

Technological change, Pay Inequality and Economic Performance: Do Institutions Matter?

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1. Introduction

This paper discusses some links between innovation activity, institutions and economic growth in ten European countries on the basis of descriptive evidence. In particular, the focus of the paper concerns the analysis of the determinants of R&D (research and development) activity and institutional arrangements on both economic performance and labour productivity.

In recent decades, a number of industrialised countries, particularly in Europe, have experienced significant changes in wage relatives, as well as a decline in employment rates and a growing joblessness. Changes in the distribution of earnings showed a widening of wage differentials across different groups of workers (OECD, 1996) and substantial differences across countries in labour market outcomes. The latter underline the diversity of forces, incentives and constraints operating in the new and global economy. The movement from the “old” to the “new” economic system has been driven by several factors, namely the technological revolution, the introduction of new product and the changes in work and firm organisation (Brynjolfsson and Hitt, 1995; Caroli, 1999; Milgrom and Robert, 1990), the increase in international competitiveness and globalisation (Bolton and Dewatripont, 1994).

These changes in the shape and in the functioning of economic systems have been often accompanied by some de-regulation in both the product and labour market.

As it is often claimed, the possibility for a modern economy to have good macroeconomic performance – long-run growth, high levels of labour and capital productivity, low unemployment, large rate of GDP per-capita - depends crucially from its stock of new technology, from the quality of its labour force and level of innovation in the industrial system (Nickell, Nicolitas and Dryden, 1997). According to a large body of new macroeconomic research, this is not all the story. In fact, in a era of restructuring, good economic results depend also on the existence of institutions that provide a proper transactional framework (Osterman, 1994; Radner, 1993, Teulings and Hartog, 1998). In fact, if production factors that are technology-based must be reallocated away from contracting activities into newly expanding ones, that incorporate the newest technique of production, one of the most important and strategic elements of success is the capability to adapt the functioning of both product and labour market to those changes.

By limiting the ability in gaining the advantages of technological opportunities, institutional failures and transactional impediment can result in dysfunctional factors such as: low performance in labour market, stagnation, inequality and slow economic growth (Blanchflower and Burgess, 1998).

In this context, one aspect which has received less attention in the literature is how the system of industrial relations and, more generally, institutions have responded to those changes. Our aim is to investigate both the role and the influence of the institutional environment in this process of restructuring and to analyse, at a more aggregate level, which are the consequences of the interactions between institutions and innovative activities on the performance of economic systems (Blau and Kahn, 1996; Freeman and Katz, 1995). Particular attention will be devoted to the analysis of effects on economic performance, on the creation of new jobs and on the distribution of earnings.

To summarise, our purpose is to test the effects on economic performance of the new system of industrial relations through some indicators related with use of both technology and flexibility.

We investigate the relationship between flexibility (in the organisation of work, in the management of human resources and in wage setting policies) and economic performance (productivity and employment) under different institutional settings: industrial relation practices, personnel policies, market competition, level of bargaining and other labour institutions in ten European countries.

To address those issues, information on economic performance has to be complemented by information on other aspects of the functioning of the firm, as well as employment relations.

In addition to information about innovation intensity, economic performance and the set of institutions, the data-set used has information on several industrial relation practices and labour market

flexibility. It has been constructed matching data from several OECD Surveys (Employment Outlook, Science indicators and the Job Study) with data provided by the EPOC Survey on work organisation. The key data-set for our research is the EPOC (Employee direct Participation in Organisational Change) Survey carried out in 1996 by the European Foundation for the Improvement of Living and Working Conditions¹.

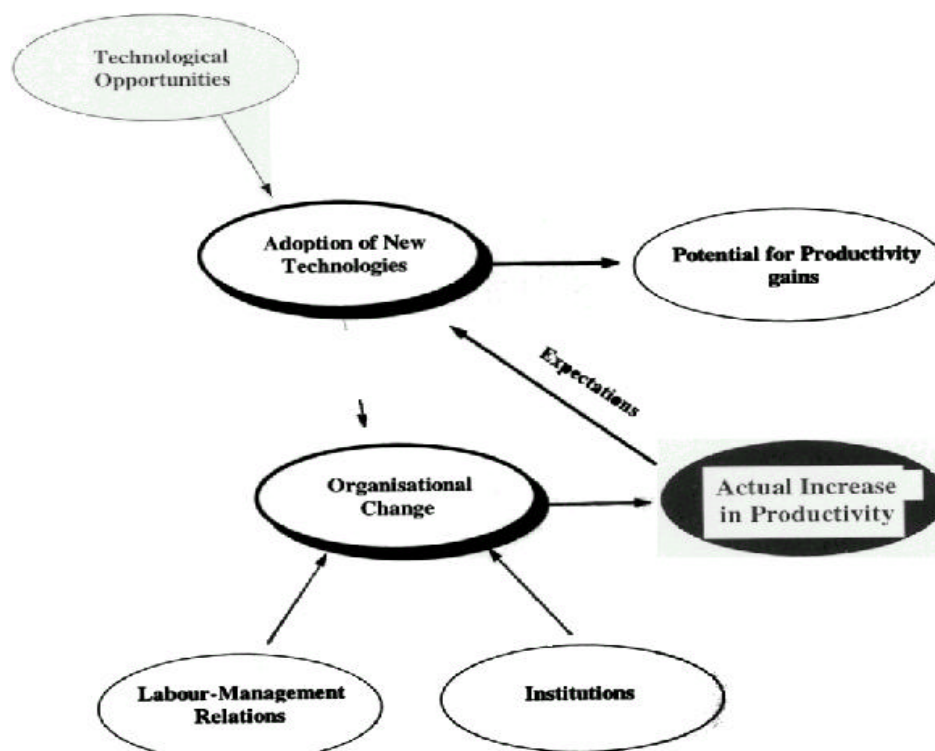
The paper is organised as follows: section 2 looks at the different forms of organisational change and at its determinants. In section 3 the relationship between organisational change and labour relations is explored. Next, labour market institutions are analysed. The last section present some concluding remarks.

2. Innovations, new technology and the move toward a more flexible work organisation

The role of technological change in the recent evolution of industrialised economies has been of central importance for innovating activity is one of most important factors of success in competitive markets. Differently from the past, the successful set of innovations driven by ICT (information and Communication Technology) has created a new paradigm, in which the so-called GPT, General Purpose Technology (Aghion et. al, 2000) is extensive and spread in the whole economy and similar across firms and sector.

However, the increase in the level of global competition and the rapid diffusion of new technological opportunities has been not neutral for the functioning of firms and, at more aggregate level, of economic systems.

Figure 1 –New technology, organisational change and productivity



Source: Caroli, 1999.

¹ as the main focus of the EPOC is on employer characteristics, it covers a wide range of personnel management and industrial relations practices ranging from the structure of employee representation, personnel management methods, pay systems, work practices and investment in new capital and innovation activity.

In fact, if, at the one hand, (embodied and disembodied) technological progress provide a great opportunity to increase firm performance, on the other hand, to fully capture the advantages of technological opportunities and to obtain increase in productivity, the investment in technology require also changes in the organisation of production and work (Brjsholfsoonn and Hitt, 1995 and 1998²), such as the development of less hierarchical structures and the reduction of work specialisation (Aghion, 1997; Caroli, 1999; Lindberk and Snower, 1996).

2.1 Aggregate evidence on technological change

The availability of technological opportunities represent the first step of the process described in figure 1. As we can see from Table 1, in the last two decades the number of people employed in research activity has constantly increased although some differences among countries still persist. The diversities in the value of R&D indicators across advanced economies introduce the concept of *national innovative capacity* (Stern et al., 2000). This represents the ability of a country to produce and commercialise a flow of innovative technology over long term and depends on the nation innovation infrastructures and the individual country “stock” of knowledge which is embodied not only in physical capital but also in the skills ability of qualified labour force (the so-called human capital).

Table 1 –Technology indicators

	Tot. R&D expenditure as a percent. of GDP			Tot. R&D personn. per thousand labour force		
	1975	1985	1995	1975	1985	1995
Denmark	1	1,3	1,8	5	7,2	10,8
France	1,8	2,3	2,3	9,8	11,4	12,6
Germany	2,2	2,7	2,3	11,2	13,8	11,6
Ireland	0,8	0,9	1,3	-	4,8	11,4
Italy	0,8	1,1	1,1	4,5	5	6,1
Netherlands	2	2,2	2	10,9	10,6	10,7
Norway	1,3	1,6	1,6	7,3	9,1	11
Spain	0,3	0,7	0,8	1,8	2,9	5
Sweden	1,8	2,9	3	9	11,2	14,5
UK	2,2	2,3	2	-	10,1	9,5
EU 12 (av.)	1,4	1,8	1,85	6,6	9	9,4

Source; Job study (1994); Science indicator and Archibugi, D and Pianta, M,

Nevertheless, over the past two decades, as a consequence of catching-up, spill-over and imitation phenomena, there has been convergence of available and technologically advanced stock of capital. In fact, table 2 shows clearly that there has been a reduction in the rate of growth of innovative intensity (R&D exp/GDP) for those European countries with the higher level during the '80.

