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Why labour market regulation may pay off: Worker motivation, co-ordination and productivity growth

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Foreword

The impact of labour market regulation on economic performance has attracted considerable attention in the economics literature. In former research in labour economics, e.g. on internal labour markets (e.g. Doeringer and Piore), in micro-economic work on life cycle wage-productivity relations (e.g. E. Lazear) and in the human capital literature (e.g. G. Becker) the benefits of tenure on worker motivation, training, wages and thus productivity were highlighted. This was at least implicitly an argument for the benefits of regulations that maintain tenure and stable employment relationships, with internal adjustments preferred to external adjustments. However, other strands of economic theory, especially those that one might call "de-regulationist", questioned the benefits of tenure and "rigid" regulation and contend that in nowadays globalized markets, inelastic adjustment of wages and employment to economic shocks becomes the binding constraint for productivity (and employment etc.) growth. In this now quite pervasive type of literature (an example being the 2004 world economic outlook report of the IMF, but numerous OECD and WB reports carry the same message) external adjustments and high mobility on labour markets are preferred to stable, tenured labour markets triggered by employer behaviour framed by "rigid" regulation such as employment protection legislation.

Other economists, to whom among others the two authors of this text belong, challenges the above view on grounds of new empirical research, which shows that after all, so called "rigid" labour regulations might indeed trigger some of the beneficial effects reckoned by former labour economists and the human capital school on productivity. Indeed, the authors of the present paper, which is part of the research activities on the effects of labour market regulations on economic and labour market performance of the Employment Analysis and Research Unit (chief P. Auer) within the Economic and Labour Market Analysis Department of the Employment Sector of the ILO, Geneva, show convincingly through sophisticated econometric analysis- that there is indeed an economic benefit stemming from the effects of some of the so called "rigid" labour market regulations. These results should also have some impact on the general economic discussion of the effects of Labour market regulations on the economy.

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Abstract

The impact of labour market regulation on labour productivity growth is ambiguous: on the one hand, regulation raises labour adjustment costs, which negatively affects productivity; but on the other hand, regulation may (for various reasons) raise worker motivation and commitment and (by means of wage bargaining co-ordination) stimulate labour-saving technological progress, thus raising productivity. We present empirical evidence for a cross-section of 20 OECD countries (1984-1997) that relatively rigid (i.e. regulated and co-ordinated) labour markets promote long-run labour productivity growth. This conclusion is reinforced when we differentiate between (three) categories of labour markets in the OECD countries and test for differences in productivity performance.

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1. Introduction

In a recent contribution, Auer, Berg and Coulibaly (2005) have argued that employment tenure – as an indicator of numerical flexibility or, more broadly, of labour market rigidities – has a positive effect on aggregate productivity in 13 European countries between 1992 and 2002. Their findings convincingly question the mainstream view, put forward by OECD (2002, 2003) and IMF (2003), that "excessive" labour market regulation reduces productivity growth and technological progress (see Elmeskov *et al.* 1998; Bassanini and Ernst 2002; Scarpetta and Tressel 2004; and OECD 2002). This paper is a follow-up and extension of Auer *et al.* (2005): we focus not only on tenure, but more broadly on the extent of labour market regulation and argue (providing empirical evidence) that aggregate labour productivity growth is higher in economies having a "rigid" (*i.e.* more regulated and co-ordinated) labour market than in economies with flexible labour markets.

Our paper is organised as follows. Section 2 reviews the literature on the impact of labour market regulation on productivity growth. Section 3 analyses the variation in labour market regulation in 20 OECD countries in the period 1984-1997.[1] We show that the strictness of employment protection legislation (*EPL*) can be used as a proxy of the overall extent of labour market regulation; in addition, we develop a new multi-variate index of labour market regulation (*LMR*). Section 4 provides an econometric analysis for the 20 OECD countries in which we test the hypothesis that a relatively regulated and co-ordinated ("rigid") labour market promotes long-run labour productivity growth. While we indeed find a statistically significantly positive impact of labour market regulation on productivity growth, we argue that much is still left to be explained and that it may be more useful to approach the kinds of institutional variations under study as qualitative and categorical, differentiating between distinctive types of industrial relations regimes. Hence, Section 5 identifies distinctive groupings of OECD countries and tests for differences in performance. Section 6 concludes.

2. Labour market regulation and productivity growth

Most of the existing work on the relationship between labour market regulation and productivity growth argues that "excessive" regulation (as is supposed to prevail in many European countries) is a major cause of slow labour productivity growth. First, labour market regulation may increase workers' bargaining power. If wage bargaining is decentralised, organised labour (unions) has an incentive to hold up innovative firms and demand higher wages, once an investment is sunk. Labour is thus capable of appropriating a higher share of the rents resulting from innovation and productivity improvements and, accordingly, labour market regulation will reduce the incentive to innovate by firms (Malcomson 1997; Flanagan 1999). Second, in a labour-turnover model, labour market regulation (and strict employment protection legislation in particular) raises the costs of workforce adjustment, which is often needed after innovations have been introduced (Bassanini and Ernst 2002; Scarpetta and Tressel 2004). More generally, labour market regulation may restrict the degree to which firms are able to experiment in finding the best

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[1] We investigate the impact of structural variables (*i.e.* regulatory labour market institutions) on average annual labour productivity growth during 1984-1997. Our period of investigation, while having the length of about two business cycles, does exclude the generally recessionary period 1980-83 and the period of "irrational exuberance" of the late 1990s; see Glyn (2006).

combination of technology and organisational structure following the uncertain outcome of innovative investments (Bartelsman *et al.* 2003). However, empirical support for the mainstream view is relatively limited and not clear cut. For example, Scarpetta and Tressel (2004) find, in an econometric analysis based on data for 17 manufacturing industries in 18 OECD countries (1980-2000), that differences in labour market regulation *per se* do not (in a statistically significant manner) affect multifactor productivity growth (see also OECD 2002). Likewise, Bartelsman *et al.* (2003:5) conclude that the "effect of high hiring and firing costs (proxied by the strictness of employment protection legislation) on productivity and innovation is less clear cut, and largely depends on the institutional system in which firms operate and the type of technology used in the sector"; for a similar conclusion, see Bassanini and Ernst (2002).

This lack of empirical support is not surprising, however. Firstly, it is well known that the effects of labour market regulation on productivity and innovation are mediated by the industrial relations system. Consider the effects of increased employment protection, for example. Under decentralised wage setting and without wage co-ordination among firms, increased employment protection may lead to sub-optimal adjustments of the workforce to technological change and poorer productivity performance. The reason is that firms, when facing high hiring and firing costs will tend to rely more on the internal labour market (e.g., training and on-the-job learning) than on the external labour market if they have to adjust their workforce after an innovation investment. But under decentralised and uncoordinated wage bargaining, these firms cannot rely on an institutional device addressing possible free-rider problems and, hence, investing in the internal labour market is risky, because other firms may poach trained workers. But increased employment protection need not significantly affect productivity growth when the industrial relations system is coordinated and wage setting is centralised.[2] As is argued by Haucap and Wey (2004), the severity of the hold-up problem associated with more regulated industrial relations is reduced when a uniform wage is set for the entire industry or economy, because the uniformity rule effectively constrains the union's (wage differentiation) hold-up potential; in contrast, under decentralised wage setting, the union of the non-innovating firm will accept a lower wage in order to restore its firm's competitiveness in the product market (vis-à-vis the innovating firm), thus reducing overall innovativeness and productivity growth. Likewise, Agell and Lommerud (1993) and Moene and Wallerstein (1997) have argued that nation-wide wage settlements, characterised by a high degree of wage equality, drive inefficient firms off the market and expedite structural change, thereby fostering productivity growth. Supporting empirical evidence is provided by Bartelsman *et al.* (2003), who find that strict employment protection legislation (*EPL*) has a negative impact on innovation in countries lacking co-ordination, while there is no significant impact of labour market flexibility in co-ordinated countries or there is even a negative impact of flexibility in some industries (see also Kleinknecht *et al.* 2006). The results of Bassanini and Ernst (2002) suggest that co-ordinated countries with high *EPL* have a greater technological comparative advantage in high-tech industries (as opposed to low-tech industries) than co-ordinated countries with low *EPL*.[3]

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[2] An industrial relations systems can be said to be coordinated when: (i) the wage-bargain occurs in a centralized way or co-ordination among employers and/or trade unions sets a uniform band of wages; (ii) employers and labour unions cooperate as regard to decision-making inside the firm; and (iii) employers' associations have an active role in solving free rider problems across firms.

