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Has "Discretionary Learning" declined during the Lisbon Agenda? A cross-sectional and longitudinal study of work organization in European nations

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A cross-sectional and longitudinal study of work organisation

in European nations

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Abstract

This paper explores changes in the organisation of work in European nations over 2000-2010. Results show a decline in the Discretionary Learning (DL). Periods of economic expansion tend to be DL enhancing, while periods of economic stagnation tend to reinforce the use of more hierarchical forms of work organisation. More generally, the results show that cross-country comparisons do not provide a sound basis for drawing conclusions about how the evolution of national labour market policies impact on changes in work organisation over time within nations.

1. Introduction

In this paper we explore both differences in work organisation between European nations and changes within them over time during the period of the Lisbon Agenda (2000-2010). From the longitudinal perspective, our results show for Europe as a whole a decline in what we refer to as the 'discretionary learning' (DL) forms of work organisation; The DL forms are characterised by high level of employee learning and problem-solving as well as considerable employee control over work methods and the pace of work.[i] In our view this decline was a constraint on the transition to the knowledge-based economy in Europe, and was a largely unappreciated factor contributing to the disappointing performance in terms of achieving the Lisbon Agenda's overall goal of making Europe, 'the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion.'

The background for this perspective is an earlier piece of research (Arundel et al. 2007) focusing on the cross sectional relation between work organisation, employee learning and national innovation performance for the EU-15. That paper showed that in nations where the DL forms of work organisation are more developed firms tend to be more active in terms of innovations developed through their in-house creative efforts. In countries emphasizing more hierarchical forms of work organisation, where little discretion left to employees in how they solve the problems they confront in their daily work activity, firms tend to engage in a supplier-dominated innovation strategy. We concluded that article by observing that a major challenge for future research is to understand the underlying "unexplained" national factors that influence firms' organisational choices as well as their innovation performance.

A principal objective of this paper is to investigate the institutional and economic conditions and changes that may account for the way work organisation evolved within European nations over the period of the Lisbon Agenda. Our objectives overlap with those of Greenan et al. (2013) who have analysed changes in different indicators of the quality of working life including a measure of the

complexity of work organisation for the EU-15 during the period 1995-2005. Different from Greenan et al. (2013), our analysis includes the new member nations and it considers how the 2008 financial crisis and the sharp contraction in economic activity which followed impacted on changes in work organisation. In developing this analysis we build on our earlier work in (Holm et al., 2010) where we investigated for the period mid-way through the Lisbon period the way cross-national differences in labour market institutions and policies are related to the frequency of different forms of work organisation. This cross sectional analysis showed that strong systems of unemployment protection combined with an emphasis on active labour market policies are a strong predictor of the likelihood of the DL forms of work organisation. However, our analysis here finds no evidence to support the view that changes over time in the frequency of the DL forms within nations can be explained by how their national labour market policies evolved.

Our main result in terms of explaining the decline in the frequency of the DL forms of work organisation in Europe concerns the effects of changes in the economic climate in which firms operate. Periods of economic expansion tend to be DL enhancing, while periods of economic stagnation and decline tend to reinforce the use of more hierarchical forms of work organisation. This suggest that the decline in the DL forms of work organisation for Europe as a whole was linked to the deteriorating economic climate European firms operated in following the 2008 financial crisis. More generally, the fact that our cross-sectional results concerning the impact of labour market institutions and polices on work organisation are not reproduced in our longitudinal analysis, suggests that cross-country comparisons are not necessarily a sound basis for drawing conclusion about the factors that may affect changes work organisation within nations over time. In the concluding section we return to this finding and consider its policy implications.

The paper proceeds as follows. In section 2 we discuss macro level factors that can be expected to affect work organisation for the individual worker. Then, in section 3, we compare the evolution of work organisation in European nations over the period 2000 to 2010. In section 4 we describe the

econometric approach to identifying the predictors of the observed evolution of work organisation as well as differences across nations. Section 5 presents the data to be used in regressions, the results are presented in section 6 and section 7 concludes.

2. Labour market institutions, economic context and forms or work organisation: cross sectional and longitudinal effects

2.1 The impact of labour market institutions

Our analysis draws inspiration from the literature on comparative national systems analysing how national labour market and education and training institutions influence work organisation and the style of employee learning. Much of this literature has been developed, at least implicitly, around a distinction between regulated and deregulated labour markets and a central concept developed in the literature is that of institutional complementarities. Following Aoki (1994), these can be defined to exist when the presence of one institution increases the efficiency or benefits from the presence of another. Thus Hall and Soskice (2001), in their work on the varieties of capitalism, argue that forms of work organisation characterised by continuous employee learning are complementary to both strong systems of initial vocational training and to regulated labour markets. Regulated labour markets limit employers' ability to lay off employees and consequently provide employees with incentives to invest in their firm-specific skills which supports learning and improvements in the quality of products. A similar point was made by Streeck (1991) in his discussion of the institutional foundations of 'diversified quality production' in Germany.

In Holm et al. (2010) we attempted to widen the debate by explicitly taking into account the role of systems of unemployment protection including active labour market policies in promoting forms of work organisation characterised by high levels of employee learning. Drawing inspiration from the literature on 'flexicurity' systems, we argued that job mobility by increasing the diversity of knowledge may be skill enhancing in nations with well-developed systems of unemployment protection combined with active labour market policies. Unemployment protection can encourage

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individuals to commit themselves to what would otherwise be considered unacceptably risky career paths that are punctuated by transitions between employment and unemployment or part-time employment. Active labour market polices can provide support for moving the unemployed into employment and help assure that extended periods of unemployment will not lead individuals to accept downgrading or take job offers that do not make use of and build on the experience and knowledge they have gained through previous employment.

In this paper we build on these earlier results and extend our analysis of the determinants of work organisation by exploring not only the time invariant cross national effects of differences in national labour market and education and training institutions but also the time varying within nation effects of changes in these institutions over the period of the Lisbon agenda. As described in more detail in Section 5 below, we make use of the data on different categories of social protection expenditure available on Eurostat's electronic data base in order to develop harmonised measures over time of the amounts spent by EU member nations on unemployment protection, including expenditures on training and retraining for the unemployed. By combining this with data on the general characteristics of national educational and training systems, we are able to show that in nations where high level expenditures on unemployment protection are combined with well-developed systems of further education and training, the likelihood of observing the DL forms of work organisation is greater. The results support the view that employee learning is sustained by investments in further education and training that serve to renew and further develop the formal and the practical work-related skills needed for solving the organisational and technical problems employees confront in work. Strong systems of unemployment protection including active retraining of the unemployed can serve as scaffolding for these beneficial effects by reducing the costs of employment transitions and helping to assure that industry-specific skills are preserved for groups of firms clustered in particular regions.

The approach in Holm et al. (2010) as well as in the comparative national systems research cited above is comparative static in the sense that no effort is made to investigate the impact on enterprises and employees of changes over time in national institutional and economic conditions. Within the context of European policy discourse and the 'open method of coordination', however, the issue of institutional change and its effects has been of central importance. The European 'open method of coordination' is built on the premise that is it possible to identify institutional best practice that may serve as benchmarks, and that policies may be put in place at the EU and national levels to promote their wider diffusion. The assumption is that changes within countries over time in the direction of the benchmark institutional arrangements should contribute to improving performance and help laggard nations to catch-up with the leaders. This paper constitutes a first empirical effort to evaluate these sorts of claims by investigating simultaneously the impact on work organisation of time-invariant cross-national changes and time-varying within-nation changes in labour market and educational and training institutions. The results, with certain qualifications, do not support the view that the observed effects of cross-national differences in institutional arrangements provide a sound basis for determining the impact of changes in institutional arrangements within nations over time. In the concluding section of the paper we elaborate on this basic result and speculate on the factors that might account for it.

2.2 The impact of the economic conjuncture

The analysis of changes in forms of work organisation over time raises the issue of the possible impact of changes in the economic conjuncture. The impact may in principle follow three different avenues: 1) Work organisation may be a determinant of firms' differentiated growth rates and survival rates over the business cycle and hence the frequencies of firms of work organisation at the aggregate level can change while there is no change within individual firms; 2) Firms' managers may choose to add or remove jobs with certain forms of work organisation at different stages of the business cycle. This is the perspective taken by Greenan et al. (2013) who argue that precarious and low skilled jobs are relatively sensitive to the economic conjuncture and that the complexity of work

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is hence counter cyclical; 3) Management may also choose to change work organisation in existing jobs. Our data does not allow us to distinguish between these three possible transmission mechanisms. To the best of our knowledge there are no studies of the effects of work organisation on firms' growth and survival but there is widespread evidence that firms adapt their strategies to the business cycle and that the selection pressure faced by firms vary with the economic conjuncture. This means that there are incentives to use different strategies, including work organisation, as the conjuncture evolves. Research indicates that firms tend to focus more on the short term during a recession and that this entails limiting investments in general to ensure short term survival (Marginson and McAaulay, 2008). The shift towards short term strategies during a recession suggests that managers increase their control over working conditions during a recession. They implement measures to minimize workers' slack time and to optimize the amount of measurable output per worker. Thus workers should experience less autonomy and less learning during a recession suggesting that the frequency of DL work organisation is pro cyclical; i.e. increasing during an economic expansion; while the frequency of more bureaucratic and less learning forms should move in a counter cyclical way.