As suggested by figure 1, the development of new technologies provide only a potential for productivity gains. To fully capture the advantages of technological change and to obtain actual increase in productivity, it is also necessary to adapt the organisation of both production and work. This is what we look in the next.

2.2 Different forms of organisational change

In the literature individuate three main areas of change in the firm’s organisation are considered: first more flexibility in work organisation (HRM), second in the production system (the use of ICT, flattening in the structure of production, de-verticalisation) and, third, in pay methods (pay for

² A common result is that IT improves productivity by enabling complementary organisational innovations.

performance, profit sharing). As shown in the recent literature, availability of new technologies and the possibility to experiment some changes in the organisation of both work and production, as well as of pay, are strategic elements to improve performance (for a review, see Snower, 1999).

Comparing organisational settings across countries is arduous because information is usually scarce, often qualitative in nature and only partially informative, and, finally, it can hardly be compared. In order to ensure a reasonable level of international comparability, the large set of practices related to organisational change reported in the EPOC Survey was synthesised into a set of detailed and summary measures. These are cardinal measures that are increasing with the degree of rigidity. The need to aggregate information on different practices into three domains involved a certain amount of discretion in the construction of the detailed indicators.

The construction of the detailed and summary indicators of regulation involved the following steps:

- collection and preparation of the basic data and classification of the procedures individuated by the EPOC Survey variables into three domains (e.g. flexibility in the organisation of work, in the organisation of production and in the pay system).
- definition of the detailed indicators (sometimes aggregating the basic data), which constitute the basis for subsequent estimations;
- estimation of the summary indicators for each domain, which summarise the various dimensions of flexibility described by the detailed indicators;

Flexible use of human resources.

In order to capture the degree of flexibility in the human resource management we use six (commonly used in literature) detailed indicators³:

- the reduction of working hours (time_red)
- the introduction of flexible working hours (time_flex)
- flattening in the structure of management (flat_str)
- more involvement of low-level workers in decisional process (inv_lowlev)
- the presence of work teams (team_work)
- job rotation of workers across different tasks (job_rot).

The results are shown in Table 1. Numbers in columns indicates the percentage of firms that, in each country, introduced the related practice during the period 1993-96.

Table 3 – Index of flexibility in the organisation of work

	Time_red	Flex_time	flat_str	inv_low	team	job_rot	Tot_org	Rk
Denmark	5,5	17,1	42	10	40	28	142,6	4
France	10,9	31,4	21	44	30	6	143,3	3
Germany	18,7	45,2	30	19	20	7	139,9	5
Ireland	8,6	22	23	32	27	10	122,6	7
Italy	6	15,8	10	24	28	13	96,8	9
Netherlands	7,5	20,8	47	46	9	9	139,3	6
Portugal	15,8	14,1	3	9	22	9	72,9	10
Spain	13,3	20,2		33	34	14	114,5	8
Sweden	7	27,3	46	60	29	38	207,3	1
UK	7,4	29,6	45	48	33	13	176	2
AVERAGE	10,07	24,35	29,6	32,5	27,2	14,7	138,4	

³ In parentheses the name of the variable reported in the tables.

The summary indicator (RK) ranges from 1 (maximum degree of flexibility) to 10, according to the differences in the aggregate intensity of reported indicators.

As we can see, Sweden and UK stand at the top of the ranking, while countries such as Spain, Portugal and Italy shows low overall degree of flexibility in the management of human resources. A lot of continental countries are in intermediate position, like France, Germany and Denmark. Looking at the data, the practice which are more commonly adopted are the flattening of hierarchical structure, the involvement of low levels in decisional process and the use of teams. It seems that persist big differences in the adoption of routines between countries. In fact, there is a sort of polarisation in the style of human resources management; from one side there are Nordic and Anglo-Saxon countries (UK, Denmark, Sweden) in which the idea of flexibility is mainly connected with the introduction of more innovative practice; from the other side there are countries more likely to use traditional tools to increase the global flexibility (change in the working hours).

Coefficients of correlation between the detailed variables and the global level of flexibility in work management show positive and statistically significant correlation especially with the flattening of the employment structure, with job rotation, with a major involvement of low-level workers in decisions and with more flexibility in work time. Differently from a widespread opinion, the reduction in the work time doesn't seem to have a strong and, especially, positive relationship with more flexible work arrangement.

Flexible organisation of production.

The set of variables used as a proxy of the presence of innovative system of production combine information about the adoption and the use of new technology, the decision of the production form and strategy. As predicted by many authors, there are some characteristic which are typical of flexible and innovative firms. In table 2, we show which is the proportion of firms that, within a country, implemented in the period 1993-96 the following practices:

- downsizing (downsize)
- outsourcing (outsorc)
- product innovations (prod_innov)
- more use of ICT (ICT)
- Quality circles (quality)
- Strategic alliance and/or return to the core business (strategy).

Table 4 – Index of flexibility in the production

	downsize	outsorc	Prod_innov	ICT	Quality	strategy	Tot_prod	RK
Denmark	9,6	15,6	28,9	46,7	10	38,5	149,3	5
France	28	15,9	31,7	30,5	20	26,3	152,4	3
Germany	19,9	17,6	26,4	28,7	19	29,1	140,7	6
Ireland	21,2	22,8	18,1	48,4	11	29,5	151	4
Italy	15,8	11	34,1	45,5	14	16,6	137	7
Netherlands	25,3	22	28,7	17,4	15	27	135,4	8
Portugal	20,5	18,8	24,2	31,2	11	12,7	118,4	10
Spain	6,5	8	32,4	37,8	17	17	118,7	9
Sweden	43,4	16,1	26,1	44,8	9	14,1	153,5	2
UK	31,9	13,2	27,6	51,2	18	31,9	173,8	1
AVERAGE	22,21	16,1	27,82	38,22	14,4	24,27	104,71	

Although there are significant differences between countries and the relative position of countries in the ranking of summary indicator is quite similar to the previous one – at least for the first position and for the last – table 2 shows that the increasing – and well-documented- convergence in

technological opportunities (due to catching-up phenomena and international spillover) have contribute to level differences in production techniques. In fact, the standard deviation in the overall adoption of practice is equal to 38 for variables expression of change in the organisation of work and to 13,7 for those related to the presence of new styles in the organisation of production.

From table 2, we can also notice that, the most adopted types of innovation in production area are both the use of ICT and the introduction of product innovations, while is seems more unusual to change the productive chain.

Flexible pay methods.

In the new system of production individual performance appears every day more important. There is greater flexibility in the management of human resources and workforce is usually requested to perform a great variety of task. In this context, a greater individualisation of wage determination has been often advocated in order to improve the functioning of labour market. In fact, it seems that a more flexible system of remuneration could be more efficient of a fix grid of wages.

Table 3 shows some figures related to the degree of flexibility in pay for the sample of European countries object of our investigation. As usual, we construct our summary index starting from six (commonly used) indicators of pay flexibility:

- pay for individual skill (pay_skill)
- bonuses related to individual attitude (bonuses)
- pay for individual output (pay_ind_out)
- pay for team output (pay_team_out)
- profit-sharing (prof_share)
- rent-sharing (rent_share)

We can classify these practices into three broad categories: bonuses, pay for performance and profit sharing. It can be noticed that there are large differences between countries not only in the global use of these schemes, but also in the use of each of them. If, from one side, UK appears again very flexible, by contrast there are countries like Sweden that demonstrate to have implemented a lot of changes in the organisation of work maintaining a traditional pay system. Quite interestingly, in Italy a large number of firms of the EPOC sample introduced recently some innovations only in the pay structure and not (with the same intensity) in the other domains.

The recourse to new practices is limited by almost all countries to forms of “pay for productivity”. Only in UK and, by some extent in France, there have been developed forms of risk sharing and financial participation of workers to the economic results of firms.

Table 5 – Index of flexibility in pay methods

	pay_skill	bonuses	pay_ind_out	pay_team_out	prof_share	rent_share	tot_pay	RK
Denmark	29	9	12	18	9	6	83	8
France	50	16	14	12	43	6	141	3
Germany	75	25	27	14	11	3	155	1
Ireland	23	16	14	22	7	3	85	7
Italy	29	19	22	38	5	2	115	4
Netherlands	50	13	11	9	13	4	100	6
Portugal	33	14	14	5	5	5	76	9
Spain	25	13	22	21	11	12	104	5
Sweden	19	8	7	22	15	1	72	10
UK	37	14	18	25	38	22	154	2
AVERAGE	37	14,7	16,1	18,6	15,7	6,4	108,5	

2.3 Evidence on new organisation practices

In this section we try to shed some light on the existence of complementary in the implementation of these practices. In fact, many authors find, at micro-level, that organisational changes in general tend to cluster, because guarantee an increase in efficiency if adopted together. At our (macro) level, of course, is very difficult to find robust evidence supporting this result, nevertheless it could be useful to analyse the relationship between our variables and to investigate if emerge some common patterns at national level.