[3] In this context, it is often claimed that countries with co-ordinated industrial relations systems and relatively stringent employment protection (e.g. Germany, Austria) have stronger technological comparative advantage in industries characterized by cumulative technological progress than countries with decentralized bargaining, no co-ordination and low EPL (e.g. the USA and the UK); the latter countries have an advantage in radical innovations (new goods and new processes). The original argument was formulated by Hall and Soskice (2001), who hypothesized that co-ordinated market economies focus more on incremental, cumulative innovations and liberal market economies specialize in radical innovation. Empirical evidence in support of this claim is provided by

But there is a second reason why labour market regulation may positively affect labour productivity growth: through its impact on *worker motivation and effort*. Worker motivation is heavily influenced by the wider social environment in which workers operate, and within which notions of trust and fairness are defined (Lorenz 1992; Gordon 1996; Buchele and Christiansen 1999). Theoretically, this can be justified in at least the following four ways:

1. (Non-economic) efficiency-wage theories suggest that, because firms and workers operate under a fairness constraint, a higher real wage rate will positively affect labour productivity by raising workers' commitment (Akerlof 1982). A firm that sets a wage below workers' perception of a fair wage will find that workers respond by reducing effort. Supporting field-survey evidence of the importance attached to real sharing of productivity gains with workers is provided by Bewley (1995) and Agell and Lundborg (1995); Fehr and Falk (1997) and Gächter and Falk (2002) provide supporting evidence from experimental studies.[4]

2. (Economic) efficiency wage theories argue that labour productivity depends positively on worker remuneration: the higher the wage, the higher will be the effort by workers due to a higher cost of job loss; a worker who is paid more than could be obtained in another job will value the current job more highly, and work harder to avoid being dismissed (Gordon 1994; Buchele and Christiansen 1999a).

3. Because workers receive (on-the-job) training specific to the firm and thus acquire firm-specific human capital (which is not available on the external market), it is optimal for firms to share the returns to the investment with workers in order to retain them and avoid costly labour turnover. Yet, to induce workers to stay at the firm, firms delay transferring the wage gains from increased productivity by means of a seniority system of compensation.[5] Based on this *firm-specific human capital model* (Blakemore and Hoffman 1989; Auer *et al.* 2005), long-term employment relations (tenure) induce firms to invest in their workers over time, while the structure of compensation motivates workers to stay at the firm. Econometric evidence of a positive impact of job tenure on productivity is provided by Auer *et al.* (2005).

4. Significant employment security (in combination with a compressed wage structure), by providing workers with insurance against (*ex ante*) wage risk, will stimulate investment in education and training and promote the willingness of workers to share their (tacit) knowledge with colleague workers and the firm (Akerlof 1982; Lorenz 1992; Agell 1999) – employees do not have to worry that process innovations will result in layoffs. Appelbaum *et al.* (2000), in their study of labour relations in 44 plants in three manufacturing industries in the United States (steel, apparel and medical instruments), find that workers assign tremendous importance to job security and that employment security gets translated into significant productivity gains. Similar results are reported for the United Kingdom (UK) by Michie and Sheehan (2003) and for the Netherlands by Kleinknecht *et al.* (2006).

The common element is that workers' willingness to give up the protection offered by rigid work rules, invest in firm-specific human capital, disclose their proprietary (tacit) knowledge, and initiate changes in the production process that raise labour productivity depends on the trustworthiness of the employers in honouring their commitments to long-term employment and

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Bassanini and Ernst (2002). But Hall and Soskice's hypothesis is rejected by Akkermans *et al.* (2005) on the basis of a statistical analysis of US Patent Office data for the period 1970-1995.

[4] Based on experiments, Fehr and Falk (1997) find that firms offered wages that were substantially above the market-clearing level, in exchange for a reciprocal increase in worker effort; firms were further found to refuse to hire unemployed workers who tried to underbid employed workers.

[5] By withholding payment until the end of an individual's work life, a firm discourages workers to leave the firm, as in doing so they would forsake the greater part of the returns of increased productivity.

a fair productivity gain sharing (Buchele and Christiansen, 1999a).[6] The most solid foundation for this kind of trust, as Lorenz (1992) has eloquently argued, is that labour is able to *enforce* those commitments. This, in turn, requires an industrial relations system which offers legal protections to workers' rights and in which labour is organised so as to give workers an effective and safe say and stake in how they do their jobs and how their firms are run. This suggests that labour productivity growth will be higher in countries in which workers' rights are stronger, employment protection legislation is strict and labour-management relations are more cooperative. To test this hypothesis, we first evaluate the nature of labour market regulation in our cross-section of 20 OECD countries.

3. Measures of labour market regulation

Important qualitative aspects of labour market regulation are hard to quantify; however, we believe that these unquantifiable aspects are correlated with the following quantitative indicators:

1. *EPL*: The employment protection legislation index, developed by the OECD (1999) (see Nicoletti *et al.* 2000) and designed as a multi-dimensional indicator of the strictness of legal protection against dismissals for permanent as well as temporary workers.[7] The higher is *EPL*, the more restricted is a country's employment protection regulation. Table 1 presents the average *EPL* index for 1989–1999.

2. *MR*: The percentage of the (non-agricultural) labour force working in administrative and managerial occupations during 1984-1997 (see Table 1). This management ratio (*MR*) is used as an indicator of the intensity of supervision and monitoring by management (see Gordon, 1994, 1996; Buchele and Christiansen, 1999a); it can be interpreted as a (negative) indicator of the extent to which management trusts employees, and of the degree of autonomy workers have in organising and coordinating their work activities.

3. UD: Union density (union members as a percentage of employees).

4. BC: Collective bargaining coverage, *i.e.* the percentage of the employed labour force whose pay is determined by collective agreement.

5. DUR: The unemployment benefits duration index.

6. COORD: An index of the extent of co-ordination in wage bargaining (range 1-3) for the period 1980-87; co-ordination refers to mechanisms whereby the aggregate employment implications of wage determination are taken into account when wage bargains are struck.

7. RR: The replacement ratio, defined as unemployment benefits divided by average earnings.

8. Tax: The total labour tax rate (including the payroll tax rate, the income tax rate and the consumption tax rate).

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[6] It is in this context that the emergence of High-Performance Work Systems (HPWS) must be understood: the purpose of HPWSs is to increase workers' participation and flexibility (regarding job tasks) in exchange for job security and a fair share in the productivity gains. The productivity benefits of providing job security are evident in many studies of HPWSs, including Huselid (1995); Ichniowski *et al.* (1997); Appelbaum *et al.* (2000); and Michie and Sheehan (2003).

[7] The *EPL* index reflects (i) procedural inconveniences which the employer faces when trying to dismiss employees; (ii) notice and severance pay provisions; and (iii) prevailing standards of and penalties for unfair dismissal. See OECD (1999).

9. Earnings: Earning inequality defined as the ratio of top (10 percent) to bottom (10 percent) earnings, which is taken as a (negative) indicator of how fairly compensated employees are likely to feel. The lower this ratio, the fairer workers will perceive their share of earnings to be (Akerlof and Yellen, 1984; Buchele and Christiansen, 1999).

Table 1. Labour productivity growth, capital intensity growth, GDP growth and labour relations 1984-1997

	Labour productivity growth 1984-97	Capital-intensity growth 1985-97	Real GDP growth 1984-97	Real wage growth 1984-97	Earnings dispersion D9/D1 1984-95	MR 1984-97	EPL Index 1989-99
Australia	1.40	1.9	3.60	1.28	2.84	12.34	0.9
Austria	2.20	3.4	2.35	2.35	3.54	6.05	2.2
Belgium	2.11	3.0	2.30	1.50	2.34	3.54	2.6
Canada	1.09	1.3	2.83	1.07	4.28	13.51	0.6
Denmark	2.01	2.6	2.17	2.43	2.18	4.27	1.7
Finland	2.95	3.4	2.18	2.41	2.44	4.98	2.2
France	1.86	3.3	1.93	1.29	3.22	n.a.	2.9
Germany	3.16	3.4	2.30	2.90	2.52	3.90	2.9
Greece	1.27	1.6	1.65	1.15	n.a.	2.40	3.6
Ireland	4.21	1.8	5.26	2.74	n.a.	3.54	0.9
Italy	2.12	2.4	2.11	0.82	2.47	2.73	3.7
Japan	2.94	5.0	3.25	2.81	3.11	4.18	2.6
Netherlands	1.58	0.8	2.87	1.21	1.94	7.02	2.4
Norway	2.98	1.2	3.48	3.46	2.07	1.99	2.8
Portugal	3.20	4.0	3.25	2.21	3.73	4.03	3.9
Spain	2.18	3.6	2.90	1.92	n.a.	2.04	3.4
Sweden	1.78	2.9	1.87	1.61	2.08	2.58	2.9
Switzerland	1.29	2.4	1.55	1.74	2.69	2.66	1.0
U.K.	2.19	3.1	2.69	2.01	3.24	11.36	0.5
USA	1.38	1.2	3.38	1.39	4.00	12.99	0.2

Sources: See Appendix.
Notes: *MR* = the management ratio. For data on the *WR-C* index, see Buchele and Christiansen (1999a). For data on union density, collective bargaining coverage, unemployment benefit duration, wage bargaining co-ordination, the replacement ratio, the total labour tax rate, see Nickell *et al.* (2005). For data on job tenure, see OECD (1997).