The observed short-termism is in contrast with the prescriptive business cycle management literature. Mascarenhas and Aaker (1989) found that while most firms cut back on investments during a recession the most profitable strategy is to increase investments during a recession. And similarly most firms expand their workforce during an economic expansion while the most profitable strategy is to cherry pick the best workers at relatively low wages during a recession. The implication is that firms need high learning jobs at any stage of the business cycle as they, for example, need to develop new products in the recession and to market and maintain these products during the expansion. Additionally, the use of HRM practices such as work hour flexibility and cross-training help to retain the talented workers, which were picked during the downturn, during the upswing. The aim of such HRM practices is to increase employees' motivation and keep them from going onto the job market, where the economic expansion entails that lucrative jobs are often available

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(Bromiley et al., 2008; Navarro et al., 2010).. Increased short-termism during downturns suggests that the frequencies of bureaucratic forms of work organisation move in a counter-cyclical fashion and this is the finding that we expect to see, even if the prescriptive business cycle management literature argues that firms need to keep learning throughput the business cycle.

3. Measuring the time trend in forms of work organisation for EU member nations

In order to characterise the trend in work organisation over the period of the Lisbon Agenda, we make use of the results from successive waves of the European Working Conditions Survey (EWCS). The EWCS is an individual level survey conducted as a structured interview at the respondent's home residence. The surveys contain detailed information on the characteristics of the working conditions of the individual but relatively limited information on the firm or workplace of the individual. The questionnaire used during the interviews has evolved over the years so that the one used for the most recent wave; the fifth wave from 2010; is much more comprehensive than the questionnaire used for the first wave in 1990. The limited scope of the questionnaire used in the early waves entails that we are restricted to the three most recent waves. These are: the fourth and fifth waves from 2005 and 2010 covering the EU27 and a number of additional European countries, and the third wave from 2000 covering the EU15 and extended with the 12 new member nations in 2001. We thus have observations from the entire EU27 for each wave for characterising the employee's form of work organisation. In keeping with our previous work, we exclude observations for employees working in micro-establishments with less than 10 employees, and we exclude employees working in the public administration, health and education sectors. This leaves 33,187 interviews distributed across 81 country-waves for constructing the taxonomy of work organisation.

In the regression analyses presented in section 6 the employee's form of work organisation is explained by individual level effects taken from the EWCS and from contextual effects referring to the country-wave of the interview. As we divide the contextual effects into between and within country effects, as explained in detail below, it is preferable to only include countries in the

regressions for which we have aggregate data over all three waves. For this reason Bulgaria and the Netherlands are excluded and it reduces the sample by 2,502 observations. Another 482 observations are lost across the remaining 75 country-waves because of missing individual level data bringing the number of observations used in the regressions down to 30,203.[ii] The descriptive statistics and results presented in this section and throughout the paper refer to these 30,203 observations in the 25 EU member nations.

As in our previous work, in order to assign employees to distinct work organisation categories or groups factor analysis is used to identify the underlying associations that exist among a set of 15 binary organisational variables. We then use the factor scores or the coordinates of the observations on the factors as a basis for clustering individuals into distinct groups of work systems, using Ward's hierarchical clustering method.[iii] The factor and cluster analysis is carried out on the pooled micro-data from the three waves of the EWCS. The results provide us with an average characterisation of the frequency of the different forms of work organisation for the 2000-01, 2005 and 2010 waves of the survey. We then calculate and contrast the frequencies for each of the three waves in order to characterise the time-trend of work organisation over the period of the Lisbon Agenda, 2000-2010.[iv]

The factor and cluster analysis allowed us to identify four distinct forms of work organisation that closely correspond to those identified in our previous analyses based on the 2000 and the 2005 waves: the Discretionary Learning (DL), Lean, Taylorist and Simple forms (Lorenz and Valeyre, 2005; Arundel et al., 2007). The final column in Table 1 below presents the frequencies for the pooled data from the three waves of the 15 binary work organisation variables used for the clustering.[v]

As discussed in detail in Holm et al. (2010), the choice of variables is based principally on a reading of the literature dealing with the relation between organisational design and the capacity for adaptation and learning (Burns and Stalker, 1961; Mintzberg, 1979, 1983; Lam, 2005; Lam and Lundvall, 2006). The variables in particular are designed to capture differences in the amount of learning and problem-solving activity employees engage in at the work place and the extent to which

employees exercise control or autonomy over the way they work and over the pace at which they carry out tasks. The variables are also chosen to capture the use of specific managerial practices including the use of team work, job rotation, individual responsibility for quality control and the need to respect quality standards in work.

The first 4 columns in Table 1 present the results of the cluster analysis on the pooled data for the 25-nation sample used in the econometric exercises. The first cluster, which accounts for about 37 percent of the population, is distinctive for the way high levels of autonomy in work are combined with high levels of learning, problem-solving and task complexity. The variables measuring constraints on work pace and monotony are underrepresented. The user of team work is near to the average for the population and job rotation is somewhat underrepresented. Work organisation in this cluster corresponds rather closely to that found in Mintzberg's (1979) 'operating adhocracy' and due to the combined importance of work discretion and learning, we refer to this cluster as the 'Discretionary Learning' forms.

Table 1 Work Organisation Clusters: pooled data for 25 European Nations

	Percent of employees by organisational form reporting each variable				
	Discretionary Learning	Lean	Taylor	Simple	Total
Learning new things in work	88.6	88.4	33.9	27.3	67.3
Problem solving activities	96.7	92.7	52.3	49.5	78.8
Complexity of tasks	79.6	81.2	30.2	17.9	59.6
Discretion in fixing work methods	89.2	61.5	9.1	43.9	59.2
Discretion in fixing work pace	87.7	62.4	15.7	54.0	61.9
Responsibility for quality control	84.5	90.1	60.1	26.3	70.6
Quality norms	78.0	96.3	90.8	34.1	76.8
Team work	56.6	91.4	54.1	41.9	62.6
Job rotation	37.4	76.8	41.4	32.9	47.7
Horizontal constraints on work rate	35.8	81.6	63.9	26.7	51.2
Hierarchical constraints on work rate	27.6	66.7	69.0	27.3	45.2
Norm-based constraints on work rate	38.8	76.1	75.0	14.7	50.5
Automatic constraints on work rate	5.3	47.9	66.1	8.0	27.8
Repetitiveness of tasks	14.3	42.0	52.0	21.1	29.6
Monotony of tasks	23.7	60.2	77.2	42.3	46.3
Total	36.8	26.7	17.7	19.0	100.0

Source: Third, Fourth and Fifth Working Conditions surveys, European Foundation for the

Improvement of Living and Working Conditions

The second cluster accounts for 26.7 percent of the population. Compared to the first cluster, work

organisation in the second cluster is characterised by lower levels of employee discretion in setting

work methods. The use of job rotation and team work, on the other hand, are much higher than in

the first cluster, while work effort is more constrained by quantitative production norms and by the

collective nature of work organisation. The use of quality norms is the highest of the four clusters

and the use of employee responsibility for quality control is considerably above the average level for the population as a whole. These features point to a more structured or bureaucratic style of organisational learning that corresponds rather closely to the characteristics of the Japanese or 'Lean production' model (Womack et al. 1990; MacDuffie and Krafcik, 1992; Lam, 2005).

The third class, which groups about 18 percent of the population, corresponds in most respects to a classic characterisation of Taylorism. The work situation is in most respects the opposite of that found in the first cluster, with low discretion and low level of learning and problem-solving. The use of teams and job rotation are at about average levels, implying that the use of these practices is a highly imperfect indicator of the transition to new forms of work organisation involving high levels of learning and problem-solving. The characteristics of this cluster draw attention to the importance of what some authors have referred to as 'flexible Taylorism' (Cézard et al., 1992; Linhart, 1994).

The fourth cluster groups 19 percent of the population. All the variables are under-represented. The frequencies of the two variables measuring the use of quality norms and individual responsibility for quality control are lowest among the four types of work organisation and there are few constraints on the work pace. This class presumably groups traditional forms of work organisation where methods are for the most part informal and non-codified.

Table 2 presents the trend in the frequencies of the four forms of work organisation over the three survey waves. A striking aspect of this trend is the secular decline in the frequency of the DL forms of work organisation over a period of time in which a major objective of European Union was to increase the capacity of firms for learning, creativity and innovation with a view to making Europe the most dynamic knowledge-based economy in the world. The frequency of the DL forms, after increasing slightly between 2000 and 2005 from 37.1 to 38.7 percent, drops sharply to 35.4 percent in 2010, a figure well below the 2000 level. The shares of the lean and taylorist forms move in the opposite direction over the decade, with increases of approximately 2 percent for the lean forms and about 1 percent for the taylorist forms. The share of simple forms declines sharply between 2000 and

2005 and then increases arriving in 2010 at a percentage somewhat below its level in 2000.[vi] The trend for Europe as a whole shown in Table 2 is a move away from the use of forms of work organisation characterised by high levels of learning and autonomy to more constrained forms in which the employee's capacity for exploring novel knowledge as a basis for new solutions in daily problem-solving activity is curtailed (see Arundel et al. 2007 for a discussion).

