, in the second sub period, the seasonal effect is almost twice as much than in the first. This could be another proof that the restructuring caused by the excessive regulation has made the firms more efficient: the costs of seasonally adjusting the workforce have been substantially reduced. Moreover, the increase in seasonality constitutes indirect evidence of an increased responsiveness to exogenous shocks. As shown in Miron and Beaulieu (1995), if the non-seasonal and seasonal components of a series are correlated, more seasonal volatility implies more business-cycle volatility. To check for this correlation, we used the Miron and Beaulieu's method<sup>17</sup>: our estimations prove evidence on the cross-sectional correlation between seasonal and non-seasonal standard deviation for the employment in different sectors. This correlation constitutes further evidence in favour of our hypothesis.

<sup>17</sup> According to Miron and Beaulieu (1995), the seasonal component is estimated regressing the growth rates of the series on seasonal dummies and calculating the fitted values, while the non-seasonal component is the residual. The source of the data is always the large firms survey by Istat. The sectors used are the whole economy, textiles, metals, manufacturing and energy.

**Figure 4**



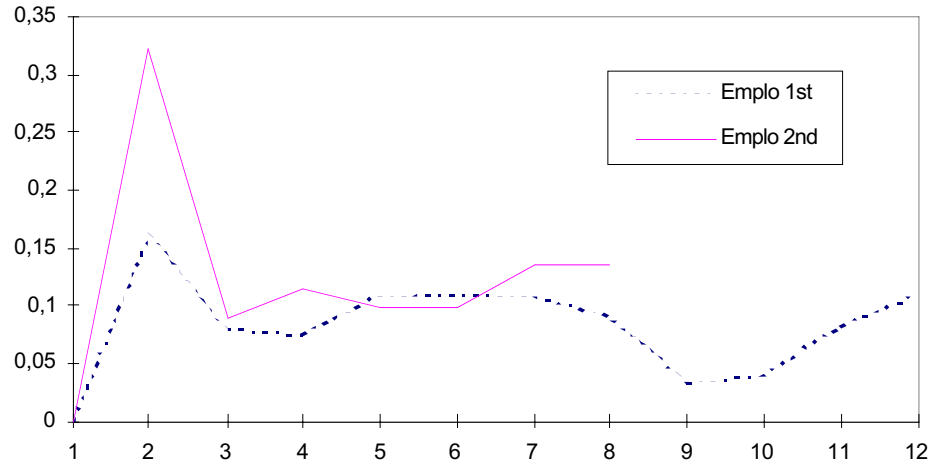
4. From the series of employment it is clear the process of labour shedding, which, as predicted in CH, coincides with the installation of new capital. To proceed with the estimation, we have used a log-likelihood ratio test to determine the optimal lag of the shocks for both samples. For the first part of the sample, we found that the optimal lag is 10. On the other hand, for the second part, the optimal lag is 6.

In our estimates, the time needed to adjust the employment in the second period is then sharply reduced. This is quite a strong result, meaning that the change in the responsiveness of the employment has been effective.

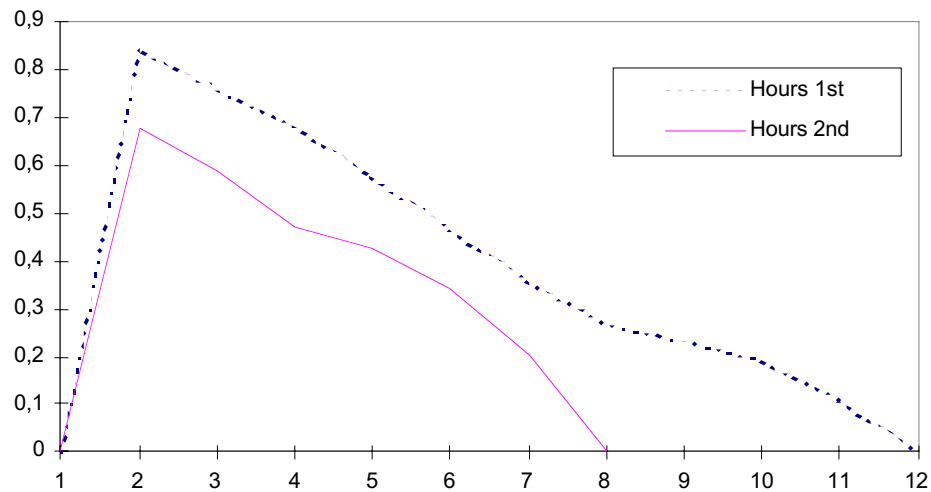
In figure 5 and 6 there are the impulse response weights, that is, the parameters  $a$  and  $b$  of the measurement equations that relates the permanent shock with the employment level and the working hours. The difference in the response is evident.

Running the Kalman filter on the adjusted series, we find that it does not show an increased response to shocks (Fig. 7 and 8).