10. Tenure: Median job tenure (in 1995), i.e. the length of time that workers remain in their present jobs or self-employed; job tenure is an indicator of the prevalence of long-term employment relations or job stability in each country.[8]

In addition to these ten indicators, we include Buchele and Christiansen's (1999a) index of workers' rights and co-operation (*WR–C*) in our analysis:

11. WR–C: This index has been constructed on the basis of data on employment protection, collective bargaining coverage, the ratio of supervisory to production workers, the ratio of top to bottom earnings, and public expenditure on social protection (as a percentage of GDP). The higher is WR-C, the greater the job and income security of workers is and the relatively

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[8]   Average tenure did not change significantly between 1985 and 2002; see OECD (1997:140) and Auer et al. (2005).

more co-ordinated labour-management relations are. We note that the WR–C index, being a composite index, is qualitatively different from the other labour market regulation indicators.

Table 1 presents data for three out of these 11 variables for 20 OECD countries in the period 1984-1997. It must be noted that we are using country-wise average annual growth rates in the regression analysis (*i.e.* the maximum number of observations is 20). 5. (Our choice to use period-averages (rather than using pooled time-series data) avoids rather artificially inflating the R^2 through across-time correlation of independent variables within countries.) Table 1 shows that there exists considerable variation among countries in extent of labour market regulation. For instance, the management ratio *MR* ranges from a low of 2 per cent in Norway to a high of 13 per cent in the United States (US) and Canada. The relative size of the Canadian and US management bureaucracy is more than three times the size of that of Germany, Italy, Belgium, Denmark and Sweden.[9] Similarly, the variation in earnings dispersion is large, ranging from 1.9 in the Netherlands to 4 and 4.3 in the USA and Canada, respectively. In terms of the *EPL* index, the United States, the United Kingdom, Canada and Australia are the least regulated countries, while employment protection is highest in Portugal, Italy, France, Germany, Sweden and Norway.

In line with comparative studies of industrial relations in the OECD countries[10], we note that many of the characteristics of labour market regulation tend to vary together. These regulatory complementarities are brought out more explicitly by the (pair-wise) correlation analysis in Table 2. What strikes in particular, is the strong (statistically significant at 5 per cent or less) correlation between the index of the strictness of employment protection legislation (*EPL*) on the one hand and the management ratio (*MR*), collective bargaining coverage (BC), bargaining co-ordination (COORD), the replacement ratio (RR), earning inequality and job tenure, on the other hand. Specifically, we find that[11]

- the higher is *EPL*, the lower is the management ratio *MR*[12]; this association is statistically significant at 1 per cent;

- a higher *EPL* is associated (at 1 per cent) with greater long-term job stability, reflected by a longer (average) job tenure; this is confirmed by Auer *et al.* (2005:333-4), according to whom the degree of strictness of the employment protection legislation is the main *determinant* of tenure; this explains our focus on *EPL* rather than job tenure.

- the higher is *EPL*, the higher is the benefit replacement ratio (significant at 1 per cent); and

- the higher is *EPL*, the lower is the earnings inequality (statistically significant at 5 per cent).

Table 2 shows in addition that there is considerable statistical interdependence between various other indicators as well. For example, the higher is *MR* (*i.e.* the higher the ratio of supervisors to the non-agricultural labour force), the higher is the dispersion in earnings and the lower is the degree of bargaining coverage, the extent of wage bargaining co-ordination, the benefit replacement ratio, and average tenure. And the lower is earnings inequality the higher is the degree of co-ordination and the higher is the benefit replacement ratio.

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[9] This difference between the United States and the other countries is not due to differences in sectoral structure of the economies concerned, as shown by Gordon (1996).

[10] *E.g.* Gordon (1996); Buchele and Christiansen (1999); and Hall and Soskice (2001).

[11] Because of the small size of our sample (of countries), our results could be significantly affected by one or a few individual countries. We have checked this: none of the correlations reported is significantly affected by changes in country coverage.

[12] This association is tested for only 19 countries because we have no comparative data on supervision intensity for France.

Table 2. OECD labour relations (1984-1997): Pairwise correlation matrix (Pearson's r)

	EPL	WR-C	MR	UD	BC	DUR	COORD	RR	Tax	Earnings
WR-C	0.88*** (14)	1.00 (14)								
MR	−0.80*** (17)	−0.75** (14)	1.00 (17)							
UD	0.09 (18)	0.36 (14)	−0.29 (17)	1.00 (18)						
BC	0.57** (18)	0.78*** (14)	−0.48** (17)	0.40* (18)	1.00 (18)					
DUR	−0.26 (18)	−0.01 (14)	0.31 (17)	0.22 (18)	0.44* (18)	1.00 (18)				
COORD	0.50** (18)	0.56** (14)	−0.67** (17)	0.33 (18)	0.56** (18)	0.27 (18)	1.00 (18)			
RR	0.59*** (18)	0.34 (14)	−0.56** (17)	0.16 (18)	0.29 (18)	−0.40 (18)	0.27 (18)	1.00 (18)		
Tax	0.20 (18)	0.47* (14)	−0.25 (17)	0.57** (18)	0.53** (18)	0.16 (18)	0.30 (18)	0.33 (18)	1.00 (18)	
Earnings inequality	−0.46** (18)	−0.61** (14)	0.62*** (17)	−0.14 (18)	−0.43* (18)	−0.05 (18)	−0.59*** (18)	−0.50** (18)	−0.20 (18)	1.00 (18)
Tenure	0.62*** (18)	0.67*** (14)	−0.54** (17)	0.14 (18)	0.36 (18)	−0.23 (18)	0.28 (18)	0.09 (18)	0.19 (18)	0.05 (18)

Notes: (1) *EPL* = the index of strictness of employment protection legislation; *WR-C* = workers' rights & co-ordination index; MR = the management ratio (*i.e.* the proportion of managers in the non-agricultural labour force); UD = union density (in percent); BC = collective bargaining coverage in 1994; DUR = unemployment benefits duration index; COORD = index of the extent of co-ordination in wage bargaining (range 1-3) for the period 1980-87; RR = the replacement ratio during 1980-87, defined as unemployment benefit entitlement before tax as a percentage of previous earnings before tax; Tax = total labour tax rate (including the payroll tax rate, the income tax rate and the consumption tax rate); Earnings inequality = the ratio of the 90th to the 10th percentile earnings; and Tenure = median job tenure.
(2) ***, ** and * denote statistical significance, in a two-tailed test, at the 0.01, 0.05 and 0.10 levels, respectively. Figures within parentheses give the number of observations (*n*).

Thus, *regulatory complementarities*[13] are an important feature of OECD labour markets: if a country features low *EPL*, it is likely to display a relatively high supervision intensity as well as earnings inequality, but relatively little co-ordination, a low level of collective bargaining coverage, a low level of unemployment benefits (compared to average earnings) and less job stability (as reflected by a low average job tenure).[14] The *EPL* index, in other words, captures other important dimensions of labour market regulation – in addition to being an indicator of the strictness of employment protection legislation. This conclusion is strengthened further by our finding (again reported in Table 2) of a statistically significant (at 1 per cent) positive association

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[13] Here we follow Hall and Soskice (2001:17-18): two regulatory institutions can be said to be complementary if the presence (or efficiency) of one increases the returns from (or efficiency of) the other. This suggests that nations with a particular type of regulation in one dimension of the labour market should tend to develop complementary practices in other dimensions as well. If this is correct, regulatory practices should not be distributed randomly across nations, but we should instead see some clustering along the dimensions that divide co-ordinated ("rigid") economies from liberal ("flexible") ones – as we indeed do in Table 2.
[14] Table 2 shows that the *EPL* index is not statistically significantly correlated with union density (UD), unemployment benefit duration (DUR) and labour taxes (Tax). It can be seen that UD DUR, Tax are not strongly associated with the remaining eight indicators, with the exception of a strong (positive) association between Tax and collective bargaining coverage (BC).

between the *EPL* index and the workers' rights & co-ordination index (*WR-C*).[15] This strong association is not surprising in itself, because indicators of the strictness of employment protection legislation (although not the *EPL* index itself!) are components of *WR-C* , but the similarity between Buchele and Christiansen's (1999a) index and the OECD *EPL* index is. This similarity can be seen from the results of a simple OLS regression (for 15 countries during 1984-1997) of *EPL* on *WR-C*:[16]

$$EPL = \underset{(11.32)^{***}}{2.05} + \underset{(4.80)^{***}}{0.90 \; WR\text{-}C}$$

$$\bar{R}^2 = 0.74 \, ; \text{F} = 40.8; \text{n} = 15; \text{df} = 13.$$

The estimated coefficient is 0.9 and we cannot reject the null hypothesis that this coefficient is statistically different from 1. Hence, there exists an (almost) one-to-one relationship between *EPL* and *WR-C*, which indicates that these two independently developed indices do, to a large extent, capture the same phenomena – though it must emphasized that the *WR–C* index is a broader indicator, as it *also* reflects earnings inequality, supervision intensity, social protection, and co-ordination in wage bargaining.