Table 2 Frequencies of Forms of Work Organisation by Survey Wave:

25 European Nations

Wave	Discretionary learning	Lean Production	Taylorism	Simple	Total
2000-01	37.1	25.4	17.2	20.3	100.0
2005	38.7	26.7	17.3	17.3	100.0
2010	35.4	27.6	18.0	19.0	100.0
Pooled	36.8	26.7	17.7	19.0	100.0

Source: Third, Fourth and Fifth Working Conditions surveys, European Foundation

for the Improvement of Living and Working Conditions

Table 3: Trends in the frequencies of the organisational forms for EU-25

Country	DL Share 2000	DL 2000-2005	DL 2005-2010	Lean Share 2000	Lean 2000-2005	Lean 2005-2010	Taylor Share 2000	Taylor 2000-2005	Taylor 2005-2010	Simple Share 2000	Simple 2000-2005	Simple 2005-2010
Continental												
Austria	45.4	0	0	23.3	0	+	16.9	0	0	14.4	0	0
Belgium	43.0	0	0	19.5	+	0	14.7	0	0	22.9	0	0
Germany	44.2	0	0	17.6	+	0	14.4	0	0	23.9	-	0
France	38.5	+	-	27.1	0	0	16.0	0	+	18.4	-	+
Luxembourg	40.0	0	0	24.1	0	0	12.2	0	0	23.6	-	0
North												
Finland	47.5	0	0	26.4	0	+	13.7	0	0	12.5	0	0
Denmark	64.4	-	0	18.1	+	-	7.7	0	0	23.9	0	+
Sweden	54.3	+	-	17.8	0	+	9.5	-	0	18.3	0	0
South												
Italy	39.1	0	0	18.6	0	0	20.2	0	0	22.2	-	+
Greece	21.0	0	0	21.4	+	-	22.9	0	+	34.7	-	0
Spain	21.4	0	0	27.2	0	0	32.4	-	0	19.0	+	-
Portugal	22.1	0	0	22.7	+	-	29.0	0	0	26.2	-	+
West												
Ireland	24.4	+	-	35.2	-	+	20.1	-	+	20.3	0	-
UK	31.4	0	0	38.5	-	+	14.0	0	0	16.1	+	0
Eastern Europe												
Czech Republic	31.9	0	0	29.3	0	0	19.3	0	0	19.5	0	0
Hungary	39.0	0	0	16.0	0	+	18.5	0	+	26.5	0	-
Poland	37.4	-	0	24.6	+	-	15.1	0	0	23.0	-	+
Slovenia	36.3	0	0	26.9	0	0	19.3	-	0	17.6	0	0
Slovakia	23.0	0	0	31.9	-	0	26.8	0	0	18.4	0	0
Romania	7.2	+	0	44.0	0	0	29.7	-	0	19.0	0	+
North-East												
Estonia	38.0	0	0	35.8	0	0	10.3	0	0	15.9	0	0
Latvia	28.7	0	+	26.7	0	-	14.3	0	-	30.4	-	0
Lithuania	24.3	0	0	21.1	0	0	21.2	0	0	33.3	-	0
South-East												
Cyprus	27.7	0	0	23.4	0	-	16.6	0	0	32.4	0	0
Malta	28.2	+	0	45.7	0	0	11.3	0	-	14.7	-	0

+ refers to a positive change and – to a negative change in the frequency of the organizational form. A zero indicates that there is no change which is statistically significant at the .05 percent level or better

Table 3 shows the share of each form of work organisation in 2000 and the direction of the trend in their frequencies for 2000-2005 and for 2005-2010. The results show that the aggregate trends for the EU-25 mask considerable diversity between nations. Focussing in on the 2005-2010 period, only three nations, France, Sweden and Ireland, sustained statistically significant declines in their share of DL forms. The changes were 18, 15 and 12 percentage points respectively. The only country to see an increase was Latvia with an increase of about 14 percentage points.

Changes in the shares of the Lean forms also show a contrast between the EU-15, excluding the south, and the new member nations, with five nations (Austria, Finland, Sweden, Ireland and the UK) within the EU-15 sustaining a statistically significant increase between 2005 and 2010 in the frequency of Lean, while two of the southern and three of the new member nations (Greece, Portugal, Poland, Latvia and Cyprus) experienced a significant decline. In the case of the Taylorist forms, while the majority of the EU-25 sustained declines, these were only significant in two cases, Latvia and Malta. France, Greece, Ireland and Hungary sustained statistically significant increases in their shares of the Taylorist forms between 2005 and 2010. The trend in the shares of the Simple forms is more balanced with six of the EU-25 sustaining significant increases over the 2005-2010 period.

The results shown in Table 3 identify a difference between the higher income member nations of the EU-15 and the new member nations regarding the trend in forms of work organisation over the 2005-2010 period. For these EU-15 nations, the dominant trend is towards lower levels of learning and problem solving and a reduction in the discretion which employees exercise in their daily work activity. France, Sweden and Ireland contribute significantly to this trend. Each of these three nations sustained statistically significant declines in their shares of the DL forms and they sustained significant increases in their shares in either the Lean or the Taylorist forms or in both. For the new member nations the dominant trend over 2005-2010 is towards an increase in the DL forms and a decline in the Lean and Taylorist forms. The statically significant changes are accounted for by a small

number of nations, in particular Latvia, Cyrus, Poland and Malta. Hungary stands out amongst the new member nations for having experiences statically significant increase in the Lean and Taylorist forms over the 2005-2010 period.

4. Methodology

When studying the effects of economic and policy context on micro-level outcomes it is important to distinguish the effects of differences across countries from the effects of change within a country (Bartelsman et al., 2005). Cross country differences in the selection environment as reflected in national differences in economic development trends and in policy, and intra country differences in the selection environment over time associated with changes in the economic conjuncture and policy will possibly not have the same effect on the outcome in focus. In other words, as other studies have shown (Bartels, 2008; Fairbrother and Martin, 2013), a policy or contextual variable, which in a cross country comparison context has a significant positive effect may have a non-significant or even negative effect over time within countries.

In order to disentangle the within from the between country effects of the policy and economic context we adopt the approach used by Fairbrother and Martin (2013) and apply contextual variables at two levels: the country-wave level and the country level. The country level value of a contextual variable is computed as the mean value of the variable over the three waves. This provides a time invariant measure of differences across nations. The country-wave level value of a contextual variable is computed by subtracting the country level, time invariant, mean values from the value observed for the country-wave. The country-wave level variables thus reflect intra country deviations from the country's time invariant value and can be interpreted as intra country variations in contextual effects. This construction of the contextual variables assures that the county-level and country-wave level variables are orthogonal, and hence allows us to separate out the effects of time invariant national differences in policies or context conditions from the effects of the time varying differences in policies within nations. The worker level observations are likely to be correlated within

the clusters created by each of the country-waves. As our hypotheses regard the effects of contextual variables we cannot control for the clustering in the data using fixed effects. Fixed effects for clusters would exhibit perfect multicollinearity with the contextual effects. One solution is to compute cluster robust standard errors but these would only correct bias in the standard errors, not bias in the estimates (Guo and Zhao, 2010/2000). To correct cluster induced bias in both estimates and standard errors we use a mixed effects model (for more details on the benefits of mixed effects models when data are clustered see for example Guo and Zhao (2010/2000) or Bartels (2008)).

The correlated nature of the data is taken into account explicitly by specifying a mixed effects model whereby we assume that clusters in the data are a random sample. That is, that the country-waves are a random sample representative for countries and the period represented in the data. The data also exhibits a higher level of clustering: country-waves clustered in countries. But it is not necessary to assume that the country clusters are a random sample as the country-wave level covariates are all orthogonal to the country level effects by construction (Bartels, 2008).

The dependent variable will be a binary variable indicating whether the respondent of the interview has his/her work organised according to the model in focus. This entails that separate and independent models are estimated for each type of work organisation. We are thus estimating generalised linear mixed effects models with a logit link function.

The general form of the mixed effects logit model is

$$Logit(p_{ijk}) = X_{ijk}^T \beta + Z_{ijk}^T b_k \tag{1}$$

The dependent variable is $Logit(p_{ijk})$ where p_{ijk} is the probability that the i'th worker has his work organised according to the form of work organisation in focus conditional on the random effects b_k. That is: $p_{ijk} = E(y_{ijk}|b_k)$ and $y_{ijk} = 1$ if the i'th worker has his work organised according to the form of work organisation in focus; otherwise $y_{ijk} = 0$. X_{ijk} is a vector of covariates for the fixed effects vector β including a 1 for the intercept. There are generally three classes of covariates: those

that are unique for each worker, i, those that are unique for each country-wave, j, but common for all workers in a given country-wave, and those effects which are unique for each country, k, but common for all country-waves in said country. We refer to these effects as level 1, 2 and 3 fixed effects respectively. Z_{ijk} is a vector of covariates for the random effects vector b_k. Z_{ijk} includes a 1 for a random intercept for countries (level 3) and three dummies for waves resulting in random intercepts for country-waves nested within countries. This means that the variance component of the random effects can be separated into a country-wave and a country effect indicating whether the variability in a parameter is mostly a within or between country phenomenon (Shoukri and Chaudhari, 2007, ch. 3).[vii] It is possible to model the level 1 fixed effects with random slopes by also adding the level 1 fixed effects to Z_{ijk} but this complication has proven to be excessive for the purpose of the present paper.