In table 6 are reported the coefficient of correlation between human resource and workplace flexibility indicators. Results show that changes in the two areas tend to be undertaken together: in fact the coefficient of correlation (CC) between the global innovation activity in each of two areas is equal to 0.72 and robust (s. e. 0,17). In addition, in more dis-aggregate perspective, we can notice also that downsizing has a positive and significant relationship with a great involvement of low-level workers in decision (0.75) and that, generally, requires a global change in the organisation of work (value 0.7). As we could expect, where the outsourcing appears a common behaviour, the percentage of firm using team work is limited. By contrast, the diffusion of team work and the adoption of new technology are strong complement. In addition, ICT clusters also with job rotation and with an increase in hour of work. Finally, a more strategic approach to markets and production is correlated with management structure less hierarchical (as we can expect).

Table 6 – Correlation between work and production practices

	time_red	flx_time	flat_str	inv_low	team	job_rot	tot_org
downsiz	-0.2056	0.3605	0.4028	0.7519*	-0.2321	0.2975	0.6989*
outsorc	0.0424	0.0806	0.0745	-0.0058	-0.6095*	-0.1833	0.0118
prod_inn	-0.1487	-0.0833	0.0014	0.0559	0.2009	-0.0017	-0.0539
ict	-0.4871*	-0.1800	0.0590	0.0285	0.7796*	0.4790*	0.2446
quality	0.4044	0.6040*	-0.0049	0.1673	-0.1219	-0.6589*	0.0078
stra_bus	-0.2410	0.2947	0.5045*	-0.1173	0.1987	-0.0897	0.2824
tot_prod /	-0.4645*	0.3135	0.3723	0.6750*	0.2651	0.3588	0.7278*

notes: *=20% statistical significance

The table 7 presents coefficients measuring the degree of correlation between HRM variables and pay system indicators. In this case, differently from the previous evidence, the overall coefficient of correlation is positive (0.15), but not significant. In other words – as we have shown also in the previous sections comparing the three summary indicators – there isn't a global, unique relationship of complementarity between all the variables here object of analysis.

Nevertheless, there is some evidence supporting the hypothesis of the existence of some degree of clustering between practices. For example, countries which are more likely change the organisation of work in a conservative way (without changing its global structure), tend to have also a more traditional pay system (positive and significant relationship with pay for individual performance and negative with pay for team output and various form of profit sharing).

On the other side, countries that appears more innovative – with reference to HRM practices – seems to be more likely to adopt performance-related-pay practices (CC between pr_share and tot_org equal to 0.5 and significant). In this context, working time flexibility stands probably in an intermediate position – shows a positive relationship both with pay for skill (0.72) and profit sharing (0.44), as well as with bonuses (0.54) and the adoption of a more globally flexible pay system (0.71)-.

Very innovative routines, such as team work, involvement of low-level and job rotation, shows generally a negative correlation with pay for individual output routines (in the measure of -0.5/-0.7)

and a positive one with profit sharing and pay for team output⁴. Rent sharing doesn't show clear associations with the other variables.

Table 7 – Correlation between HRM and pay methods

	pay_skill	bonus	pay_ind	pay_team	pr_share	rent_share	tot_pay
time_red	0.5672*	0.5810*	0.5437*	-0.5276*	-0.1061	-0.0544	0.2852
flx_time	0.7249*	0.5441*	0.3821	-0.1331	0.4473*	0.0765	0.7121*
flat_str	0.0392	-0.4488	-0.3548	-0.0046	0.2755	0.3041	-0.0609
inv_low	-0.1304	-0.3156	-0.3922	0.1509	0.5596*	0.1929	0.3804
team	-0.5126*	-0.3550	0.0145	0.4511*	0.2090	0.3813	0.1289
job_rot	-0.5711*	-0.7134*	-0.5333*	0.2716	-0.1649	-0.1497	-0.5375*
tot_org /	-0.0067	-0.3646	-0.3800	0.1242	0.4943*	0.1858	0.1524

notes: *=20% statistical significance

At last, table 8 reports the results from the analysis of the relationship existing between more flexible production and pay systems. Some interesting aggregate figures emerge: workplace-innovation oriented economic systems are more likely to adopt also profit-sharing schemes but not pay for individual performance practices (pay_skill, bonus, pay_ind). – and this result is very similar to the previous one (see table 7).

In particular, downsizing is complement of downsizing decision and the use of total quality schemes. In addition, countries where firm are more quality-oriented are those in which there has been more adoption of quite almost the set of newest pay practices⁵ (global coefficient of correlation equal to 0.91).

Table 8 – Correlation between production practices and pay methods

	pay_skill	bonus	pay_ind	pay_team	pr_share	rent_own	pay_tot
downsiz	0.0048	-0.2114	-0.5119*	-0.0638	0.4705*	-0.0231	0.0495
outsorc	0.2405	0.0434	-0.4568*	-0.5505*	-0.1510	-0.4387	-0.2662
prod_inn	0.1078	0.0177	0.2982	0.2934	0.2395	0.1646	0.3393
ict	-0.6517*	-0.2600	-0.0294	0.7232*	0.0217	0.3078	-0.1107
quality	0.6884*	0.5954*	0.6249*	-0.0694	0.6182*	0.4438*	0.9115*
stra_bus	0.3307	0.0628	0.0177	-0.0649	0.2871	0.2785	0.3490
tot_prod /	-0.1966	-0.1776	-0.2941	0.4176	0.5938*	0.2637	0.2404

notes: *=20% statistical significance

Results show also that the adoption of new technology (ICT) shows a strong correlation with pay systems based less on individual outcomes and more on team productivity (correlation between ICT and pay_team is 0.72).

⁴ The only practice that seems to be associated with a general change in pay system is flex_time. The other ones tend to cluster only with some practices and not with other.

⁵ With the exception of pay for team output.

3. Organisational change and labour relations

As suggested by figure 1, changes in the organisation both of production and work could also affects (and be affected by) the system of labour-management relations and its outcomes. Increasing rates of employment for part-time and temporary workers, decrease in the age of managers, increase in turnover rates and a reduction in the level of satisfaction in the workforce are often addressed as typical characteristics of this phenomena (OECD, 1994 and 1999).

To analyse this aspect we need a set of indicators which give (broad) information about the characteristics of both labour and industrial relations. Some are obtained from the EPOC Survey, others come from alternative sources (indicated in bracket).

The nine variables are:

from the EPOC Survey;

1. existence of a collective agreement
2. increased competition over the period 1993-1996;
3. reduction of employment over the period 1993-1996
4. increase in the proportion of part-time workers;
5. increase in the proportion of temporary workers
6. increase in the proportion of woman in the workforce.

from other sources:

7. ratio between managers aged less-than-35 and those aged more-than-55 (Blanchflower, 1996) ;
8. ratio between small and big firms (OECD, 1994);
9. index of the degree of satisfaction in the workforce (Blanchflower, 2000)

Table 9 shows the matrix of correlation between these variables. We can argue that, for example, high rates of coverage are positively related with negative trends in employment but, at the same time, with increasing percentage of temporary workers – i.e. the existence of collective agreement and the rate of growth of temporary workers don't seem substitutes. There is also some evidence that woman's share in workforce and non-regular type of work contract tend to cluster.

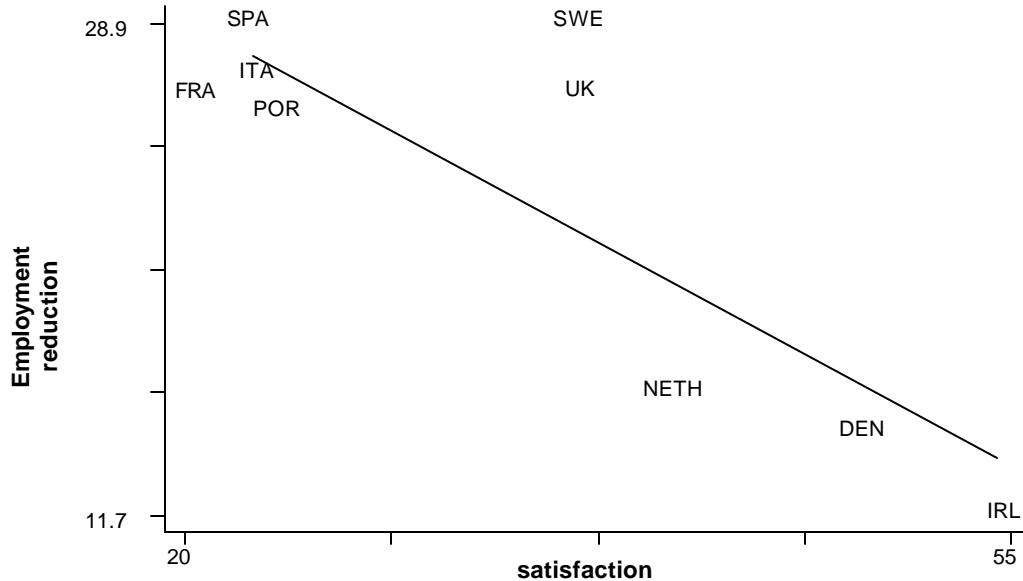
Table 9 – Structure of employment and industrial relations

	coll_agre	incr_cmz	red_empl	incr_pme	incr_tmp	incr_wom	manag-55	small_big	satisf
collett_agre	1.0000								
incr_competiz	-0.2679	1.0000							
red_empl	0.5518*	-0.0001	1.0000						
incr_partime	0.2008	0.3400	0.0697	1.0000					
incr_tempor	0.4817*	0.1520	0.2352	0.6111*	1.0000				
incr_wom	0.4027	-0.0906	0.1918	0.7118*	0.8912*	1.0000			
manag35_55	0.1204	0.0382	0.2391	0.0876	-0.3803	-0.2048	1.0000		
small_big	0.0534	-0.1244	-0.0687	-0.7586*	0.3549	0.0308	-0.6006*	1.0000	
satisf	-0.6535*	0.1083	-0.8285*	0.3184	-0.1042	0.1332	0.3905	-0.2681	1.0000