The high (but imperfect) collinearity between the various labour market variables poses serious problems to estimating their impact on labour productivity growth. First, the higher is the degree of collinearity between the explanatory variables, the larger will be the standard errors of the OLS estimators; as a result, the estimated coefficients (and their standard errors) become sensitive to even small changes in the data and/or model specification. Second, because of this, it may be impossible to isolate the individual effects of the explanatory variables.

To minimise the collinearity problem, we adopt the following three-pronged approach:

- First, in view of the significance of the association between the employment protection legislation index and *WR-C*, *MR*, BC, COORD, RR, earnings inequality as well as average tenure (Table 2), we use the *EPL* index as our measure of the nature of a country's labour relations: the higher is *EPL*, the more co-operative are labour-management relations and the more co-ordinated is wage bargaining.

- Second, in an attempt to compare our results to those by Auer et al. (2005), we assess whether job tenure contributes to productivity growth or not.

- Third, and alternatively, to avoid problems of multicollinearity we used factor analysis to create a composite indicator of the nature of the labour relations systems (Buchele and Christiansen, 1999). This factor score – called the Labour Market Regulation (*LMR*) score – was created for 18 OECD countries[17] for the period 1984-97 and loads highly on employment protection, the management ratio, earnings inequality, bargaining co-ordination and collective bargaining coverage (see Appendix). The eigenvalue of this score is 3.51 and it represents 80.8 per cent of the variance in the data, which indicates that LMR statistically captures the component indicators. The higher is *LMR*, the more intensively regulated a country's labour market is. Figure 1 ranks the estimates of *LMR* by country in descending order. The ranking generally conforms to most observers' views that countries in Southern Europe and in Scandinavia have the most highly regulated labour markets, followed by

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[15]   Buchele and Christiansen (1999) report that the rank correlation between their ranking and Calmfors and Driffill's (1988) ranking of countries on the centralization of wage bargaining is 0.62.

[16]   Robust *t*-statistics adjusted for heteroskedasticity of unknown form appear in parentheses. *** denotes statistical significance at the 1% level.

[17]   Ireland and Greece are excluded because of lack of comparable data on earnings inequality, bargaining coverage, the replacement ratio and bargaining co-ordination.

France and Germany, while the USA, Canada, the UK and Australia are at the opposite end of the spectrum.[18] It is not surprising therefore that our *LMR* score is strongly associated with the workers' right & co-ordination index *WR-C*:

Figure 1. OECD labour market regulation (1984-1997)

Source: Authors' estimation.
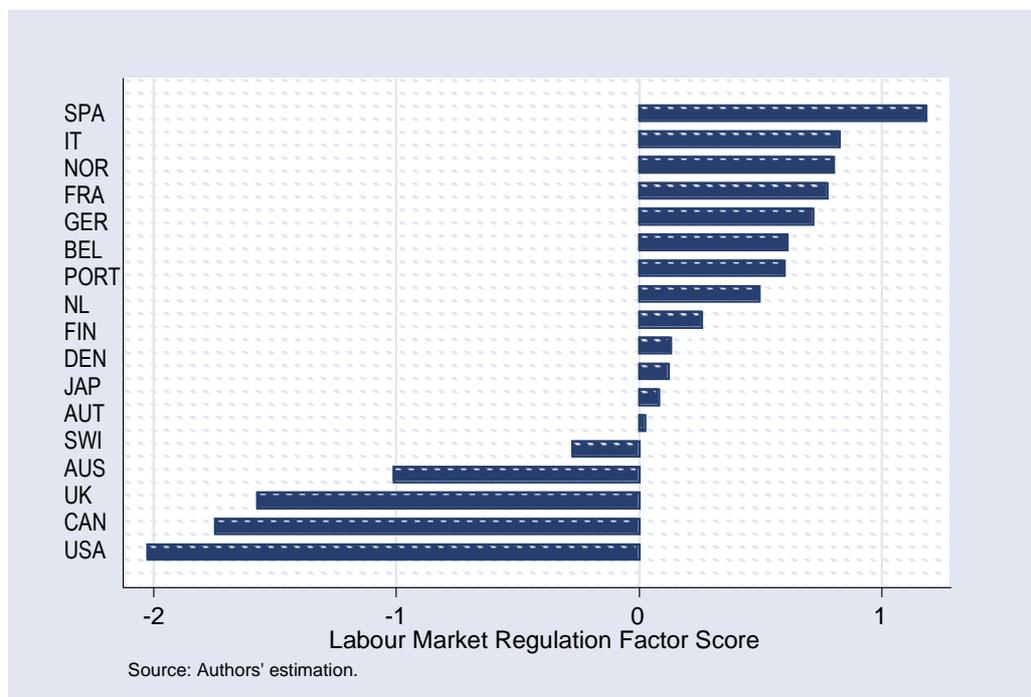
Hence, we feel confident that our indicator *LMR* captures essential elements of industrial relations systems in the OECD.

4. Productivity growth and labour market regulation

The three measures of labour market regulation – *EPL*, average tenure, and *LMR* – are used to empirically examine for our cross-section of 20 (respectively, 18) OECD countries (1984-1997) the hypothesis that (average annual) labour productivity growth will be higher in countries in which labour market regulation is more strict, *i.e.* workers' rights are stronger and labour-management relations are more cooperative as well as co-ordinated. To do so, we use the notion of a Productivity Regime developed by Naastepad (2006), and extend the analysis by including labour relations. The Productivity Regime is defined as (lettering a "hat" over a variable denotes its growth rate):

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[18]   Switzerland also has a negative *LMR* index. This is a reflection of the Swiss decentralized collective bargaining system based on voluntarist social partnership at the sectoral, industrial or company levels which are preferred to centralized agreements. Unions have been traditionally fragmented due to the dispersed and small-scale nature of Swiss industrial development (Boucher and Wickham 2003:27-36).

$$(1) \qquad \hat{\lambda} = \beta_0 + \beta_1 \, \Xi + \beta_2^* \, \hat{w} \qquad\qquad \beta_0, \beta_2^* > 0.$$

where λ is labour productivity (defined as real GDP per hour worked); Ξ is the indicator of the extent of labour market regulation (the more regulated the labour market is, the higher is Ξ); and w is the real wage rate (per hour) The Productivity Regime can be derived from an neoclassical production function (Storm and Naastepad 2005). The coefficients of (1) have a clear interpretation:

- Coefficient β_1 indicates to what extent the nature of the regulatory regime in the labour market, influences labour productivity growth. The hypothesis is that $\beta_1 > 0$, *i.e.* the more regulated is the labour market, the higher will be the rate of labour productivity growth. This can be justified following Agell (1999), arguing that institutions regulating the labour market formalise basic social norms governing exchanges between firm and workers and/or are put in place to solve a number of (inherent) labour market imperfections – for example, the failure of markets to provide adequate unemployment insurance. In either case, labour market regulation will improve labour productivity by promoting workers' motivation and by stimulating investment in human capital formation (Fehr and Falk 1997; Gächter and Falk 2002). Supporting empirical evidence is provided by Gordon (1996), Buchele and Christiansen (1999), Michie and Sheehan (2003), Storm and Naastepad (2005), Auer *et al.* (2005), and Kleinknecht *et al.* (2006).
- Coefficient β_2^* reflects the degree of wage-led technological progress, *i.e.* the extent to which more expensive labour induces firms to intensify their search for and adoption of labour productivity-raising techniques (Foley and Michl 1999); β_2^* can be interpreted as the elasticity of capital-labour substitution.

Using our *three indicators of labour market regulation*, we estimated equation (1) using data for our group of OECD countries during the period 1984–1997 given in Table 1. The regression results appear columns 1-3 in Table 3. Overall, the explanatory power of the estimated equations is high: the adjusted R^2 varies between 0.6 and 0.82.

Consider first the estimation results for the impact of real wage growth, which is used to reflect the effects of wage-led technological progress.[19] The estimated coefficient β_2^* is statistically significant at 1 per cent in regression 1 and significant at 10 per cent in regression 2; its value – varying between 0.36 and 0.59 – is in line with available estimates of the elasticity of capital-labour substitution (see Rowthorn 1999; Naastepad and Kleinknecht 2004). In regressions 1 and 2, we included a (highly significant) country dummy for Ireland, because Ireland is an "influential outlier" in terms of productivity growth.[20]

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[19] Note that equations 1, 2, and 3 were estimated by instrumented (2SLS) regression with robust standard errors. Real wage growth $\hat{w}$ was instrumented using unemployment, export growth and the change in the real interest rate during 1984-1997as instruments.

[20] For an analysis of the transformation of the Irish economy from a semi-peripheral country on the edge of Europe to one of its core countries with the highest growth rates of GDP, productivity and employment, see Boucher and Wickham (2003:46-52). The Irish economic development strategy has been based on attracting mostly US global high technology manufacturing and (financial) services firms.