**Figure 5 Impulse Response Function Employment**

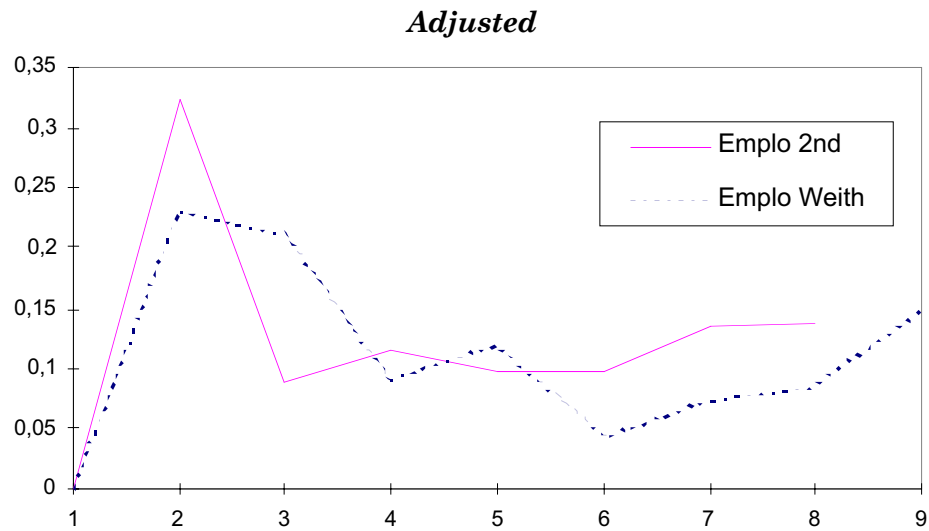


**Figure 6 Impulse Response Function Hours**

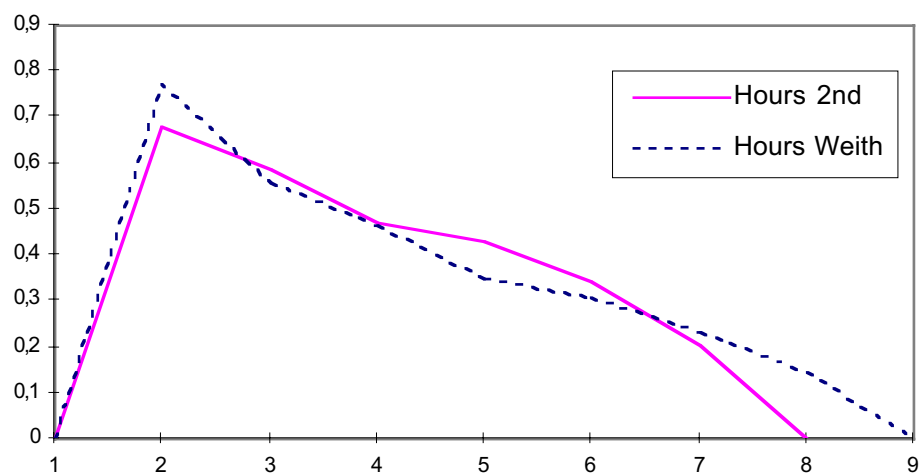


This is somewhat surprising, because, in the raw series, the bigger volatility with respect to the non-adjusted series is apparent. Moreover, being the «Cassa Integrazione Guadagni» a flexibility-improving device, one expects the opposite result. In our estimates, however, this increased volatility is entirely explained by the seasonal factor. Figures 9 and 10 show that the seasonal factor in the adjusted data is twice as much as in the non-adjusted data.