The growth in part-time employment shows also to has a negative relationship with the relative weight of small firms on the total, as well as the percentage of young managers. Quite interestingly, in countries where large parts of workforce are covered by collective agreement, the average level of satisfaction seems to be particularly low. In addition, satisfaction shows a positive and strong correlation with a decrease in the total employment. As we can see from figure 2, the distribution of dissatisfaction is not equally distributed, but has a high concentration in some of those countries – like

Spain, Italy, France and Portugal - which experimented in recent years a significant decrease in employment rates.

Figure 2 – Reduction in employment and satisfaction



The analysis of the relationship between these variables and summary indexes of flexibility previously defined (table 10) shows that, while the degree of total coverage doesn't seem to have significant correlation with our set of HRM indicators⁶, a reduction in employment rates is positively associated (at the level of 50%) with the reduction or flexibility in working time. In this context, also the use of part-time plays a great role in organisation of work: in fact, the latter shows a strong and positive correlation (89%) with the synthetic indicator of the degree of flexibility, as well as with other four partial indexes. As we know that part-time is also correlated strongly with temporary employment and increase of the woman's share in workforce, not surprisingly they show similar patterns⁷.

The ratio between small and big firms is the only variable with a negative relationship with the degree of flexibility in the management of human resource. In other words, some practices are more likely to be implemented when the (relative) percentage of small firms is low. In particular, countries where the average size of firm is (relatively) large shows also higher levels of time flexibility.

By contrast, countries where the organisation of works experimented significant de-verticalisation processes are also characterised by high levels of satisfaction in the workforce. Nevertheless, the degree of satisfaction is low where there has been significant reduction in the working time – and, probably, in the general level of working conditions.

⁶ In other words, the presence of strong institutions doesn't seem to have a negative impact on the possibility to innovate the organisation of work.

⁷ It can be noticed also that these three indicators are negatively correlated with the reduction in working time.

Table 10 – Labour relations and work organisation

	time_red	flx_time	flat_str	inv_low	team	job_rot	tot_org
collett_agree	0.3395	0.1411	-0.1586	0.2036	-0.1862	0.1666	0.0488
incr_competz	-0.2978	0.3309	0.2863	0.6312*	0.1034	-0.2412	0.3611
red_empl	0.5088*	0.4620*	-0.2021	0.1168	0.0447	-0.0277	0.0877
incr_partime	-0.2951	0.4316*	0.6438*	0.8506*	-0.0485	0.4923*	0.8971*
incr_tempor	-0.1738	-0.1050	0.1565	0.6460*	0.0678	0.5359*	0.3888
incr_wom	-0.1213	0.0365	0.2687	0.5048*	0.1426	0.7363*	0.5451*
manag35_55	0.5646*	0.8506*	0.1685	-0.1190	-0.3525	-0.2939	0.1763
small_big	-0.4078	-0.7361*	-0.4274	-0.3294	0.2452	0.3949	-0.6023*
satisf	-0.5419*	0.0528	0.6014*	0.0746	0.0302	0.3184	0.3916

Turning now to the determinants of firm's organisation, we can see that, for example, downsizing is positively related to a extensive utilisation of non standard forms of employment and to an increasing proportion of female in the workforce. As we can expect, downsizing is more likely to be adopted by more big firms than small ones – in fact, the correlation between these two variables is negative and significant. The evidence suggests also that outsourcing decisions are negatively related with both reductions in employment and small/big firms.

More interestingly, evidence in table 10 shows that unions seem to be slightly, but significantly, against the adoption of new technologies and strategic alliance⁸. By contrast, the introduction of new or better-performing products doesn't seem to be opposed by the presence of strong institutions.

At last, in those countries where the productive system has become more quality-oriented, there has been also an increase in the level of competition and a reduction in employment rates. Not surprisingly, for this reason, the introduction of a quality-based approach in the production of goods is negatively associated with the level of satisfaction.

Table 11 – Labour relations and flexibility in production

	downsize	outsorc	prod_inn	ICT	quality	stra_bus	tot_prod
collett_agree	0.1865	-0.2035	0.4621*	-0.5200*	0.0871	-0.6586*	-0.1604
incr_competz	0.1925	-0.1949	0.1318	0.2463	0.5350*	0.2497	0.4801*
red_empl	0.1831	-0.5939*	0.4449*	-0.0872	0.4648*	-0.5262*	0.1595
incr_partime	0.8880*	0.2342	-0.2599	0.1283	-0.0992	0.0075	0.7576*
incr_tempor	0.4942*	-0.1604	-0.0719	0.1898	-0.3393	-0.6556*	0.3603
incr_wom	0.5873*	0.0077	-0.3044	0.2863	-0.5239*	-0.4734*	0.4343*
manag35_55	0.0092	0.2768	-0.1237	-0.4220*	0.4716*	0.3788	-0.1393
small_big	-0.6292*	-0.5337*	0.5851*	0.3779	-0.5245*	-0.4848*	-0.2772
satisf	0.0896	0.5707*	-0.6456*	0.3062	-0.4773*	0.6722*	0.1511

Up to now, little work has been done to investigating, both at micro and micro level, the relationship between new pay methods and the development of more flexible forms of work from one side, and the presence of extensive collective agreement from the other one (Metcalf et al., 2000). Table 12 shows that, excluding pay for individual, there is a negative correlation between the extension of collective agreements and the use of innovative schemes of remuneration.

The evidence reported below suggests also that, as both previously discussed and – in broader sense – predicted by the theory, increasing competition and the decision to introduce more flexibility both in pay policies and workplace organisation are complements. Among available indicators,

⁸ Maybe because they see in these practices a potential factors of erosion in the in the quality of working conditions.

increased competition is associated with wider use of profit sharing and rent sharing practices. In other words, firms⁹ are more likely to incentive workers with pay-related-performance schemes when they are facing periods of intense competition is high.

Table 12 –Labour relations and pay methods

	pay_skill	bonus	pay_ind	pay_team	pr_share	rent_share	tot_pay
collett_contr	0.1280	-0.0566	-0.1140	-0.4008	-0.0122	-0.4912*	-0.1321
incr_competz	0.0204	0.1977	0.2148	0.4867*	0.5407*	0.4061*	0.5378*
dim_empl	0.2879	0.3642	0.5138*	0.1294	0.2214	0.1410	0.4694*
incr_partime	-0.0844	-0.3476	-0.5326*	0.0117	0.4389*	-0.0170	-0.0131
incr_tempor	-0.5782*	-0.4681*	-0.4068*	0.2042	-0.0332	-0.1646	-0.4461*
incr_wom	-0.5076*	-0.5106*	-0.4991*	0.0831	-0.0945	-0.2305	-0.5075*
manag35_65	0.8631*	0.6719*	0.4621*	-0.2938	0.0465	-0.2240	0.5428*
small_big	-0.7144*	-0.1758	0.1105	0.6476*	-0.5967*	-0.2594	-0.5172*
satisf	-0.2335	-0.4009	-0.4853*	-0.0026	-0.1833	-0.0556	-0.3264

There is also some evidence that remuneration policies based, in broad sense, on pay for performance (thus including the whole range of practices here presented) are also positively related with a reduction in employment rates (at 47 percent) and with the structure of management (at 54 percent). On opposite, changes in the composition of employment towards a greater presence of non standard contracts are substitutes of pay practices, especially those based on individual performance.