Equation 2 expands equation 1 to describe the multilevel structure of the model as applied here. The explanatory variables are divided into the level 3 or time invariant country means of the contextual variables, $X_{3,k}$, the level 2 or country-wave deviations from the time invariant means of the contextual variables, $X_{2,jk}$, and the level 1 or worker level variables, $X_{1,ijk}$. The parameters in β_3 describe the effects of differences between countries in policy and economic conjuncture, β_2 describes the effects of changes within a country in policy and economic conjuncture and β_1 are the effects of worker level variables. The term $X_{1,ijk}^T \beta_1$ also contains controls for the size and sector of the workplace of worker i as well as dummies for time effects.

Level 1

$$Logit(p_{ijk}) = \alpha_{1,jk} + X_{1,ijk}^T \beta_1$$

Level 2

$$\alpha_{1,jk} = \alpha_{2,k} + X_{2,jk}^T \beta_2 + b_{2,jk}$$

Level 3

$$\alpha_{2,k} = \beta_0 + X_{3,k}^T \beta_3 + b_{3,k}$$

Random effects

$$b_{2,jk} \sim N(0, \sigma_{jk}^2)$$

$$b_{3,k} \sim N(0, \sigma_k^2) \tag{2}$$

The level 3 equation is substituted into the level 2 equation and the level 2 equation into the level 1 equation so that the estimated model contains only the beta parameters and no alpha parameters, and the two random effects (the bs) for which the variance components are estimated.

Three models will be estimated for each form of work organisation. Model 1 includes only the overall intercept (β_0) and the two random effects. For Model 2 we add the level 1 covariates and for Model 3 we also include the level 2 and level 3 covariates. The weights used when creating the taxonomy of work organisation is used in the regressions.

5. Employee-level and country-level covariates

5.1 Employee-level covariates

Our focus in this paper is mainly on the effects of between and within country changes in the economic and policy context on work organisation at the employee level. At the employee level, we develop a relatively simple model. The choice of variables is constrained by the fact that it is only possible to include as employee or level 1 covariates measures based on questions that are identical across the three waves of the EWCS. Most notably this means that it is not possible to control for the level of initial education or for the employee's total number of years of working experience. It is possible to control for the gender, tenure at current workplace, whether or not the worker has

undergone vocational training in the prior year, occupation, and for the sector and size of the respondent's main work place. The distributions of these variables are summarized below.

After applying weights the data consist of 64 per cent males. We distinguish between three occupations: 29 per cent are high skill white collar (*HighWhite,* ISCO 1: Legislators, senior official and managers, ISCO 2: Professionals and ISCO 3: Technicians and associate professionals), 24 per cent are low skill white collar (*LowWhite*, ISCO 4: Clerks and ISCO 5: service workers and shop and market sales workers) and the remaining 47 per cent are blue collar (ISCO 6: Skilled agricultural and fishery workers, ISCO 7: Craft and related trade workers, ISCO 8: Plant and machine operators and assemblers and ISCO 9: Elementary occupations). *Tenure* refers to the number of years the respondent has been in his/her current job. The overall weighted mean individual tenure is 10 years with a standard deviation of 10 years. Vocational training is measured as the per cent of employees that have received employer provided vocational training within the 12 months leading up to the interview. It is referred to *iCVT* to distinguish individual-level vocational training from the higher-level contextual variable (see below).

Table 4 - Distribution of level 1 covariates

Variable	Reference	Other categories						
Gender	Female 35.53	Male 64.47						
Occupation	Blue collar 46.87	Low skill White collar 24.38	High skill White collar 28.75					
Sector	Comunt_soc	Sector Manuf	Elect	Const	Sale	Hotel	Transp	Bus_Ser
	6.87	36.37	2.82	9.95	15.70	3.72	11.09	13.48
Size	500 and over 14.82	Size group 10-49 44.51	50-99 15.84	100-249 15.52	250-499 9.31			
iCVT	No 67.96	Yes 32.04						
Tenure		Mean 9.63	Std. Dev. 9.53					

Weighted percentages for categorical variables. Weighted mean and standard deviation in years for Tenure. The number of observations is 30,203

The sector control has 8 categories: *Manuf* (NACE rev.1 categories C-D: manufacturing, mining, quarrying); *Elect* (NACE E: electricity, gas and water supply); *Const* (NACE F: construction); *Sale* (NACE G: wholesale, retail trade and repairs); *Hotel* (NACE H: hotels and restaurants); *Transp* (NACE I: transportation and communication) *Bus_Serv* (NACE J: Financial intermediation and NACE K: Real estate and business activities); and *Comunt_soc* (NACE O-P-Q: Community, social and personal services). The reference is *Comunt_soc*. The size of a respondent's workplace is measured by the number of employees. The size control has 5 levels: 10-49 employees, 50-99 employees, 100- 249 employees, 250-499 employees and 500 or more employees. The distribution of the size and sector covariates can be seen in Table 4.

5.2 Country and country-wave level covariates.

In order to characterise national labour market and education and training systems, we conduct a factor analysis using aggregate indicators derived either from Eurostat's electronic data base or from the group averages of micro-indicators derived from the different waves of the EWCS. Systems of

labour market protection are measured by making use of the European System of Integrated Social Protection Statistics (ESSPROS) available on Eurostat's electronic data base. The ESSPROS provides a detailed breakdown of protection expenditures by type of scheme and by function. We use the 'unemployment function' figures that are divided between three main categories: expenditures to compensate for income loss due to unemployment or early retirement; expenditures contributing to the cost of training or retraining persons looking for employment; and expenditures on placement services and job search assistance. *Tot/exp* is defined as the total of these expenditures per inhabitant. *Active* is the share of total expenditures going towards training or retraining, and *Passive* is the share going towards income maintenance or support.

The national continuing education and training system is measured with two indicators: an indicator of life-long learning opportunities (*LLL*) and a measure of employer-provided continuing vocational training (*CVT*). *LLL* is defined as the percent of the population, both active and inactive, between the ages of 24 and 65 that received education or training in the four weeks preceding the survey. *LLL* is broadly defined to include formal, non-formal and informal forms of learning. Formal life-long learning is defined as that provided by the degree conferring institutions of the formal educational system. Non-formal education and training refers to all forms of taught learning that occur outside the formal degree-conferring educational system. Informal learning refers to self-taught learning including the use of printed materials and on-line computer based learning. This broad measure of learning serves to capture the diverse types of knowledge that may contribute to employee learning and innovativeness. Thus formal forms of lifelong learning can contribute to the updating of the formal scientific and technical knowledge required to keep abreast rapid changes in technology. Non-formal and informal learning typically contribute to the acquisition of more applied or experience-based knowledge, including knowledge that may have little apparent relation to work-related activities. Further, by including in the measure of life-long learning the further education and training received by inactive persons, it is possible to takes into account that the knowledge gained during periods of inactivity may prove of value to the learning activities of persons who have recently

entered the labour market. The acquisition of more firm-specific and work-related-skills is captured with *CVT*. *CVT* is computed from the EWCS micro-data as the weighted share of respondents reporting to have undergone vocational training within the previous 12 months. Small workplaces and the public, health and education sectors were included for these computations.

The EU Labour Force Survey based data that we used in Holm et al. (2010) to measure labour market mobility are not available for all 25 member nations prior to 2005. For this reason we use the micro data on job tenure from the different waves of the EWCS to develop an aggregate indicator of labour market mobility. Our measure of labour market mobility (*Mob*) is the percentage of respondents in a nation that report they have been working in their current company or organisation for 1 year or less. The measure will be sensitive to differences in the age composition of the national workforce, and it should be interpreted with some caution.

In order to identify national institutional configurations, we performed a principal components analysis on the six labour market and education and training variables. The principal analysis resulted in three components with eigenvalues greater than 1 that account for slightly less than 80 percent of the total variance in the data set. Further details on the principal components analysis are presented in Appendix A1.