Table 3. Determinants of OECD labour productivity growth

Estimated equation:	Dependent variable: Average annual labour productivity growth (1984-1997)				
	(1)	(2)	(3)	(4)	(5)
Constant	0.50 (1.52)	0.22 (0.49)	1.40[***] (3.28)	1.20[***] (3.42)	1.29[***] (3.51)
EPL	0.20[**] (2.33)				
Average tenure		0.14[***] (4.00)			
Labour Market Regulation Score (*LMR*)			0.26[***] (2.87)		
Group dummy Group 1				0.64[**] (2.03)	0.66[**] (2.07)
Group dummy Group 3				–0.20 (0.96)	–0.35[*] (1.69)
Real wage growth	0.59[***] (3.26)	0.46[*] (1.73)	0.36 (1.67)		
Capital-intensity growth				0.27[**] (1.99)	0.24[*] (1.61)
Country dummy Ireland	1.90[***] (9.01)	1.96[***] (7.94)			
$\overline{R}^2$	0.82	0.82	0.60	0.62	0.64
F (prob.>0)	18.9 (0.000)	20.6 (0.000)	10.3 (0.002)	13.1 (0.002)	17.6 (0.001)
Standard error	0.40	0.34	0.40	0.46	0.46
No. of observations	20	20	18	19	18

Notes: *(i)* Equations (1) and (2) are estimated for a sample of 20 OECD countries (1984-1997), including Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the UK and the USA. Equation (3) is estimated without Ireland and Greece. Ireland and Greece are excluded because of lack of comparable data on earnings inequality, bargaining coverage, the replacement ratio and bargaining co-ordination. Equation (4) is estimated without Ireland (which – for reasons explained in the text – is included from our country classification. *(ii)* Robust *t*-statistics appear in parentheses. *, ** and *** denote statistical significance at the 10, 5 and 1% level, respectively. Figures in parentheses in *F*-column are *p*-values. *(iii)* Equations (1), (2) and (3) are estimated by instrumented (2SLS) regression with robust standard errors. Real wage growth $\hat{W}$ was instrumented using unemployment, export growth and the change in the real interest rate during 1984-1997 as instruments. *(iv)* Please note that equations (4) and (5) will be discussed in Section 5.

Turning to the productivity impact of the labour relations system, the estimated coefficient β_1 is statistically significant and *positive* in the case of the *EPL* index (at 5 per cent), average tenure (1 per cent) and the *LMR* score (1 per cent). This implies that, in our sample of OECD countries, more extensive labour market regulation (more "rigidity") is associated with *higher* labour productivity growth (we have checked that the statistical significance of coefficient β_1 does not depend on one particular country.) This confirms – in a more general setting – the findings by Auer *et al.* (2005). Nickell and Layard (1999:3065) report a similar *positive* impact of employment security on productivity growth. They conclude:

> "there is no reason to be surprised that employment protection shows up with a positive coefficient in our […] productivity regressions."

First, productivity improvements often depend crucially on the co-operation of workers and upon their ideas and suggestions; these will be withheld if workers feel their jobs are at risk as a

consequence. Second, substantive employee participation, where workers have some degree of autonomy in decision taking, is associated with high productivity growth; but it requires more training, and this is only worth providing if the employment relation is long-term; this is why Auer, Berg and Coulibaly (2005) find a positive association between productivity growth and employment tenure. Similar productivity-growth enhancing effect of *pro-worker* labour relations have been shown to exist, at the macro-economic level, by Gordon (1996), Buchele and Christiansen (1999a) and Storm and Naastepad (2005), and, at the firm level, by Ichniowski *et al.* (1995) and Michie and Sheehan (2003).

5. Are country-wise differences in labour market regulation statistically significant?

The observed complementarities between the various structural dimensions of labour market regulation in Table 2 indicate that it may be more useful to approach the kinds of institutional variations under study as qualitative and *categorical* (see Pekkarinen *et al.* 1992; Gordon 1996; Hall and Soskice 2001; Glyn 2006). The larger literature on cross-national differences in institutional systems governing production relations [21] would lead one to expect that both the *EPL* index and our *LMR* score (as indicators of the broad nature of labour market regulation) will be lower in liberal/flexible systems and higher in co-ordinated/rigid systems. A second dimension in which economies vary internationally is (hourly) real wage growth. Therefore, in line with our econometric explorations (Table 3), we grouped countries by their scores on either the *EPL* index or the (multivariate) *LMR* score and their rate of real wage growth. Figures 2 and 3 provide the corresponding scatter plots. From these plots, the following three groups of countries emerge:

- **Group 1**: Austria, Denmark[22], Finland, Germany, Japan and Norway – all with very strict employment protection (high *EPL*), co-ordinated labour markets, and relatively high real wage growth during 1984-1997.
- **Group 2** including Belgium, France, Greece, Italy, the Netherlands, Portugal, Spain, Switzerland and Sweden; these countries have a high *EPL* and high *LMR*, but relatively low real wage growth.[23]
- **Group 3**: Australia, Canada, UK and USA which feature very low employment protection, relatively un-coordinated labour markets as well as low real wage growth.

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[21]   Hall and Soskice (2001) distinguish between liberal market economies (LMEs), in which firms coordinate their activities primarily via competitive markets (externally) and hierarchies (internally), and co-ordinated market economies (CMEs), in which firms depend more on non-market relationships to co-ordinate their activities.

[22]   We note that the strictness of employment protection legislation is not high in Denmark (as can be seen from Table 1), which is known for its "flexicurity" approach to the labour market. The average value of the *EPL* index for group 1 countries is 2.4, but the Danish *EPL* is only 1.65. However, Denmark is significantly more close to the other group 1 countries in terms of our *LMR* score, as can be seen from Figure 2. We also note that the productivity growth – *EPL* regression (reported in column (1) of Table 3) does not change significantly when the observations for Denmark are dropped; the positive coefficient for *EPL* is 0.19 (t=2.19) and the coefficient for real wage growth is 0.62 (t=3.22).

[23]   Note that Switzerland's score on employment protection is low (close to the Anglo-Saxon average) in Figure 2, but its score on overall labour market regulation (the *LMR* index) is much higher (Figure 3); because of the latter score, Switzerland is included in Group 2.

We note that Ireland is excluded from our categorisation, because its economic performance during our reference period was – on account of country-specific factors – significantly out of line with that of the other 19 OECD countries.[24]

Countries of Group1 and Group 2 are all "co-ordinated market economies" (Hall and Soskice 2001): all have legally mandated work councils, which are typically under a legal obligation to seek cooperation with the employer and to resolve disputes by negotiation rather than by conflict. Employers are typically required to consult with the council on matters of work reorganisation, new technology, outsourcing, overtime scheduling and health and safety issues. Wage bargaining is mostly centralised: the wages of between 80 to 90 per cent of the labour force are set through collective, centralised bargaining. Centralised wage bargaining facilitates labour-management cooperation at the workplace by removing conflict over wages from the local level; in principle, centralisation will reduce employers' resistance to wage increases, because these are equal for all firms and hence play no role in inter-firm competition. In Group 1 countries, this has led to (relatively) high real wage growth (but lower employment growth, see below). But in the countries of Group 2, labour unions have not used this potential for real wage increases and instead pursued a high employment protection strategy; this explains the location of these countries in the lower right corner of Figures 2 and 3. The Dutch experience is an important case in point (Naastepad and Kleinknecht 2004; Naastepad 2006): while real wage growth was drastically and *voluntarily* moderated after 1982 (in exchange for a promise of a rise in employment growth), labour unions opposed policies to deregulate the labour market.

Figure 2. Scatter plot of the EPL index and average annual real wage growth: 20 OECD Countries (1984-1997)

Source: Authors' calculations; for the data sources: see Appendix.

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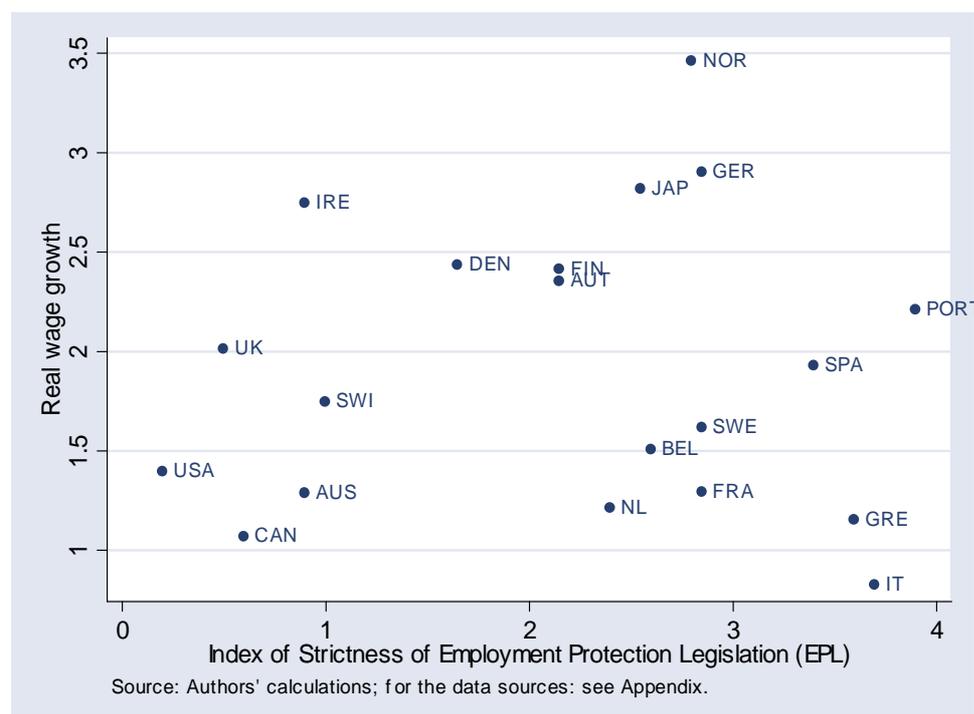
[24] Irish real GDP growth exceeded average OECD growth by more than 3.5 standard deviations; and Irish labour productivity growth exceeded OECD productivity growth by 2.5 standard deviations. For an analysis of the determinants of the Ireland's growth miracle, including its rather extreme dependence on multinational companies, see Boucher and Wickham (2003).