4. Organisational change and labour market institutions

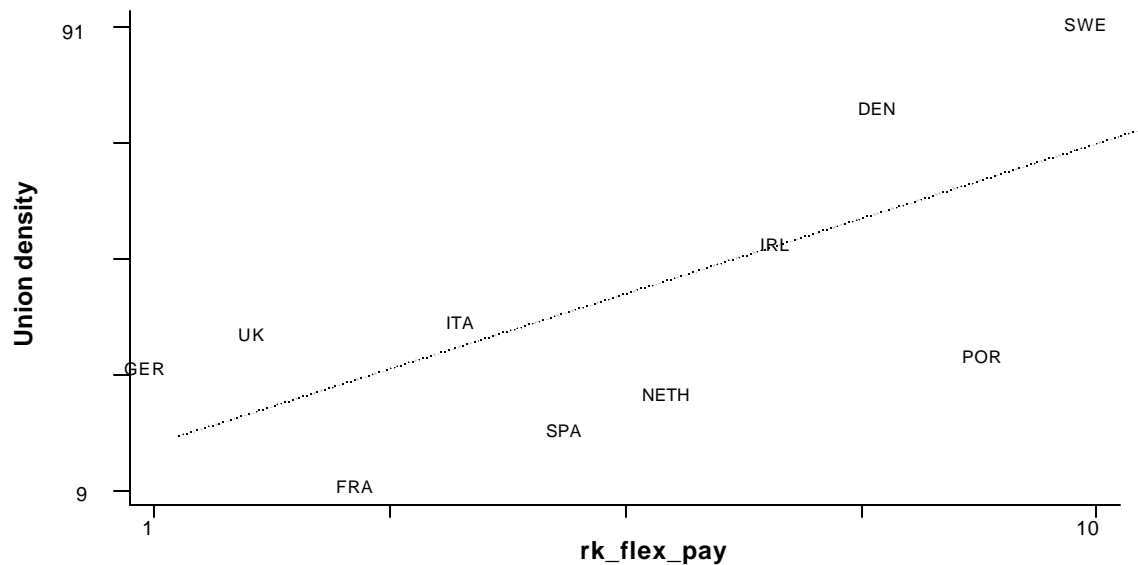
Inspection of figure 1 shows that the final effect on productivity of the decision to adopt advanced technologies is filtered by organisational changes but depend largely also on how institutions respond to those changes.

At aggregate level, this implies that, in presence of some structural and widespread trends, like the development of new technologies and the move toward more flattering in work organisation, the final effect on the economic performance depends crucially from the collection of production and institutional arrangements typical of the setting in which these actors operate (see also Caballero and Hammour, 2000)¹⁰.

For this reason, in recent years, the question of labour market flexibility received a lot of attention in the literature. In particular, it has been often blamed as the main explanation for the poor performance of European labour markets (compared, for example, with the employment growth in the US economy). While in the US flexible markets could adapt the functioning of labour market to the fast structural change driven by technological change, in the EU countries suffered from a set of pervasive institutions providing strict regulation in labour market and entrepreneurial activity, thus vanishing the potential advantages of the technological revolution.

⁹ Especially large firms, as we can derive from the negative correlation value (-0.57) between profit sharing and the small/big indicator.

¹⁰ In other words, in a period of generic change of technology and increase in the importance of innovation activity to be competitive, every system adopt and develop a certain “technological specificity” which interacts with its “relationship specificity” (the set of institutional arrangement and labour market relationships) to determine the final effect of restructuring process.



In this section our aim is to verify the relationships between institutions and flexibility, as well as technological change, and their effects on economic performance. In the first part, we try to shed light on the relationships between the set of institutions and the search for more flexibility both in the utilisation of human resources and in the organisation of work. In the second part we analyse the final effect on economic performance.

4.1 Institutions and labour market flexibility

As done in many previous studies, we try to capture the amount of labour market flexibility available to European countries by using mainly two indicators: the degree of union density and the strictness of employment protection legislation¹¹.

Although institutions alone are not the only responsible of the scarce level of labour market flexibility, a lot of studies showed that, by some extent, they have contribute to the large increase in unemployment rates and to inefficient and unequal distribution of outcomes (for a detailed review, see for example OECD, 1997; OECD, 1999; Scarpetta, 1996). In this context, as shown by many authors (Pissarides, 2000; Bertola, 1990) high levels of employment protection reduce performance by limiting the capability to adapt labour markets to new conditions. OECD's Job Study (1994) states expressly that the one of the best way to increase labour market flexibility consists in reducing employment protection, thus increasing economic performance. Nevertheless, there is weak econometric evidence on the positive effects of the reduction of regulation and protection on economic and employment performance (OECD, 1999; Nickell and Layard, 1999; Nickell and Nunziata, 2000).

In this paragraph we investigate if the search for more flexibility in the organisation of work has been affected by the presence of pervasive unions and strict regulations on employment.

In the previous section, dis-aggregated evidence based on EPOC Survey showed that the extension of collective agreements seem to have a (weak) negative, though not significant, effect on the adoption of innovative pay methods, while the evidence on the effects on various sources of organisational changes is rather mixed and it was difficult to discover an unique bond between the variables.

Now, by using union density, a more accurate measure of union power, as a proxy for labour market institution we try to shed more light on these relationships.

Figure 3 – Union density and pay methods

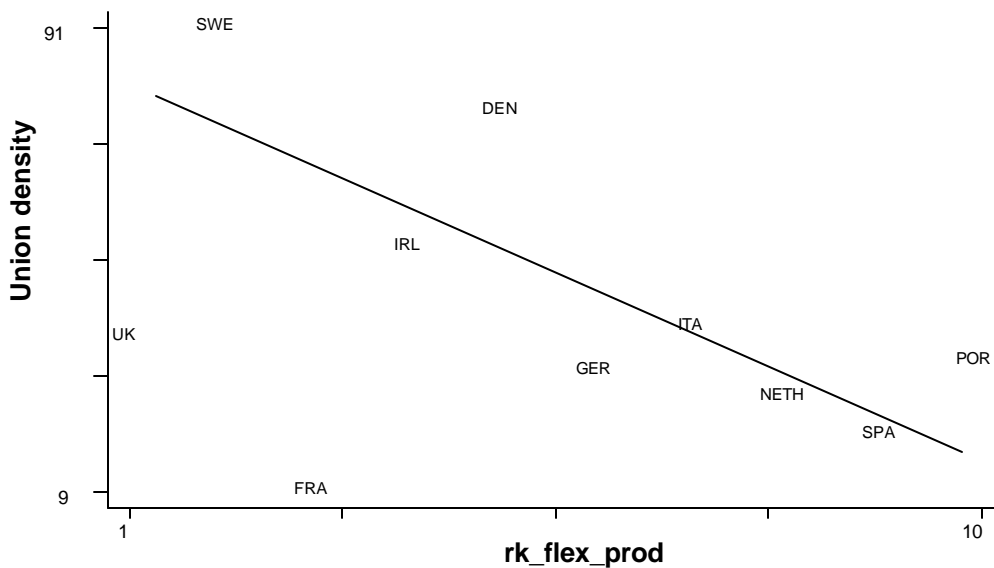
¹¹ For an extensive analysis

As shown by figure 3, where we plot union density rates and the summary ranking of pay flexibility (see table 3 for a description) we find some (rather robust) evidence – at aggregate level - supporting the hypothesis that the presence of pervasive institutions disincentive firms in adopting more flexible pay policies.

The role of union in the decision to introduce more flexibility in the organisation of work isn't clearly *ex-ante* predictable. From one side, unions could use their “voice effect” (Freeman, 1980) to hinder changes in the management of human resources¹². From the other side, empirical evidence at micro-level suggests that union presence also could affect positively the decision to innovate the organisational form – sometimes the relation is positive and statistically significant (see Osterman, 1994; Machin and Wadhvani, 1991). What seem to matter is degree of decentralisation of industrial relation and the co-ordination between unions and firm.

Figure 4 and 5 seem to partially confirm the last interpretation; there is a (weak) positive relationship between union density and flexibility, especially for the adoption of those changes concerned with both workplace and technology characteristics.

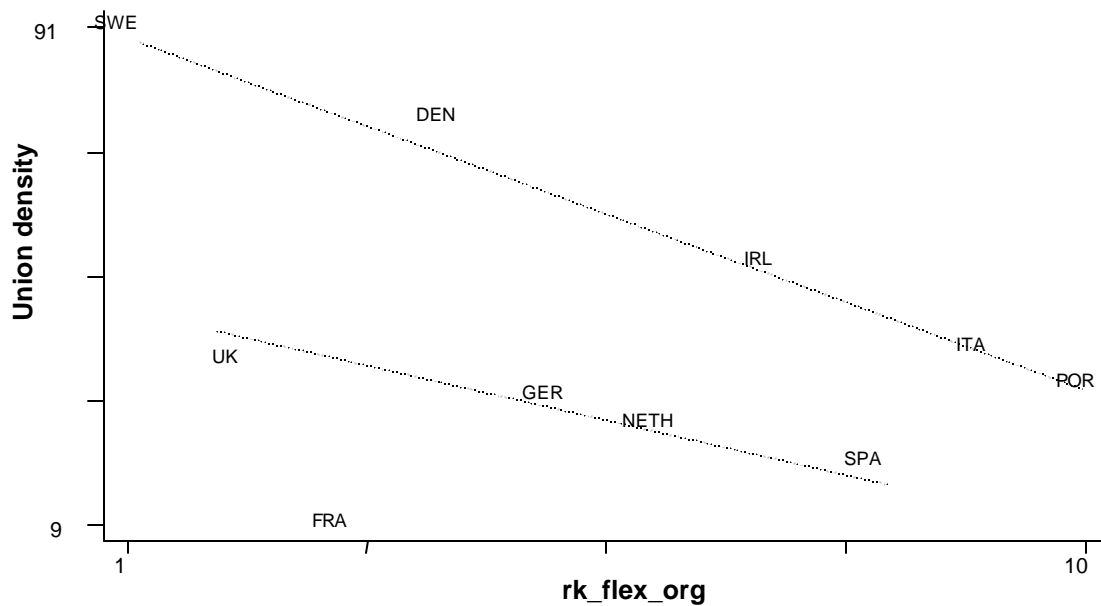
Figure 4 – Organisational change and union density



In fact, excluding France – where union density is very low but collective agreements cover (quite) the whole workforce – and UK, in the other countries emerge a positive relationship between variables. An explanation of this result can be found observing that, though in Northern countries union density rates are relative high – compared to those existing for continental Europe – , the industrial relation system is based on more co-operative and less adversarial relationships between social partners. Figure 5 seems also to suggest that, if European countries are grouped into two classes according to their degree of union density (more than 30 percent; less than 30 percent), within each class the level of flexibility increases with union density.