The first principal component is positively correlated with *Tot/ex*p, *CVT* and *LLL*. Countries scoring high on this factor combine high levels of expenditure on unemployment protection with an emphasis on investing in further education and training. Due to the socially inclusive nature of this combination of social protection expenditures and training investments we refer to the first principal component as *Inclusive training* (*IncTrn*). Since unemployment protection expenditure and investments in further training may be complementary in promoting employee learning at the workplace we would expect, other things equal, that employees in nations scoring relatively high on *Inclusive training* to have relatively high odds of being engaged in the DL forms of work organisation. The second principal component is positively correlated with *Active* and negatively correlated with

Passive. It measures differences across nations in the importance given to expenditures on training and retraining relative to expenditures on income maintenance and support, and we refer to it as *Active protection* (*ActPrt*). Expenditures on training and retraining may help assure that extended periods of unemployment will not lead individuals to accept downgrading or take job offers that do not make use of and build on the experience and knowledge they have gained through previous employment and for these reasons we would expect such policies to have a positive impact on the odds of working under the DL forms of work organisation.

The third principal component, referred to as *Mobility*, is positively correlated with our measure of labour market mobility. It can be argued that job-to-job mobility promotes learning and creativity at the enterprise level by increasing the diversity of knowledge. However, the effects of labour mobility in this respect may depend on the nature of the skills that are transferred and on the extent to which they contribute to related variety in knowledge (Boschma and Frenken, 2011). On the other hand, it can be argued that high levels of employee turnover pose a problem in terms of knowledge accumulation for creative and innovative firms due to the loss of tacit knowledge and skills. For the reasons we remain agnostic on how differences in the labour market mobility are likely to impact on the odds of the DL forms of work organisation.

Table 5 shows mean rank over the period for countries by each of the three principal components. The Nordic countries in general rank highly on *Inclusive Training* but most countries have positive trends for this variable. The Nordics also rank highly on mobility but so do countries in Central Europe and the Baltics. Countries in Western Europe rank particularly low and the trend is negative in most cases. There are no strong patterns in the ranking of countries according to active protection but it must be kept in mind that the variable is capturing the balance between active and passive measures. This means that countries spending very little on income maintenance and only slightly more on training and re-training will come out high in the ranking while countries spending heavily on both measures will end up lower.

Table 5 – Mean rank and trend by country for contextual variables

Country	Inclusive Training		Active Protection		Mobility	
	Mean rank	**Trend 2000-2010**	**Mean rank**	**Trend 2000-2010**	**Mean rank**	**Trend 2000-2010**
Continental Europe						
Austria	6	+	7	+	24	-
Belgium	5	+	12	+	20	-
Germany	11	+	6	-	25	-
France	12	+	14	-	15	-
Luxembourg	9	+	3	-	21	+
North						
Finland	1	+	18	-	8	-
Denmark	2	+	2	-	4	-
Sweden	3	-	4	+	11	-
South						
Italy	18	+	24	-	22	+
Greece	23	+	1	-	23	-
Spain	20	+	15	-	2	-
Portugal	19	+	23	-	16	+
West						
Ireland	8	+	9	-	19	-
UK	4	+	17	-	3	-
Eastern Europe						
Czech Republic	10	+	21	-	14	-
Hungary	24	+	8	-	6	+
Poland	22	+	5	+	7	+
Slovenia	7	+	13	-	9	-
Slovakia	13	-	19	+	12	-
Romania	25	+	22	-	13	-
North-East						
Estonia	15	+	11	-	1	-
Latvia	21	+	10	-	10	-
Lithuania	17	-	16	+	5	-
South-East						
Cyprus	14	+	25	-	17	-
Malta	16	+	20	+	18	-

We argued above that the share of DL is expected to be pro-cyclical: increasing during expansions and decreasing during contractions. Some of this change will be caused be firms altering the way they organise work, be it because of rational anticipation of the changed conjuncture or as a delayed

adaptive response. Another part will be caused by a selection mechanism driving out firms with inferior forms of work organisation. Such processes will be working at different speeds indicating that there are several lags in the effect of the conjuncture on work organisation. Thus our conjuncture variable (*Conjuncture*) is computed as three year averages. More specifically the trend in growth will be estimated using k independent OLS regressions as specified in equation 3 where t is year, k is country and y_{tk} is real GDP per capita.

$$\log(y_{tk}) = \gamma_{0k} + \gamma_{1k}t + \epsilon_{tk} \tag{3}$$

The residuals from these regressions, e_{tk}, are then used to construct *Conjuncture* as shown in equation 4.

$$Conjuncture_{jk} = \sum_{t=t_{j-2}}^{t_j} e_{tk}\Big/3 \tag{4}$$

Where j is EWCS wave and t_j is the year of wave j. *Conjuncture* can be interpreted as the average percentage deviation from trend growth over the two years leading up to the survey and the year of the survey. For the regressions (equation 3) we use data on real GDP per capita from Eurostat's webpage for the years 1997-2010 except for Malta where the first year is 2000. The third EWCS was undertaken in Malta in 2001 so for this country-wave combination we can only use two years for computing *Conjuncture.* As there cannot logically be a time invariant deviation from a trend the conjuncture variable cannot be split up into level 2 and level 3 effects. However the estimated slope coefficients from the Equation 3 regressions can be used at level 3 as an indicator of the trend in economic growth.

$$Trend_k = \widehat{\gamma_{1k}} \tag{5}$$

While *Conjuncture* and *Trend* are not orthogonal by construction they are only weakly correlated. The correlation is -0.21 over the 75 country-waves of our data. Based on the theoretical argument we would expect changes over time in the within country share of DL to be positively correlated with *Conjuncture*.

The principal components all have mean zero, a standard deviation of one and are orthogonal to each other. However for use in the regression analyses the contextual variables are decomposed into a time invariant country mean and deviations from this mean and these values will be correlated. The correlations are reported in Table 6. The top right part of the table reports the correlations among the deviations from the mean and the bottom left part reports the correlations among the means. Mobility is positively correlated with the growth trend and a change in mobility is correlated with the economic conjuncture. Changes in inclusive training are negatively correlated with the conjuncture but the mean of inclusive training is not correlated with the trend in growth. There is some correlation among the variables describing the national labour market and education and training systems, the strongest being the negative correlation among inclusive training and active protection.

Table 6 – Correlation matrices

	IncTrn	*ActPrt*	*Mobility*	*Conjuncture*
IncTrn	0	**-0.589**	**-0.364**	**-0.369**
ActPrt	0.129	0	**0.257**	0.196
Mobility	0.103	-0.189	0	**0.327**
Trend	-0.360	-0.056	**0.411**	-0.213

Values above the diagonal are correlations at level 2 ($n_2 = 75$) while values below the diagonal are correlations at level 3 ($n_3 = 25$). Values in bold are significant at 5 percent

6. Results

Table 7 reports the results from estimating the model with only the overall intercept and the random effects, Model 1, for each form of work organisation. Table 8 reports the results from estimating Model 2, which is Model 1 with the level 1 covariates and the time controls added, and Table 9 reports the results from estimating the full model, Model 3.

Table 7 - Results for Model 1

	DL		Lean		Taylorist		Simple		
Level 1	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	
Intercept	-0.605	0.094 ***	-0.991	0.054 ***	-1.608	0.086 ***	-1.475	0.056	***
Random effects									
Level 2	0.043	0.013	0.032	0.010	0.025	0.009	0.056	0.016	
Level 3	0.187	0.060	0.047	0.019	0.146	0.051	0.039	0.022	
AIC	39241.94		35476.34		28913.30		30028.92		
Dispersion	1.02		1.02		1.02		1.02		
Quadrature points	1		1		1		1		

Estimates for fixed effects and for the variances of random effects along with standard errors. *: significant at 10%, **: significant at 5%, ***: significant at 1%. No significance test for random effects

The unconditional probabilities of the different forms of work organisation for the population as a whole can be estimated from the coefficients on the intercept terms in the models without covariates presented in Table 7. The unconditional probability of the DL forms is 35.4 percent. The unconditional probabilities for the Lean, Taylorist and Simple forms are 27.2, 16.8 and 18.6 percent respectively. The results in Table 7 give an idea of the amount of the variance at the country-wave and country levels which the contextual effects are expected to explain. (The level 1 variance is equal to the variance of the standard logistic distribution as determined by the mean: $\pi^2/3$, where π is the mean; ie the proportion of workers with the form of work organisation in question). The results show that the cross country variation in the prevalence of the DL and Taylorist forms is much higher than the within country variation over time. For the Lean and Simple forms the results show that there is variation both within countries and between them but of roughly similar magnitude. As a variance must be positive it does not make sense to test whether these estimates are significantly different from zero. However, with the exception of the level 3 variance for Simple, the standard errors of the estimates suggest that zero would not be within customary confidence intervals.