Figure 3. Scatter plot of the labour market regulation index and average annual real wage growth: 18 OECD countries (1984-1997)

Source: Authors' calculations; for the data sources: see Appendix.
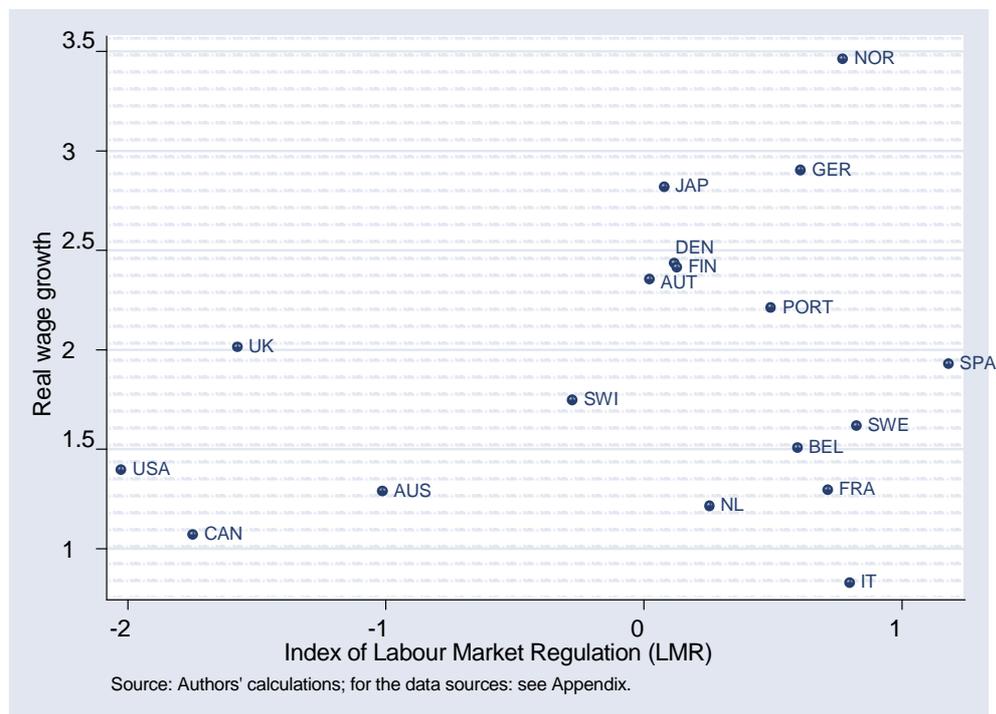
How different has been the macro-economic performance of the three country groups during 1984-1997? Table 4 provides a simple analysis of variance. We find that the mean real wage growth rate for group 1 is 2.73 per cent; for group 2, 1.50 per cent; and for group 3, 1.44 per cent. The differences in means between groups 1 and 2 and between groups 1 and 3 and are statistically significant at the 1 per cent level; the difference in average real wage growth between groups 2 and 3, however, is insignificant. Group 1 countries are therefore *high wage growth countries*, whereas wage growth has been moderated in group 2 countries (by means of wage bargaining co-ordination) as well as group 3 countries (by the market mechanism). Chart 1 decomposes the total sum of squared deviations (from the overall OECD mean) of real wage growth into a within-group and a between-groups mean variation. As is apparent, differences across groups account for as much as 69 per cent of the total variation in OECD real wage growth. Likewise, we find important differences in productivity and employment growth between groups. Indeed, the mean of labour productivity for group 1 is 2.71 percent; for group 2, 1.93 per cent; and for group 3, 1.52 per cent; the difference in means between groups 1 and 2 is statistically significant at the 5 per cent level, and the difference between groups1 and 3 is significant at 1 per cent; but there is no difference (in a statistical sense) between average productivity growth in groups 2 and 3. Between-group variation explains about 46 per cent of the total variation in OECD labour productivity growth; (large) differences within group 2 accounts for another 33 per cent of the total variation; the intra-group variation in productivity growth is much smaller in groups 1 and 3.

Table 4. Macro-economic performance (1984-1997): 3 OECD country groups

Average annual growth rate of:	Average				Test of difference between group means μi		
		Group:			The variance ratio F		
	All	1	2	3	Group 1 versus Group 2	Group 1 versus Group 3	Group 2 versus Group 3
GDP	2.57	2.45	2.38	3.16	0.09	9.00**	6.93**
Labour productivity	2.09	2.71	1.93	1.52	7.25**	16.97***	1.56
Employment	0.48	–0.25	0.45	1.65	7.57**	24.04***	11.62***
Real wages	1.87	2.73	1.50	1.44	30.09***	25.85***	0.05

Note: The taxonomy into three groups is explained in the text.

Chart 1. Decomposition of differences in macro-economic performance: 19 OECD countries (1984-1997)

Source: Authors' calculations.
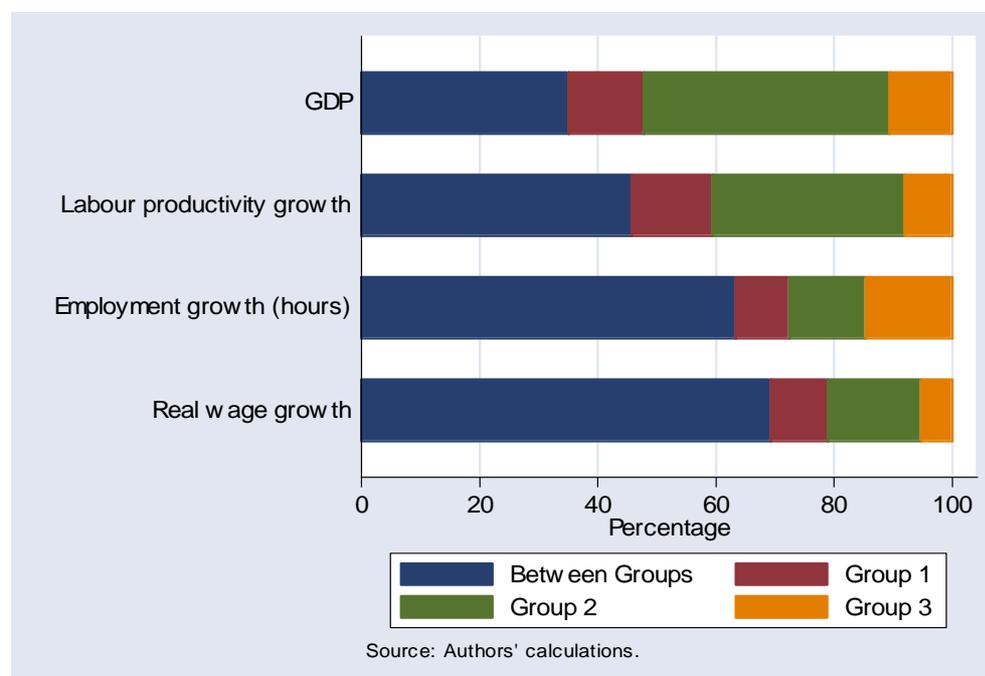
Inter-group differences in employment growth are striking: the differences in employment growth between group 3 (where employment growth has been very high) and the other two groups (where employment growth was far lower and in the case of group 1 even negative) is statistically significant at the 1 per cent level. The flexible labour markets relations system in group 3 countries has apparently resulted in considerable job creation. But we also find a statistically significant (at 5 per cent) difference in employment growth between groups 1 and 2. Group 1 countries stand out for having experienced negative employment growth (in terms of hours worked) during 1984-1997. Inter-group variations capture as much as 63 per cent of total variation in OECD employment growth (Chart 1). We note that these patterns of productivity and employment growth suggest a trade-off: labour productivity growth is highest in those

countries (of group 1) where employment growth is lowest; productivity growth is lowest, where employment growth is highest (in particular in group 3).[25]