¹² Changes in work organisation are often opposed by workers as a potential factor of worsening of their employment status.

Figure 5 – Ranking in HRM and union density

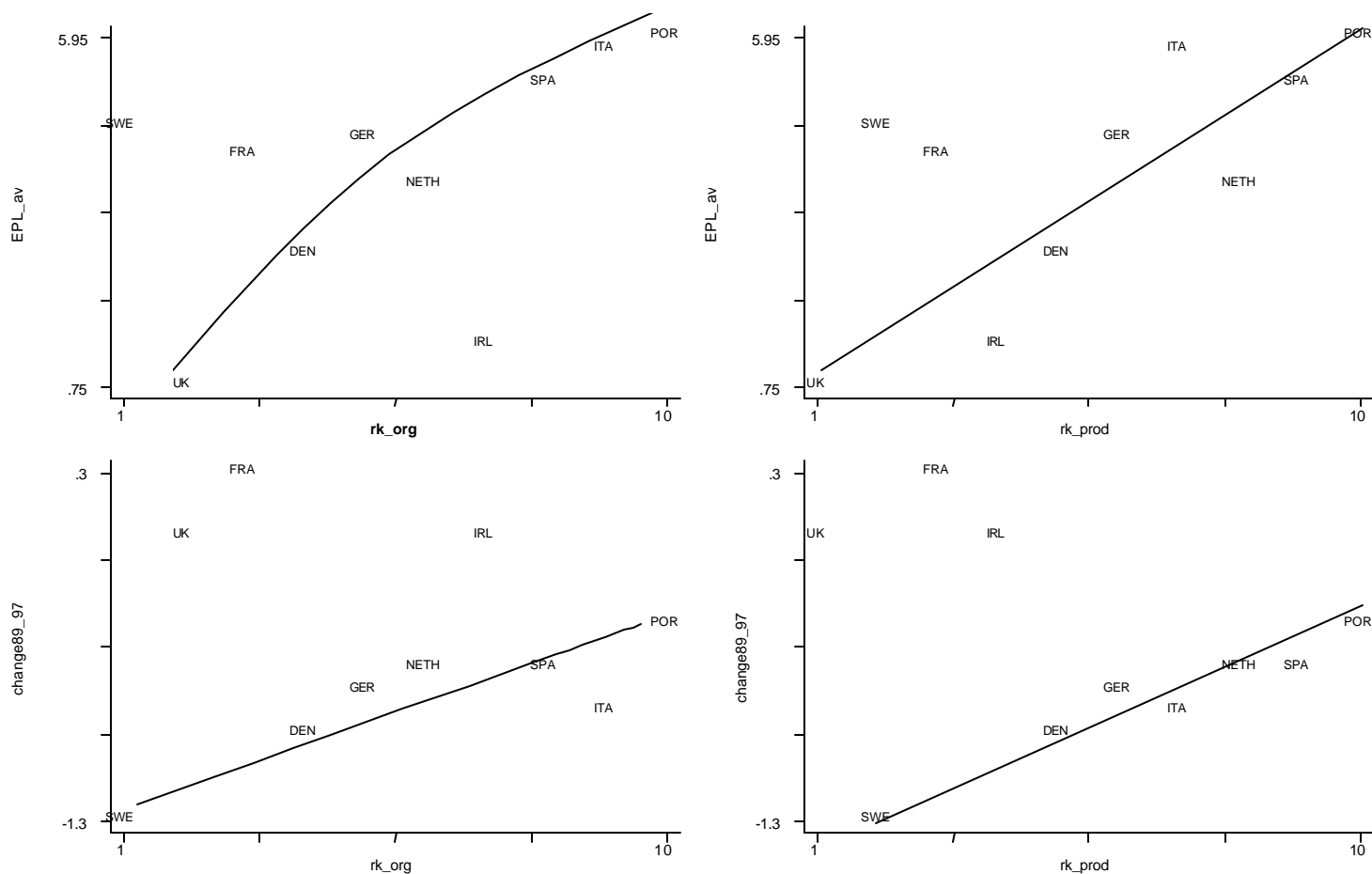


Carry on the analysis of the determinants of labour market flexibility and their bonds with new practices, we try to shed more light on the role in this context of employment protection. While previously we expected to find an influence of union density on pay more than on the form assumed by work organisation, now, by principle, we should reverse the perspective. In fact employment protection legislation affects particularly the global degree of flexibility of labour market. Severe restriction in hiring and firing decisions, as well as the existence of regulations and constraints in the mobility of job within firms disincentivise firms in undertaking change in the organisation of work, as these decisions could result too expensive – compared with the gains in efficiency and better allocation of work across firms.

Although our results seem to support this view, the evidence suggests that there are also some exceptions. First of all, data available confirm that employment protection legislation doesn't work as an incentive for the introduction of new pay methods. On the other side, it could represent a constraint to the introduction of innovative forms of employment and business management, though in some cases high levels of employment protection coexist with high flexibility – Sweden represents the most notable example.

Nevertheless, countries that exhibit this pattern are those where employment protection has been significantly reduced between 1989 (first point of observation) and 1997 (second point of observation).

Figure 6 – Employment protection (97 levels and trend 89-97) and organisational change



Note: lines has been drawn.

Of course, at this level of analysis, the determinants of this puzzle can't be totally understood. Here we present only descriptive evidence and, for this reason, it is not possible to investigate the direction of causal link between labour market and organisational change indicators. However, stylised facts previously discussed introduced some interesting findings:

Union density: by some extent, unions seems to have a positive attitude towards organisational change: where union power is higher there are higher level of flexibility. On the other side, unions seems to be interested to preserve pay systems from excessive flexibility.

By contrast, employment protection legislation has a negative effect on the introduction of innovations in employment and productive structure (with some exceptions): by this point of view, countries performing well are those with small or fast decreasing levels of protection.

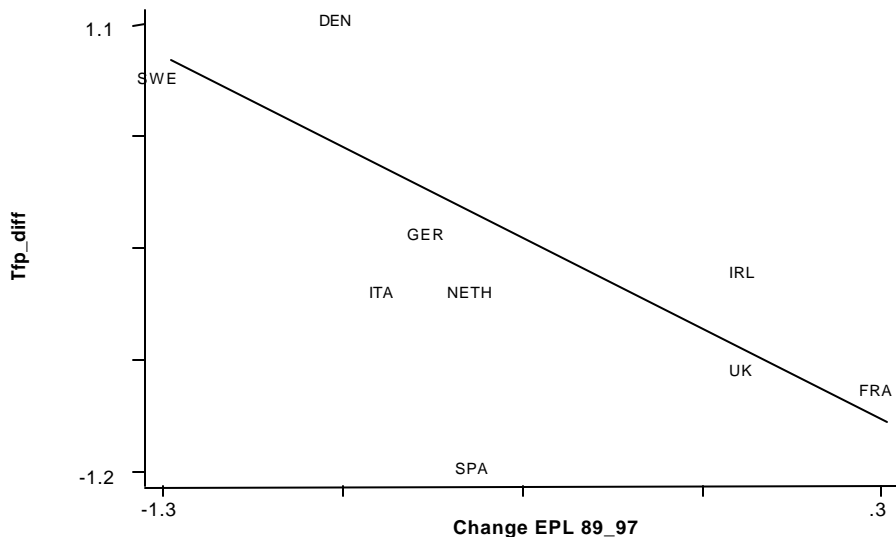
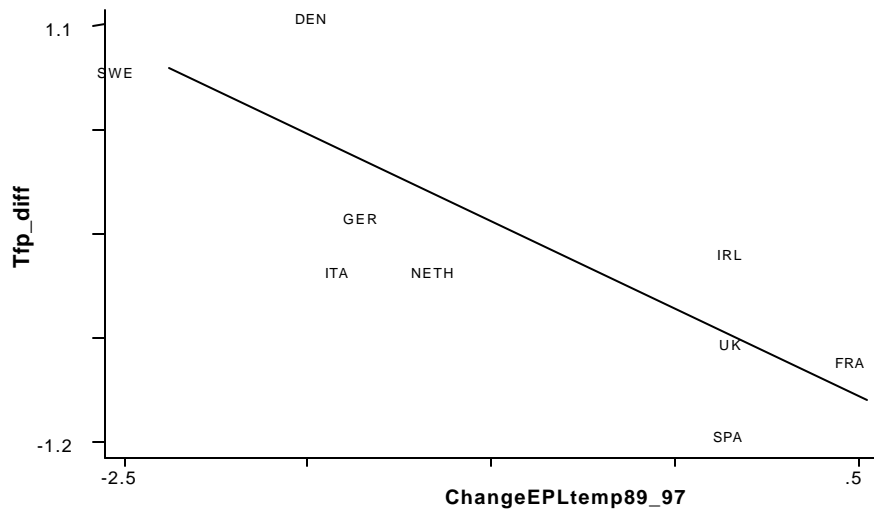
4.2 Institutions, innovations and economic performance (to be completed)