	DL			Lean			Taylorist			Simple		
Level 1	Estimate	SE		Estimate	SE		Estimate	SE		Estimate	SE	
Intercept	-1.542	0.120	***	-1.560	0.101	***	-1.117	0.129	***	-0.425	0.109	***
10-49 employees	0.196	0.041	***	-0.129	0.042	***	-0.447	0.050	***	0.338	0.053	***
50-99	0.080	0.048	*	-0.074	0.048		-0.236	0.057	***	0.233	0.061	***
100-249	0.003	0.048		-0.051	0.048		-0.075	0.056		0.155	0.062	**
250-499	0.004	0.055		0.113	0.054	**	-0.264	0.067	***	0.061	0.073	
Manuf	-0.406	0.054	***	0.556	0.060	***	1.106	0.085	***	-1.164	0.063	***
Elect	0.372	0.089	***	0.179	0.096	*	-0.314	0.163	*	-0.518	0.112	***
Constr	-0.106	0.065	*	0.678	0.069	***	0.426	0.097	***	-0.880	0.076	***
Sale	-0.201	0.057	***	0.059	0.066		0.448	0.092	***	-0.099	0.062	
Hotel	-0.381	0.084	***	0.329	0.090	***	0.861	0.113	***	-0.470	0.088	***
Transp	-0.368	0.062	***	-0.018	0.070		0.627	0.094	***	0.130	0.067	*
Bus_serv	0.014	0.058		0.065	0.067		0.286	0.101	***	-0.297	0.067	***
Male	0.257	0.030	***	0.223	0.031	***	-0.341	0.037	***	-0.326	0.034	***
High White	1.491	0.033	***	-0.137	0.034	***	-1.871	0.055	***	-0.750	0.045	***
Low White	0.685	0.038	***	-0.172	0.040	***	-0.978	0.047	***	0.208	0.041	***
iTenure	0.014	0.001	***	0.000	0.001		-0.015	0.002	***	-0.008	0.002	***
iVocTra	0.403	0.028	***	0.363	0.029	***	-0.484	0.040	***	-0.779	0.038	***
Time effects												
y2005	0.084	0.072		0.147	0.069	**	0.051	0.068		-0.294	0.087	***
y2010	-0.122	0.072	*	0.185	0.069	***	0.226	0.067	***	-0.206	0.087	**
Random effects												
Level 2	0.033	0.011		0.030	0.010		0.020	0.008		0.050	0.015	
Level 3	0.169	0.055		0.051	0.020		0.111	0.042		0.045	0.023	
AIC	35644.66			34695.24			25498.04			27396.82		
Dispersion	1.01			1.02			1.02			1.02		
Quadrature points	1			1			1			1		

Estimates for fixed effects and for the variances of random effects along with standard errors. *: significant at 10%, **: significant at 5%, ***: significant at 1%. No significance test for random effects

In Table 8 we have added the level 1 covariates and dummies for time which capture the direction of change in the frequencies of the forms of work organisation and control for potentially common trends in the variables. The estimated variances of the random effects generally decrease after including the level 1 covariates which indicates that inclusion of the level 1 covariates partially explains the variation across countries (level 3) and/or over time within a country (level 2). However, the magnitude of the estimated variances relative to their standard errors suggests that there is still some variation to be explained at both levels. The ability of the level 1 covariates to add explanatory

power to the model is also indicated by the decrease in Akaike's Information Criterion (AIC) for all models.

The results of Model 2 are in line with earlier results (Holm et al., 2010). Men are significantly more likely to have DL or Lean work organisation and less likely to have Taylorist or Simple work organisation. White collar workers are significantly more likely to have DL work organisation, and are less likely to have Taylorist or Lean. Low skill white collar workers are more likely to have Simple work organisation but high skill white collar workers are less likely than blue collar workers to have Simple. DL and Simple work organisation are more typical of smaller work places while Lean and Taylorist are more typical of larger work places. The Lean and Taylorists forms are typical of manufacturing, construction and hotels and restaurants, while the DL forms are relatively developed in business services and in the utilities. The Simple forms are least developed in manufacturing and the utilities sectors. Longer tenure increases the probability of DL and decreases the probability of Taylorist and Simple while having undergone vocational training increases the probabilities of both DL and Lean and decreases the probability of Taylorist and Simple.

Adding the contextual variables (Model 3) has a very limited effect on the AIC. In all models except for the model for Simple work organisation there is a very slight increase in AIC indicating that it is questionable whether the increase in the explanatory power of the models is sufficient to justify the consumption of degrees of freedom. On the other hand, adding the contextual variables leads to considerable decreases in the variances of both random effects. This indicates that the contextual variables do explain an important share of the variation over time and across countries in work organisation. The inter country variation (level 3) especially is seen to be lower when comparing Models 2 and 3 (Tables 8 and 9).

Focusing first on the time-invariant level 3 cross national effects, a main result is the positive and statistically significant impact of *Inclusive training* on the likelihood of the DL forms and the negative and statistically significant impact of *Inclusive training* on the Taylorist and Simple forms work

organisation. This cross-national effect is much in keeping with a main result in Holm et al. (2010) where we showed, other things being held constant, that the likelihood of an employee being engaged in the DL forms is higher in nations that combine high level expenditure on labour market protection policies with an emphasis on further training, while the likelihoods of being engaged in the Taylorist and Simple forms are lower. While the coefficient on *Active Protection* at level 3 in the model for DL is positive as we anticipated, it is not statistically significant. The level 3 coefficients on *Mobility* are not statistically significant in any of the models.

Table 9: Results for Model 3

	DL			Lean			Taylorist			Simple		
Level 1	Estimate	SE		Estimate	SE		Estimate	SE		Estimate	SE	
Intercept	-1.389	0.182	***	-1.749	0.131	***	-0.911	0.169	***	-0.533	0.127	***
10-49 employees	0.198	0.041	***	-0.130	0.042	***	-0.449	0.050	***	0.334	0.053	***
50-99	0.082	0.048	*	-0.075	0.048		-0.238	0.057	***	0.231	0.061	***
100-249	0.004	0.048		-0.052	0.048		-0.076	0.056		0.154	0.062	**
250-499	0.004	0.055		0.113	0.054	**	-0.263	0.067	***	0.060	0.073	
Manuf	-0.404	0.054	***	0.554	0.061	***	1.104	0.085	***	-1.169	0.063	***
Elect	0.374	0.089	***	0.175	0.096	*	-0.315	0.163	*	-0.526	0.112	***
Constr	-0.106	0.065		0.678	0.069	***	0.428	0.097	***	-0.884	0.076	***
Sale	-0.200	0.057	***	0.058	0.066		0.449	0.092	***	-0.100	0.062	
Hotel	-0.382	0.084	***	0.331	0.090	***	0.863	0.113	***	-0.469	0.088	***
Transp	-0.367	0.062	***	-0.020	0.070		0.628	0.094	***	0.128	0.067	**
Bus_serv	0.014	0.058		0.064	0.067		0.287	0.101	***	-0.296	0.067	***
Male	0.256	0.030	***	0.225	0.031	***	-0.341	0.037	***	-0.324	0.034	***
High White	1.489	0.033	***	-0.136	0.034	***	-1.869	0.055	***	-0.746	0.045	***
Low White	0.682	0.038	***	-0.168	0.040	***	-0.976	0.047	***	0.212	0.041	***
iTenure	0.014	0.001	***	0.000	0.001		-0.015	0.002	***	-0.007	0.002	***
iVocTra	0.403	0.028	***	0.363	0.029	***	-0.482	0.040	***	-0.776	0.038	***
Time effects												
y2005	-0.008	0.074		0.225	0.069	***	0.097	0.075		-0.347	0.089	***
y2010	-0.139	0.097		0.160	0.090	*	0.204	0.098	**	-0.124	0.115	
Level 2												
IncTrn	0.015	0.154		-0.094	0.130		-0.046	0.143		0.162	0.163	
ActPrt	-0.050	0.084		0.026	0.078		-0.056	0.090		0.053	0.097	
Mobility	-0.073	0.061		-0.029	0.058		0.018	0.067		0.134	0.073	*
Conjuncture	3.497	1.436	**	-3.608	1.344	***	-2.493	1.506	*	3.174	1.674	*
Level 3												
IncTrn	0.184	0.088	**	0.038	0.054		-0.201	0.072	***	-0.155	0.046	***
ActPrt	0.104	0.080		-0.077	0.051		-0.062	0.067		-0.028	0.044	
Mobility	0.050	0.109		0.038	0.067		-0.051	0.089		-0.057	0.056	
Growth trend	3.582	5.454		5.395	3.424		-8.774	4.515	*	5.258	2.982	*
Random effects												
Level 2	0.024	0.009		0.019	0.008		0.019	0.008		0.036	0.012	
Level 3	0.111	0.037		0.033	0.014		0.064	0.026		0.012	0.011	
AIC	35644.80			34695.83			25500,40			27388,03		
Dispersion	1.01			1.02			1.02			1.02		
Quadrature points	1			1			1			1		

Estimates for fixed effects and for the variances of random effects along with standard errors. *: significant at 10%, **: significant at 5%, ***: significant at 1%. No significance test for random effects

Turning to the level 2 time-varying within nation effects, it is notable that the coefficients on *Inclusive training* are not statistically significant in any of the four models. The likelihoods of the different forms of work organisation appear to be insensitive to changes in the policy variables within nations

over time. We return to possible interpretations of this paradoxical result in our concluding section.