Finally, Table 4 shows that there is no difference in real GDP growth between groups 1 and 2, but there exists a difference (significant at the 5 per cent level) between the (higher) GDP growth rate of group 3 and (lower) GDP growth of groups 1 and 2. However, the between-groups variation captures only 35 per cent of the total variation in OECD economic growth, while the differences within group 2 account for another 42 per cent. Performance is therefore most heterogeneous in terms of GDP growth. It is because GDP growth does not differ significantly between groups, there exists a trade-off between labour productivity growth and employment growth (see also Buchele and Christiansen 1999b). To see this, note that GDP (denoted by x) is equal to the product of "total hours worked" (denoted by l) and the level of labour productivity (λ), *i.e.* x = l * λ. Expressed in growth rates, this gives us

$$(2) \quad \hat{x} = \hat{l} + \hat{\lambda},$$

i.e. by definition, GDP growth is equal to employment growth plus labour productivity growth. It follows that, at a given GDP growth rate, higher labour productivity growth (as in Group 1 countries compared to the other countries) means lower employment growth.[26]

To what extent can these differences in macro-economic performance, and in productivity growth in particular, be attributed to differences in labour market regulation? This question is addressed in Table 5[27] and Chart 2. In Table 5, we look for statistically significant differences in labour market regulation between the three country groups; Chart 2 presents the between-groups variation and within-group variation in characteristics of labour markets in the three country grouping. The following conclusions can be drawn:

- Differences across groups in labour taxation and unemployment benefit duration are statistically *not* significant; this shows up in a (relatively) small between-groups variation, which accounts for only 9 and 16 per cent of the total OECD variation in labour taxes and benefit duration, respectively.

- Labour market regulation in Group 3 differs significantly (*i.e.* at the 1 or 5 per cent level) from that in Groups 1 and 2 in earnings inequality; average job tenure; the degree of wage bargaining co-ordination; employment protection; and the management ratio. Accordingly, we find a statistically significant difference (at 1 per cent) in our aggregate indicators of the extent of labour market regulation (the *WR-C* index and the *LMR* index) between Group 3 and the other groups.

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[25] See Buchele and Christiansen (1999b), who find for six major OECD countries (1961-1992) that labour market regulation (including collective bargaining, employment protection and social protection) has a negative effect on employment growth and a positive effect on productivity growth, thus giving rise to an inverse relationship between these variables.

[26] It must be emphasized that this does not necessarily mean that unemployment, particularly of the low-skilled workers, is higher in Group 1 countries. First, empirical evidence by Baker *et al.* (2005) shows that the statistical association between labour market regulation and unemployment is very weak. Second, the unemployment consequences of productivity growth can be "neutralised" by a more equitable distribution of the available labour time (hours of work) over the labour force – as is the case in many European countries.

[27] As pointed out by the referee, because the country grouping is (partly) based on *LMR* (which is in turn derived from indicators of labour market regulation), we may face an endogeneity problem. Our main purpose here is to test for consistency of the country groupings and, as Table 5 and chart 2, the clustering has been meaningful.

Table 5. Test of difference between group means μ$_i$: the variance ratio F^*

Regulatory variable:	Group 1 versus Group 2	Group 1 versus Group 3	Group 2 versus Group 3
Labour taxes	0.15	2.93	0.78
Benefit duration	2.35	0.02	1.63
Collective bargaining coverage	0.27	3.30	10.97***
Earnings inequality	0.00	6.56**	5.49**
Average tenure	0.12	7.89**	9.61**
Replacement ratio	6.60**	1.61	15.46***
Wage bargaining co-ordination	3.21*	17.50***	7.90**
WR-C Index	2.59	11.38***	14.32***
EPL Index	2.01	55.83***	26.05***
LMR Score	1.82	72.3***	66.35***
Management ratio	1.11	129.07***	109.05***

Notes: The taxonomy into three groups is explained in the text. We test the null hypothesis H$_0$: μ$_1$ = μ$_2$ = μ$_3$ against the alternative hypothesis H$_0$: μ$_i$ not all equal. If H$_0$ is true, the observed variance ratio F^* will approximate the value of one: the observed difference in the means is not statistically significant and may well be attributed to chance. *, **, *** denote that the differences in means are statistically significantly different from zero with $P < 0.10$, $P < 0.05$ and $P < 0.01$, respectively.

Chart 2. Decomposition of the differences in labour market regulation: 19 OECD countries (1984-1997)

Source: Authors' calculations.
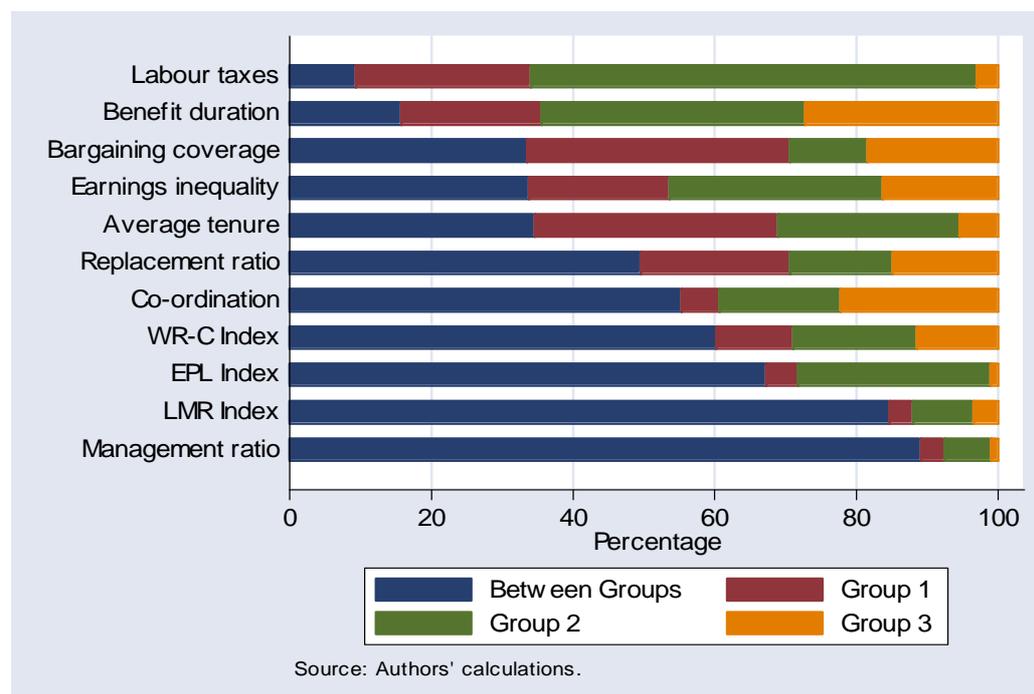
Notes: The taxonomy into three groups is explained in the text.

- While there exist marked differences between group 3 and the other two groups of countries, we find hardly any significant differences in labour market regulation between Group 1 and Group 2. Wage bargaining co-ordination is stronger in group 1 than in Group 2 (significant at 10 per cent) and the unemployment benefit replacement ratio is higher in Group 2 than in Group 1 (significant at 5 per cent). Overall, the indicators *WR-C*, *EPL* and *LMR* are not

statistically different for these two groups. Group 1 and Group 2 do differ in one important respect, however: real wage growth is higher (statistically significantly at 1 per cent) in Group 1 than in 2 (Table 4).

- From Chart 2, it is clear that differences across country groups capture more than 60 per cent of the variation in OECD labour market regulation: the between-groups variation accounts for 60 per cent of total variation in the case of the *WR-C* index, 67 per cent in the case of *EPL*, and as much as 85 per cent in the case of the *LMR* score. Differences between groups are also important in tenure, replacement ratio, bargaining co-ordination and the management ratio.