As suggested by figure 1, new technologies and organisational changes are introduced mainly to obtain increases in productivity. Therefore, we investigate the characteristics of better-performing countries as well as the relationship (at aggregate level) between flexibility and productivity. Our principal measure of productivity is TFP (total factor productivity). In order to limit the impact of cyclical and country fixed effects on the estimation of TFP, we analyse the relationships between our variables and the difference in TFP growth between 1980-1990 and 1990-98 (TFP_diff). These values

has been calculated using trend series, which controls for differences in the cyclical position of countries (see Scarpetta et al., 2000). In our opinion, TFP is a good proxy for productivity growth because, defined as the portion of output growth left after accounting for growth in capital and labour, captures those disembodied technological change and organisational improvements that increase the output for given amount of inputs (see Bassanini et al., 2000).

In figure 7 and 8 we show the relationship existing between TFP growth and changes in the degree of employment protection occurred between 1989 and 1997 (both for regular and temporary workers), our proxy for labour market flexibility.

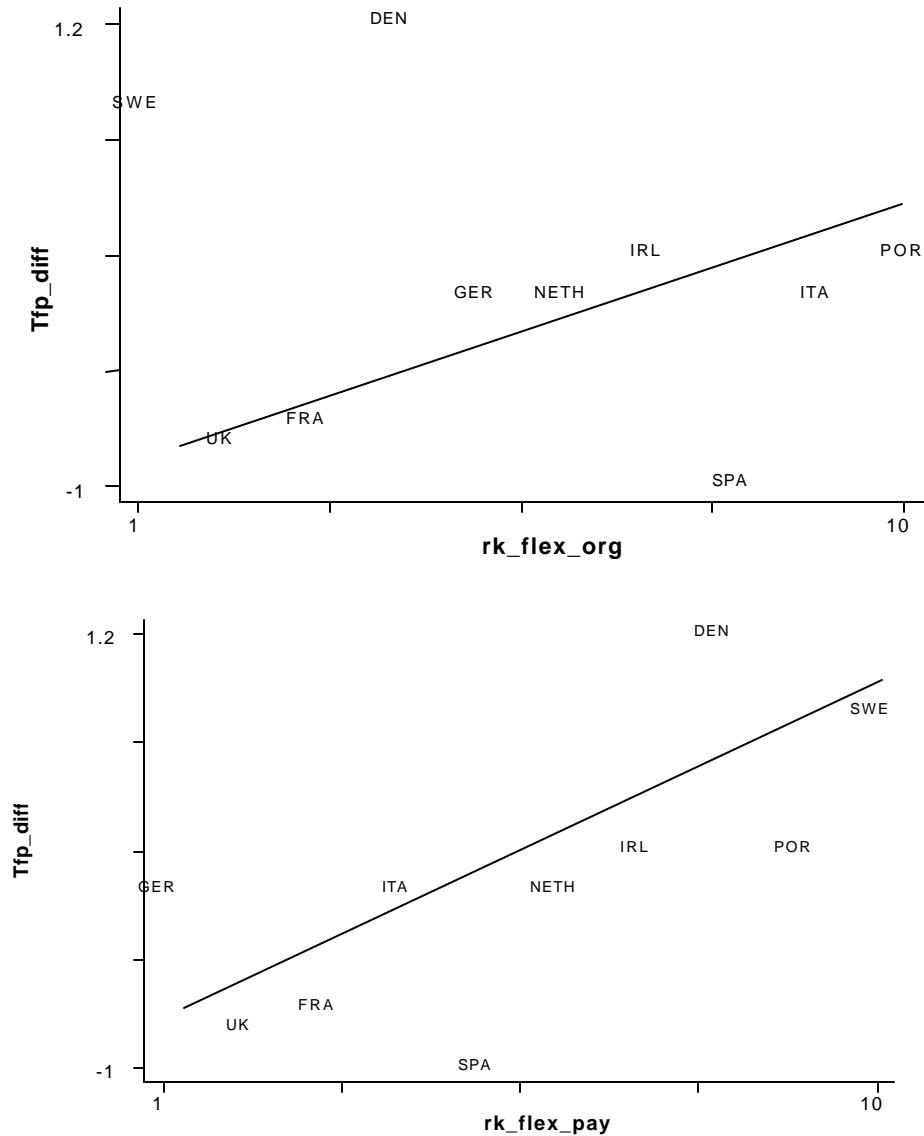
Figure 7 – TFP growth and change in Employment protection
(regular and temporary workers)



The picture shows that a reduction in the degree of employment protection (especially for non regular form of employment) appears slightly associated with increases in productivity. How it is argued, the reduction in the degree of protection produces, as a consequence, higher rates of turnover that allow for better job-matching between firms and workforce (Boeri, 1999).

Quite surprisingly, figure 8 shows that, with few exceptions, exist a negative relationship between flexibility and improvements in performance; in fact, better-performing countries are generally those experimenting low levels of flexibility, both in the organisation of work and in pay methods. At a first look, this result seems the opposite of what we expect to find. Nevertheless, these figures must be interpreted with some cautions. In fact, in an aggregate perspective, it is often difficult to individuate a clear link between cross section indicators and a measure of productivity growth calculated in differences.

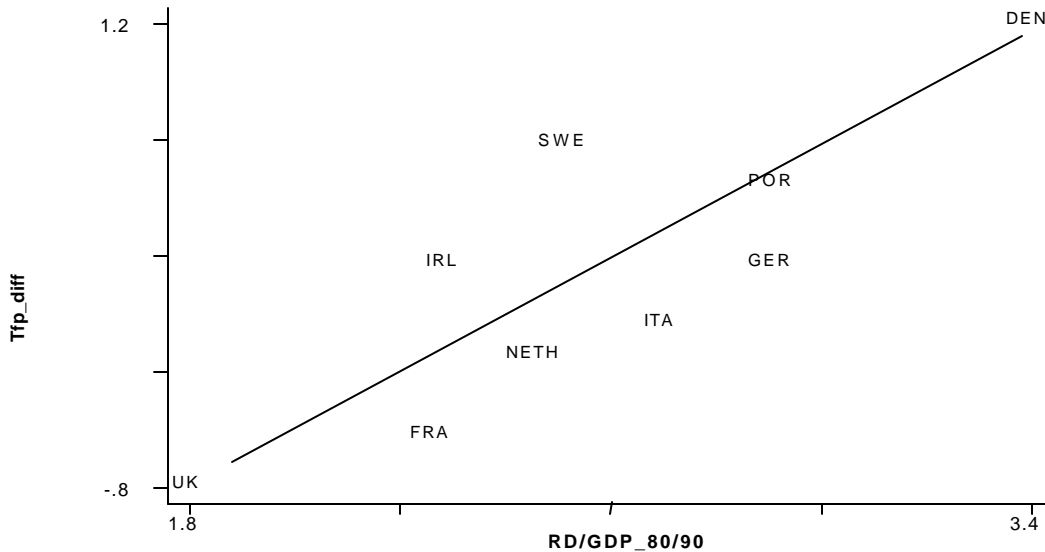
Figure 8 – TFP growth and organisational change



To shed more light on the interactions between innovation and growth, we look now at the relationship between our measure of TFP and R&D activity . We analyse if the average growth in R&D expenditure /GDP¹³ during the period 80-90 influenced the rate of productivity growth in the period 1990-98. Figure 9 shows the result of this exercise. From the observation of the figure, this empirical evidence appears generally supportive of a positive relationship between the variables.

¹³ We use GERD (Gross expenditure in R&D), but the picture is very similar using BERD (Business Enterprise Expenditure in R&D).