Our main result in terms of explaining the within country trend in the shares of the forms of work organisation concerns our economic conjuncture variable. In keeping with our theoretical argument, there is a positive and statistically significant impact on DL and a negative and statistically significant impact on the Lean forms. Over the business cycle, the results support the view that downturns lead to a decline in the frequency of use of the DL forms of work organisation and to a relative increase in the use of the more bureaucratic Lean forms of work organisation. This is consistent with strategies of business cycle management where workers are given room to experiment and learn during an upswing, while slack is cut and discretion reined in during a downturn to increase short run performance of firms. The economic conjuncture also has an effect on the likelihoods of Taylorist and Simple work organisation. The likelihood of Simple increases and the likelihood of Taylorist decreases in an upswing, and vice versa. This also suggests that hierarchical control increases during a downswing. For Taylorist and Simple work organisation there are also slightly significant effects of the growth trend at level 3. The results show that in countries with a high trend growth rate Taylorist work organisation is less likely while Simple work organisation is more likely.[viii]

7. Discussion

Our emphasis in this paper has been on exploring the impact of changes in policy and context variables at the country level on the likelihood of different forms of work organisation at the individual level. In interpreting the impact of an aggregate contextual variable on individual level outcomes a first fallacy to avoid is interpreting the aggregate effects of a variable in terms of a micro-level mechanism. For example, from the cross-national point of view, our results show a positive relation between the likelihood of the DL forms and our first principal component (*Inclusive training*) capturing the extent to which well-developed systems of further education and training are combined with high level expenditure on unemployment protection. Given the level-1 result showing that employees benefiting from further training are more likely to be engaged in forms of work

organisation involving learning and discretion, this result might be interpreted as simply reflecting that the share of employees having received such training is higher in nations scoring high on the first principal component.

To properly interpret the estimated effects of an aggregate contextual variable, however, it is important to keep in mind that the coefficient should be interpreted as a shift in the estimated intercept, either up or down, depending on the sign. In other words, the fixed effects at the aggregate level show the impact of a unit change in a contextual variable on the likelihood of the outcome for all individuals, regardless of their individual characteristics. The positive impact of the first principle component on the likelihood of the DL forms means that employees in general are more likely to be engaged in these forms of work organisation in nations scoring high on the component, including employees that do not benefit from further training.

A possible explanation may have to do with a form of externality linked to the interconnected and collective nature of work organisation within the firm. As work on learning organisations has argued (Greenan and Lorenz, 2010), problem-solving activity in highly innovative firms cannot be confined to an elite group of upper level managers and technicians. The introduction onto the market of a new product or technology which has been developed in the design offices depends on further changes at the level of the production, sales and purchasing services. Ultimately the capacity of the firm to continuously innovate will be affected by the ability of employees to solve problems and adapt at all levels of the organisation. If employers are encouraged to adopt innovation enhancing organisational designs because the institutional setting assures their access to ample supplies of workers that are motivated to invest in the further development of their skills, then learning and problem-solving activity in daily work activity will tend to increase for all employees in the organisation regardless of whether they have recently benefited from employer provided training.

In the case of the Taylorist and Simple forms, the logic of the causation works is the same way but with a change of sign. If the lack of access to ample supplies of workers with up-to-date skills

encourages employers to adopt bureaucratic or relatively informal forms of work organisation with low learning requirements, the results are likely to drag down the likelihood of autonomous learning activity for employees in general, including that have benefited over the previous year from employer provided training.

As in the case of other studies distinguishing the within from across nation effects of policy (Bartel, 2008, Fairbrother and Martin, 2013), we find that the time invariant cross national effects of an increase or decrease in a policy or institutional context variable are not in general reproduced by the time varying within nation effects. Indeed the only statistically significant within country effect for the three principal components is the positive effect over time of increases in *Mobility* on the simple forms of work organisation.

One possible explanation for this difference is that the time span over which the policy or institutional changes are being investigated is too short to observe significant change in their values. More generally the reasons for why the effects of a policy or institutional variable that varies both in the cross-country and within country sense are not the same is not well explained in the literature. Plausible explanations presumably should take into account the specific characteristics of what is being explained at the micro-level. In the case of work organisation a possible explanation is that the nature of managerial strategies and behaviour around work organisation are deeply rooted in the national or even sector specific experiences of communities of employers. Beliefs about best methods especially as regards hierarchical relations of authority and subordination will only change slowly. While changes in the wider institutional context may create a favourable setting for introducing changes in work organisation, the actual implementation of change will necessarily depend on decision making at the plant level.

Of course we do observe important changes in the odds of the different forms of work organisation and in the case of DL and Lean forms our results point to the explanatory role of changes in the economic conjuncture. The discussion in section 2 regarding the change in firms' strategies over the

economic conjuncture suggested that during an economic expansion firms use HRM practices that increase the intrinsic motivation of employees such as increasing their influence and autonomy and letting them engage in challenging activities. This effect is consistent with the odds of DL increasing during an economic expansion. In a contraction firms tend to employ strategies that focus on the short term even though the prescriptive business cycle literature argues that they should invest in the development of new innovation in preparation of the next expansion. The short term strategies entail cutting costs and decreasing employee discretion to achieve higher accountability of costs. Regarding HRM practices it will be easier to justify changes that are designed to save on costs in part by tightening up control over employee effort in bad times, when the firm is facing a decline in its markets and may be threatened by closure. The tendency for increasing control during downturns is clearly seen in the increasing likelihood of Lean and Taylorist forms of work organisation. The decrease in the likelihood for DL during downturns on the other hand suggests that firms fail to follow the prescriptive literature, i.e. they fail to focus on developing new products for the ensuing expansion. Firms need to be adaptable and innovative for different reasons at each stage of the business cycle, thus ideally the conjuncture would not affect the probability of DL. But our results show that European firms tend to apply counterproductive short term strategies in downturns and thus the conjuncture does affect work organisation.

A final point to be considered is that the evidence presented here showing that changes in the institutional framework conditions do not have major impacts on work organisation, at least in the short run, does not mean that policy has no role to play. More focused micro-policy frameworks that in no sense infringe on managerial prerogative are possible. The Nordic nations in particular have a long and rich experience of policy programs designed to foster organisational change and innovation at the workplace level. These programs typically operate by providing competitive funding for the implementation of change within individual firms or within networks of organisations, with management and staff actively working along with outside researchers or experts. Examples include the Value Creation (VC) program in Norway, the TEKES program in Finland, and the workplace

innovation programs administered though VINNOVA in Sweden. These policy initiatives at the level of the workplace or networks of firms are highly complementary to the emphasis at the national level in these nations on developing broad-based vocational training and life-long learning systems. These policy initiatives may well provide part of the explanation for the considerable achievements made in the Nordic nations in extending and deepening learning at the workplace.

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Appendix

A.1 Factor analysis on contextual variables

Table 10 shows descriptive statistics for the data going into the principle components analysis.

Table 10 - Descriptive statistics for contextual variables

	Tot/exp	Active	Passive	CVT	LLL	Mob
Tot/exp	1.00					
Active	0.400	1.00				
Passive	-0.259	-0.570	1.00			
CVT	0.369	0.186	-0.201	1.00		
LLL	0.499	0.451	-0.223	0.673	1.00	
Mob	-0.075	0.164	-0.016	0.093	0.165	1.00
Mean	294.90	14.13	65.70	31.20	8.85	10.91
Std.dev	296.14	13.48	16.93	11.16	7.07	2.98

n = 75

LLL is positively correlated with total unemployment protection expenditure per inhabitant, with the share of these going towards training or retraining, and with the measure of employer-provided training. The figures show that nations spending more per inhabitant on unemployment protection tend to spend a higher proportion of the total on training and retraining. Our measure of labour market mobility is only weakly correlated with the other five indicators. The descriptive statistics show that on average over the three waves the average expenditure on unemployment protection for the 25 nations was 296.14 euro per inhabitant. On average over the three waves, the share spent on income maintenance was over 4 times that spent on training or retraining. On average over the

three waves about 31 percent of employees received employer provided training, and slightly less than 9 percent participated in some form of life-long learning. On average over the three waves, the average percent of employees for the 25 nations that had worked for their current enterprise for one year or less was just under 11 percent.

Table 11 show the correlations between the principal components after orthogonal varimax rotation and the original variables. Principal component 1 accounts for 33 percent of the variance, principal component 2 for 28 percent and principal component 3 for 17.6 percent.