These qualitative and categorical variations indicate that it is useful to differentiate between different *systems* of labour market regulation. We thus created dummy variables to distinguish between the three groups of OECD countries: one variable which takes a value of 1 for all Group 1 countries (where labour markets are heavily regulated and real wage growth is high) and a second variable (taking a value of 1) for group 3 countries (with liberal/flexible labour markets and low real wage growth). We regressed labour productivity growth on these two group dummy variables, while controlling for capital intensity growth. We thus postulate that the productivity growth functions of the three country groups in relation to capital intensity growth have the same slope but different intercepts. Geometrically, we would have the situation shown in Figure 4 if the coefficient of the group 1 dummy is statistically significantly different from zero and positive

Figure 4. Productivity growth, capital deepening and industrial relations systems
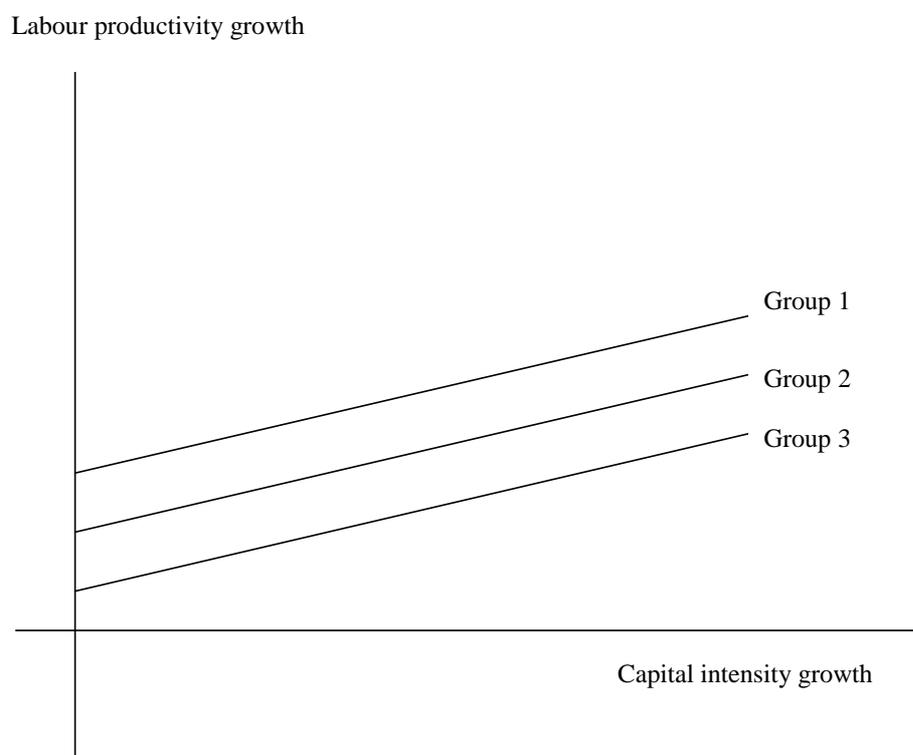
Note: Group 1 countries feature a regulated, co-ordinated industrial relations system which exhibit relatively high real wage growth. The industrial relations system of Group 2 countries resembles that of Group 1 countries, but labour unions in Group 2 countries accepted real wage moderation in exchange for higher employment growth. Group 3 countries feature the most liberal, unregulated industrial relations systems.

and (at the same time) the coefficient of the group 3 dummy is statistically significant and negative. The results appear in column (4) of Table 3 and they suggest that the categorical grouping contains about as much information as the continuous country scoring on the *EPL* index or *LMR* index. The $\overline{R}^2$ is the same in column (3). The coefficient on the group 1 dummy is statistically significant at the 5 per cent level and has the expected positive sign. But the coefficient on the group 3 dummy is not statistically significant (at 10 per cent), although it has the expected negative sign. Sensitivity analysis, however, shows that the significance of the coefficient on the group 3 dummy depends on the inclusion of the UK; if we exclude the UK from the analysis, we obtain the result reported in column (5) of Table 3, *i.e.* a statistically significant negative coefficient on the group 3 dummy. Hence, although the evidence on the difference between groups 2 and 3 is not clear-cut, we may conclude that a categorical distinction among countries is at least as useful an approach of controlling for the impact of labour market regulation on labour productivity growth as a continuous approach (Gordon 1994).

6. Conclusions

Our cross-country data confirm the presence of significant differences in the nature of labour market regulation among the industrialised economies of the OECD. We find – in line with the literature – that these characteristics tend to vary together, which makes it possible to distinguish, broadly, three types of labour relations systems: highly co-ordinated systems featuring high real wage growth (group 1 countries); highly co-ordinated systems but with low real wage growth (group 2); and liberal systems having low real wage growth (group 3). Differences are particularly strong between countries of group 3 and all other countries in earnings inequality, tenure, degree of wage bargaining co-ordination, employment protection and the management ratio. Real wage growth in Group 1 countries is (statistically significantly) higher than that in the two other groups.

Our cross-country regression analysis suggests that labour productivity growth is higher in group 1 countries than in the other countries. This directly contradicts the claim that "excessive labour market regulation" is a major cause of slow labour productivity growth and should caution against too optimistic assessments of the possible productivity impacts of labour market deregulation and real wage restraint. It must be mentioned here that our period of analysis ends in 1997[28] and that in particular the US economy has experienced much higher productivity growth since then. A relevant question is whether our results will hold when the period of analysis is extended beyond 1997. We think they do: firstly, while it is true that US productivity growth has increased in recent times, it is also true that this did not happen in the other (Anglo-Saxon) group 3 countries (Australia, Canada and the UK) – which means that changes in the group average will be less pronounced than the US productivity growth increase suggests. Second, when we re-do the labour productivity growth – *EPL*-index regression (reported in column (1) of Table 3) using average figures for the period 1984-2002, then we find no significant changes in the estimated coefficients[29]; specifically, the impact of labour market

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[28]   One reason to restrict our period of analysis to 1984-1997 is that most data on labour market regulation run up to only the middle or the end of the 1990s. For others reasons, see our endnote 1.

[29]   The estimation results for the period 1984-2002 are as follows:

Labour productivity growth =   1.10 +   0.17 EPL + 0.28 Real wage growth + ….
                                                (3.29)***   (2.72)**   (1.59)

regulation, as measured by the *EPL*-index, remains positive and statistically significantly different from zero. Hence, our results remain empirically robust also for the more recent period. Our findings are important in light of the steady deregulation of labour markets in (many) OECD countries during the 1990s (see Glyn 2006). Further deregulation and flexibilisation of OECD labour markets may lead to a deteriorated productivity performance, because it fails to effectuate the contribution that workers can make to the process of organisational and technological innovation which raises labour productivity. Our overall conclusion is reinforced when we use a categorical dummy variable to explain OECD productivity growth and find that the explanatory power of this categorical distinction among countries is about as high as that of (continuous) regressions.

$$\overline{R}^2 = 0.81; \text{F} = 15.9 \ (0.0000); \text{n} = 19.$$

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Appendix

Factor analysis

We use factor analysis to reduce seven measures of labour market regulation to one factor, which serves as a meaningful index of the extent of Labour Market Regulation (*LMR*). The eigenvalue of this first factor is 3.51 (which is > 1) and this (unrotated) factor solution represents 80.8 per cent of the variance in the data. We report only one factor, because the eigenvalues of the second (and third) factor were well below 1, namely 0.838 and 0.403 respectively, and they lacked substantive interpretation (unlike the first factor). The factor loadings and factor scoring coefficients are shown below; the latter were used to calculate each country's score on the factor.

Variables	Factor loadings	Factor scoring coefficients
EPL Index	0.8772	0.3746
Collective bargaining coverage	0.6600	0.1037
Management ratio	–0.8855	–0.3215
Wage bargaining co-ordination	0.6990	0.1500
Replacement ratio	0.6006	0.0553
Earnings inequality	–0.6350	–0.1351
Average tenure	0.5210	0.0331

The resulting *LMR* index for 19 OECD countries is presented in Figure 1.

Data sources and definitions

The countries in the sample are:

Australia	Finland	Italy	Spain
Austria	France	Japan	Sweden
Belgium	Germany (West)	The Netherlands	Switzerland
Canada	Greece	Norway	United Kingdom
Denmark	Ireland	Portugal	United States

Where possible, the data refer to West-Germany throughout. The period of analysis is 1984-1997. The full dataset is available in Storm and Naastepad (2005).

Employment Protection Legislation (*EPL*) index: the index used is the average of the indices for 1989 and 1999 as provided by Nicoletti *et al.* (2000). The index has a range (0—4). *Workers' Rights and Co-operation* (*WR-C*) index is the factor RTS-CO1 constructed by Buchele and Christiansen (1999a), Table 3b (range between —2.1 and +2.1). The management ratio (MR) was calculated based on data on employment by occupation from ILO, *Yearbook of labour*

Statistics, various years. Data on the *Benefit Duration* index (for the period 1980-7; range 0—1.1), *Collective Bargaining Coverage* (in 1994) and the *Co-ordination* index (1980-7; range 1—3) are from Nickel *et al.* (2005). The index of Duration of Unemployment Benefits is based on a measure of how the longer-term generosity of benefits compares to the one-year replacement rate. The Collective Bargaining Coverage refers to the percentage of the employed labour force whose pay is determined by collective agreement. Data on union density (union members as a percentage of employees during 1980-87), the replacement ratio (for 1980-87), and total labour taxes (for 1980-87) are from Nickell *et al.* (2005). Data on average tenure (1995) are from OECD (1997). The source of the data on D9/D1 earnings inequality (during 1984-1995) is OECD (1996).

 Real GDP growth (at factor cost and at market prices), *net public expenditure growth*, *and export growth* are from the OECD Economic Outlook Database. Labour productivity growth is defined as the average annual growth rate of real GDP (at factor cost) per hour worked. Data on *hours worked* are from the GGDC Total Economy Database (http://www.eco.rug.nl/ggdc), University of Groningen and the Conference Board. *Real wage growth* is the average annual growth rate of real compensation per employee per hour worked; data on real compensation per employee are from the OECD Economic Outlook Database.

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