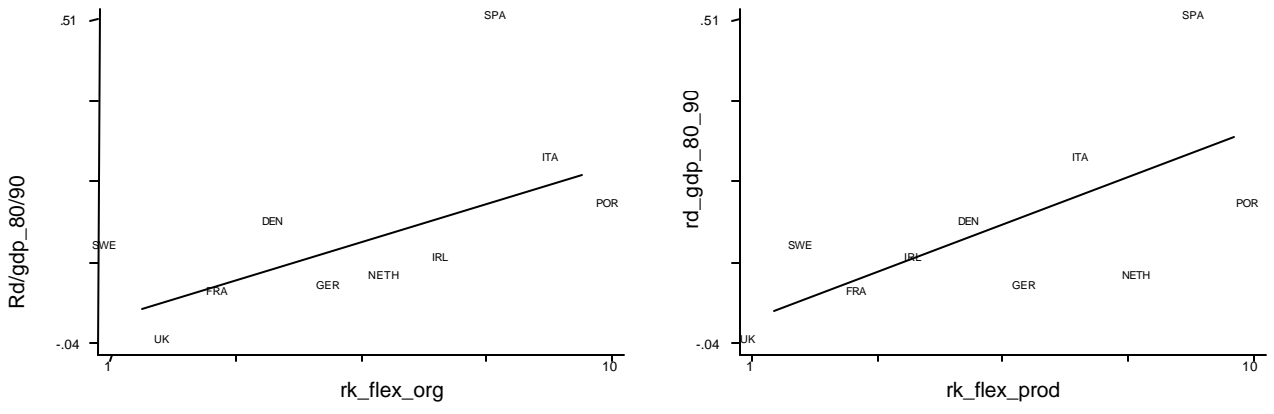
Figure 9 – TFP growth and R&D growth in the 80's



Bearing in mind the limited informative content of bivariate correlation, from figure 10 we can also argue that countries experimenting slow rate of R&D growth in the '80s, are those who introduced more innovation and flexibility in the organisation of work in the 90's.

Again, this relationship should be read with particular care. In fact, it is difficult to compare an index of organisational change with R&D intensity and to interpret the latter as a direct and real proxy for effective innovation activity. However, this evidence might suggest that organisational changes could be also a way to recover or improve competition for those countries – like UK, Germany and France - which experimented a slowdown in the growth of innovative investment in the previous period. In this context, the negative relationship presented in figure 10 can be read in two different ways: at one hand, it could mean that the positive effect of flexibility on TFP growth couldn't be observed yet, because the period considered is too limited. On the other hand, it could indicate that the picture described in figure 1 operates only at micro-level and that, at more aggregate level, the overall negative effect of flexibility on productivity depends on non-neutral effects of substitutions between contracting and expanding activities and on sector composition within each country and between countries.

Figure 11 – R&D growth in 80's and adoption of innovations in 90's
(flexibility in work organisation and in production)



REFERENCES (to be revised)

- Aghion P., (1997): "Inequality and Economic Growth", *Lezioni Raffaele Mattioli*, Università Bocconi, Milan.
- Aghion P, Howitt P. and Violante G. L., (2000), "General Purpose Technology and Withering Group Inequality", *CEPR Discussion Paper*, n. 2474
- Archibugi D. and Pianta M., (1994), "Aggregate Convergence and Sectoral Specialisation in Innovation", *Journal of Evolutionary Economics*, vol. 4, n. 1.
- Bassanini A., Scarpetta S. and Visco I., (2000), "Knowledge, Technology and Economic Growth: Recent Evidence from OECD Countries", *OECD Economic Department*, WP n. 259.
- Bean C. R., (1994) "European unemployment: a survey.", *Journal of Economic Literature*, 32:2, June, pp. 573-619.
- Bertola G., (1990), "Job Security, Employment and Wages", *European Economic Review*, vol. 34
- Bertola G., (1999), "Microeconomic Perspectives on Aggregate Labour Market", *Handbook of Income Distribution*, vol. 3.
- Black S. and Lynch L., (2000), "What's Driving the New Economy: The Benefits of Workplace Innovation", *NBER Working Paper*, n. 7479.
- Blanchflower D., (1996); "The Role and Influence of Trade Unions in the OECD", *CEP-LSE Discussion paper*, n. 310.
- Blanchflower D., (2000); "Self-employment in OECD Countries", *Labour Economics*, n. 5.
- Blanchflower D. G. and Burgess S. M. (1998): "New Technology and Jobs: comparative Evidence From a Two Country Study", *Economics of Innovation and New Technology*, 5, pp. 100-138.
- Blau F, and Kahn L. (1996) "International differences in male wage inequality: institutions versus market forces", *Journal of Political Economy*, 104: 4, pp. 791-837.
- Boeri T., Nicoletti G. and Scarpetta S., (2000), "Regulation and Labour Market Performance" *CEPR Discussion Paper*, n. 2420.
- Bolton P. and Dewatripont M., (1994): "The Firm as a Communication Network", *The Quarterly Journal of Economics*, 109(4), pp. 809-839
- Boyer R. and Petit P., (1981), "Forecasting the Impact of Technical Change on Employment: Methodological reflections and Proposals for Research", *paper prepared for the first Community Symposium in Social Science*, 3-4/9/1981.
- Brynjolfsson E. and Hitt L. (1995): "Information Technology As a Factor of Production: the Role of Differences Among Firms", *Economics of Innovation and New Technology*, 3, pp. 183-199.
- Brynjolfsson E. and Hitt L., (1998): "Beyond computation: Information technology, Organisational transformation and Business Performance", *mimea*.

Caballero R. J. And Hammour M. L., (2000), "Institutions, Restructuring and Macroeconomic Performance", *invited lecture in the XII World Congress of International Economic Association*, Buenos Aires, Argentina.

Caroli E. (1999): "New Technology, Organisational Change and the Skill Bias: a Go into the Black Triangle", *Forthcoming in Petit P. and Soete L. eds: Employment and Economic Integration*, London, Edward Elgar.

Freeman R., (1980), "Unionism and the Dispersion of Earnings", *Industrial and Labour Relation Review*, Vol. 34.

Freeman R, and Katz L. eds., (1995) "Differences and changes in wage structures"., *NBER*, University of Chicago Press, Chicago.

Griffith R., Redding S. and Van Reenen J., (2000), "Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Countries", *CEPR Discussion Paper*.

Lindbeck A. and Snower D. J., (1996), "Reorganisation of Firms and Labour-Market Inequality", *American Economic Review*, 86(2), pp. 315-321.

Machin S. (1997), "The Decline in Labour Market Institution and the Rise in Wage Inequality", *European Economic Review*, 41, pp. 647-657.

Machin S. and Wadhvani S., (1991), "The Effects of Unions on Organisational Change and Employment", *The Economic Journal*, 101, pp. 835-854.

Metcalf D., Hansen K. and Charlwood A., (2000), "Unions and the Sword of Justice: Unions and Pay Systems, Pay Inequality, Pay Discrimination and Low Pay", *CEP-LSE Working Paper*.

Milgrom P. and Roberts J., (1990), "The Economics of Modern Manufacturing: Technology, Strategy, and Organization", *The American Economic Review*, 80(3), pp. 511-528.

Nickell S. and Layard, R. (1999) "Labour Market Institutions and Economic Performance", in O.Ashenfelter and D.Card (eds.), *Handbook of Labour Economics*, Vol.3, North Holland.

Nickell S. and Nunziata L., (2000), "Employment Patterns in OECD Countries", *CEP-LSE Working Paper*, n. 448.

Nickell S., Nicolitsas D. and Dryden N., (1997), "What Makes Firms Perform Well?", *European Economic Review*, 41, pp. 783-796

Nicoletti G, Scarpetta S., and Boylaud O. (2000), "Summary Indicators of Product Market Regulation With an Extension to Employment Protection Legislation", *OECD Economic Department*, WP n. 226

OECD, (1994) *The OECD Jobs Study: facts, analysis, strategies.*, OECD, Paris.

OECD, (1995) *Technology, Productivity, Job Creation*, OECD, Paris

OECD, (1996), *Employment Outlook 1996*, OECD, Paris

OECD, (1997), *Employment Outlook 1997*, OECD, Paris

OECD, (1998), *Employment Outlook 1998*, OECD, Paris

OECD, (1999), *Employment Outlook 1999*, OECD, Paris

Osterman P., (1994), "How Common Is Workplace Transformation and Who Adopt Is?", *Industrial and Labour Relations Review*, 47(2), pp. 173-188.

Radner R. (1993), "The Organization of Decentralized Information Processing", *Econometrica*, 61(5), pp. 1109-1146.

Romer P., (1994) "The origins of endogenous growth"., *Journal of Economic Perspectives*, 8:1, Winter, pp. 3-22.

Scarpetta S., (1996), "Assessing the Role of Labour Market Policies and Institutional Settings on Unemployment: A Cross-country Study", *OECD Economic Studies*, n. 26.

Scarpetta S., Bassanini A., Pilat D. and Schreyner P., (2000), "Economic Growth in the OECD Area: Recent Trends at Aggregate and sectoral Level", *OECD Economic Department*, WP n. 248.

Snower D., (1999) "The Reorganisation of Work", *paper presented at the 1999 EALE Conference*, Regensburg, Germany.

Stern S., Porter M. E. and Furman J. L., (2000), "The Determinants of National Innovative Capacity", *NBER Working Paper*, n. 7876