Table 11 - Correlations between rotated principal components and original variables

	PC1	PC2	PC3
Tot/exp	**0.639**	0.361	-0.295
Active	0.241	**0.853**	0.111
Passive	-0.059	**-0.874**	0.022
CVT	**0.873**	0.013	0.077
LLL	**0.869**	0.231	0.144
Mob	0.075	0.050	**0.966**
Label	*Inclusive training*	*Active protection*	*Mobility*

A.2 Survey questions and frequencies of organisational variables

Table 12 - Organisational Variables

Survey questions	2000/01	2005	2010
Team work: Does your job involve doing all or part of your work in a team?	62.9	62.4	63.4
Job rotation: Does your job involve rotating tasks between yourself and colleagues?	47.6	48.6	49.0
Quality norms: Does your main paid job involve meeting precise quality standards?	75.2	77.8	77.5
Discretion in fixing work methods: Are you are able or not to choose or change your methods of work?	60.9	60.3	58.2
Discretion in setting work pace: Are you are able or not to choose or change your pace of work?	63.4	63.3	61.2
Horizontal constraints on work pace: On the whole, is your pace of work dependent or not on the work of your colleagues?	53.0	52.2	49.0
Hierarchical constraints on work pace: On the whole is your pace of work dependent or not on the direct control of your boss?	43.1	45.9	44.5
Norm-based constraints on work pace: On the whole is your pace of work dependent or not on numerical production targets?	42.7	52.2	53.4
Automatic constraints on work pace: On the whole is your pace of work dependent or not on the automatic speed of a machine or movement of a product?	29.6	26.2	26.6
Employee responsibility for quality control: Does your main paid job involve assessing yourself the quality of your work?	71.1	69.7	71.2
Employee problem-solving: Does your main paid job involve solving unforeseen problems on your own?	78.3	78.9	80.2
Learning new things: Does your main paid job involve learning new things?	69.2	68.2	66.0
Task Complexity: Does your main paid job involve complex tasks?	57.7	61.9	60.0
Task monotony: Does your main paid job involve monotonous tasks?	42.8	44.6	48.7
Task repetitiveness: Does your job involve short repetitive tasks of less than one minute?	30.9	25.1	30.6

Source: Third, fourth and fifth EWCS.

A.3 Multiple correspondence analysis on organisational variables

Figure 1– MCA factors 1 and 2
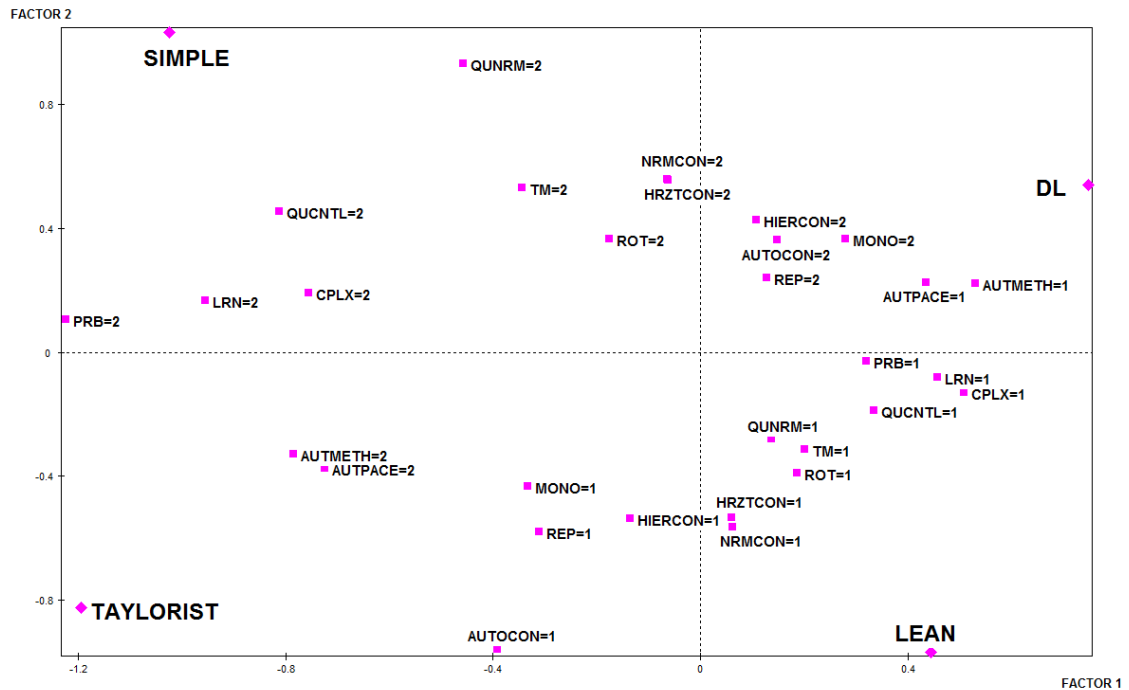
The figure above presents the first two axes or factors of the MCA performed on the pooled data for the 2000/01, 2005 and 2010 waves of the EWCS.[ix] For all work organization features 1 = the presence of the feature and 2= its absence.

AUTMETH: control over methods	TM: team work
AUTPACE: control over pace	REP: repetitive tasks
PRB: problem-solving	MONO: monotonous tasks
LRN: learning new things	HIERCON: work pace constrained by boss
CPLX: complex tasks	HRZTCON: work pace constrained by colleagues
QUCNTR: self-assessment of quality	AUTOCON: work pace constrained by machinery
QUNRM: precise quality standards targets	NRMCON: work pace constrained by performance
ROT: task rotation	

The interpretation is comparable to that presented in Holm et al. (2010) The first factor of the analysis, accounting for 17.3% of the variation in the data matrix or the chi-squared statistic, distinguishes between "new" forms of work organization and Taylorist or simple ones. It is structured by the variables measuring autonomy in work (in the methods and the pace of work), learning, problem-solving and task complexity, and self-assessment of quality of work. The second factor, accounting for 15.6% of the variation in the data matrix, is structured by variables capturing the formalization of work and characteristic of the Taylorist and lean forms of work organization: the variables of work pace constraints, repetitiveness and monotony of tasks, quality norms, task rotation, and teams.

The centre of gravity of the four work organization clusters coming out of the hierarchical classification analysis (Table 3.1) onto the graphic representation of the first two factors of the MCA The DL and lean forms share the features of high levels of learning, problem solving and complexity, while the DL can be distinguished from the lean forms by the relatively higher levels of autonomy in work and by the lower levels of constraints on work pace. The Taylorist and simple forms share the characteristics of low levels of learning, problem-solving and complexity, while they can be distinguished by the higher levels of monotony and repetitiveness in the Taylorist forms as well as by the relative absence of team work and job rotation in the simple forms.

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[i] The characteristics of the DL forms of work organisation as well as the other forms of work organisation analysed in this paper are described in more detail on Section 3 below.

[ii] In the econometric analyses the country-waves are treated as a random sample so removing six should not have an effect on the results. The organisation responsible for the EWCS, the European Foundation for the Improvement of Living and Working Conditions, computes weights for the surveys, which must be employed for the surveys to be representative. There are three weights: selection probability weights, non-response weights and country weights. We re-standardise the combined selection probability and non-response weight to mean 1 by country-wave, and then multiply this weight with the proportion of total employment across all

country-waves represented by the country-wave of the interview. Whenever tables and regressions report to be weighted, it is these combined weights that are referred to.

[iii] The factor analysis method used here is multiple correspondence analysis (MCA) which is especially suitable for the analysis of categorical variables (Greenacre, 1993, pp. 24-31). The clustering is performed on the factor scores of the first four factors each of which accounts for an above average amount of the total variation of the data matrix.

[iv] See Appendix A2 for the original survey questions and for the frequencies of the organisational variables for the individual waves. In order to reduce country-specific bias associated with respondents coming from different cultural and linguistic areas, the majority of the measures we use in our analysis are based on questions posed in an objective manner, asking people what they do in their daily activities rather than registering their feelings or opinions about other people or their context.

[v] In order to support the robustness of the trend estimated on the basis of the pooled clustering results, we also estimated the trend by performing a cluster analysis on the 2005 wave data, mid-way through the Lisbon agenda, and used the weights from this clustering as a basis for allocating individuals to each of the four work organisation clusters in 2000 and 2010. Although the exact percentages resulting from this exercise vary in comparison to the clustering based on the pooled data, the results are qualitatively similar in the sense that the relative importance of the clusters remains the same and the directions of change over the decade remain the same as those shown in Table 2. In particular, there was a statistically significant (.05 level) increase in DL based on the alternative clustering between 2000 and 2005, from 37.1 to 38.1 percent, and a statistically significant (.01 level) decrease between 2005 and 2010, from 38.1 to 36.3 percent. The detailed results of the alternative clustering are available from the authors upon request.

[vi] The 1.7 percent fall in the share of the DL forms and the 2.2 percent increase in the share of the lean forms over the decade are statistically significant at the .001 level. The 0.8 percent increase in the share of the taylorist forms is significant at the .05 level, and the 0.7 percent fall in the share of the simple forms is statistically significant at the .1 level.

[vii] There are multiple options for estimating logistic mixed effects models and much discussion focuses on whether various versions of quasi-likelihood or the slightly more general pseudo-likelihood estimation techniques result in less bias (Gou and Zhau (2010/2000); Hox (2002) ch. 6; McCulloch (2008) ch. 14). However, recent simulation studies (see Austin (2010) and the review therein) suggest that methods based on adaptive Gauss-Hermite quadrature are superior in terms of being less biased; especially regarding the variance components of random effects.

[viii] The growth trend at level 3 is not a significant predictor in the regressions of Table 9 and we have therefore also estimated the models without it. In the models for DL and Lean, where the growth trend is not significant in Table 9, the only consequence is a marginal decrease in the AIC. In the other two models the AIC increases slightly and the standard error of the estimate for *Conjuncture* increases so that the effect is no longer significant at the 10 percent.

[ix] Results for the 3rd and 4th axes provided upon request from the authors.