**Figure 7 Impulse Response Function Employment Adjusted and non-**

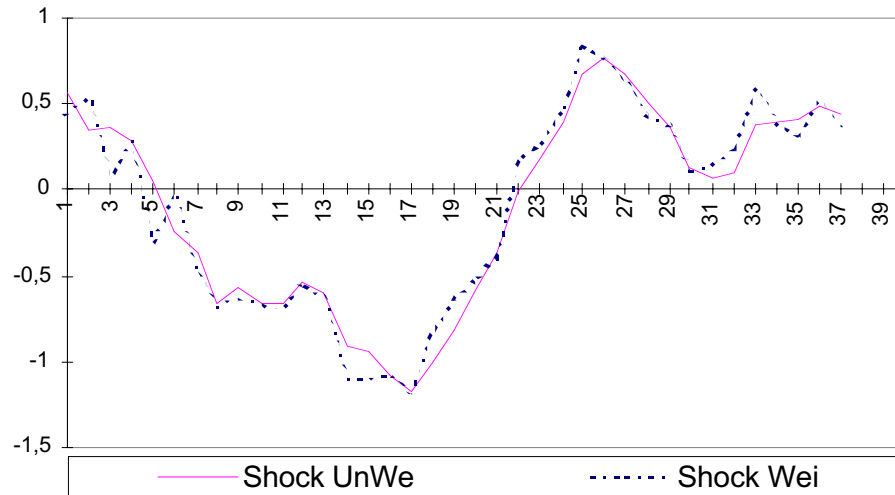


**Figure 8** *Impulse Response Function Hours Adjusted and non-Adjusted*

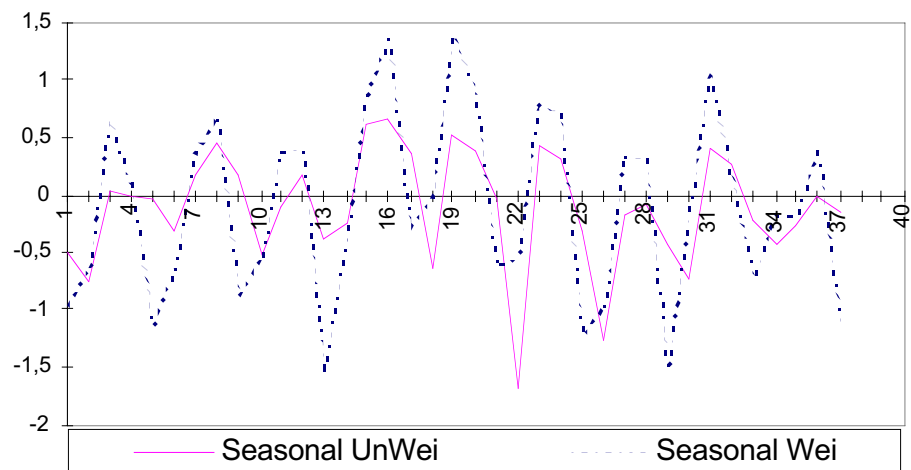


It is noteworthy that the series of the estimated permanent shocks is almost identical in the two cases, proving that the filter is successful in identifying the shocks. Thus, the «*Cassa integrazione Guadagni*» seems mainly used to accommodate seasonal fluctuations.

**Figure 9** *Permanent Shock*



**Figure 10 Seasonal Factor**



This could seem an empirical puzzle, but we think that, since its use is basically related to the diversifiable risk at the firm level, the fact that we use aggregated data tends to cancel out this risk. Thus, the importance of the «Cassa Integrazione Guadagni» in the adjustment process should be hidden by the aggregation. However, it is confirmed that though it was originally conceived to deal with occupational emergencies, it has become an ordinary flexibility device as well.

## 6. Conclusions

This paper has studied the impact of the labour market regulation on the Italian large firms since the 70s.

Our results support the view that, according to the CH theory, the protection granted to workers has first been successful in modifying the income distribution, but has pushed the firms to a radical restructuring in order to re-form their profit margins. Both the figures presented and the impulse response functions show that the attempt to «force» the output sharing in favor of workers in the long run has been offset through new labour saving technologies.

A comparison with the evidence presented in Caballero and Hammour (1998) seems to suggest that the mechanisms behind the unemployment growth in Italy and France have been similar: in both countries the strong pro-workers legislation set up in the seventies has increased the wage share in the short run, while in the long run it has pushed employers to minimise the labour input.

Further evidence for our argument comes from Barca and Magnani (1989): they argue that large and small firms have followed two different patterns: the former show drastic restructuring and labour shedding, and the latter - less subject to regulation - show smooth, uniform restructuring and employment growth.

Somewhat surprisingly, the estimation on the data adjusted for the effect of the *Cassa Integrazione Guadagni* (the lay-off system) do not show any increase in the impulse-response function. Given the importance of this mechanism, this finding is unexpected. This probably happens because the adjusted series are indeed more volatile, but this volatility turns out to be mostly a seasonal effect, which is not accounted for in the impulse-response function. Thus, firms seem to have used the CIG as a further «ordinary» flexibility device, to adjust seasonal fluctuations in production. This result is probably due to the use of aggregated data, which do not reflect the diversifiable risk at the firm level. However, it suggests further research in this direction: it is our opinion that the real importance of the *Cassa Integrazione* as an adjustment mechanism can be better studied using firm-level data.

Our results confirm the importance of the institutions in shaping the behaviour of the economy, but also the feedback of an institutional balance too far from the competitive outcome. The evolution in labour market legislation since the 80s shows important signs of an evolution toward an institutional environment more favourable to employment growth. The persistency of the jobless growth, however, indicates that maybe this process is not accomplished yet<sup>18</sup>, and, probably, that the

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<sup>18</sup> Bertola and Ichino (1995) argue that the flexibility-oriented reforms are

employment losses in the large firms are permanent, because they reflect a structural technical change.

Consequently, a policy aimed to employment growth should be focused on institutional arrangements able to incentivate the creation of new firms on the labour demand side, and on the improvement of the human capital on the supply side. In fact, the technical innovation shifts the labour demand toward skilled workers. From this point of view, we remark that the current Italian employment policy, based on incentives to hiring, more than on incentives to firm creation, does not seem to be a proper solution.

Moreover, introducing labour market flexibility in an environment where the number of employees has been minimised is unlikely to create new employment: indeed, it may cause even more labour shedding.

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undermined by a lack of credibility that makes firms still reluctant to hire, while they fully exploit the possibilities of firing.

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