Determinants of Open-Ended Contracts in Europe: The Role of Unemployment and Job Characteristics

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Abstract

While there has been a significant amount of research on the determinants of different types of employment contracts, there has not been so far a systematic attempt to examine the respective contributions of demographic, organizational, institutional, and economic factors in a multi-country framework. In particular, the impact of unemployment has not received the attention it arguably deserves. Using data from four waves of the European Working Conditions Survey (EWCS) covering 15 European countries between 1995 and 2010, and focusing on 2010, in this paper we provide a comprehensive multi-level analysis of the determinants of indeterminate-duration contracts. We find that job characteristics matter and that worker autonomy is positively associated with open-ended contracts, although the impact is generally small. Perhaps more importantly, we find that high unemployment exerts a massive depressive effect on the probability of holding a regular contract for workers with little market power and young age.

Keywords

Unemployment, job characteristics, permanent contracts, temporary work, European Working Conditions Survey.

The ongoing economic and financial crisis has heightened concerns about the increasingly precarious nature of employment contracts and the disappearance of 'good jobs' generally associated with regular, indeterminate-duration contracts (Kalleberg 2009; Verick 2009; Standing 2011; Dieckhoff 2011). Research suggests that job insecurity, often determined by

the type of employment contract held by workers, has important consequences for worker outcomes and precarious employment contracts have been linked to a host of negative consequences for workers, such as lower commitment (Berkhoff and Schabracq 1992) and job satisfaction (Bardasi and Francesconi 2004); poorer health conditions (e.g. Rodríguez 2002; Waenerlund et al 2011); reduced psychological well-being (see de Witte 1999 for a review); heightened stress (Burchell, Ladipo, and Wilkonson 2005); and lower self-esteem (Kinnunen, Feldt, and Mauno 2003).

There is a large amount of research trying to understand why certain workers hold particular types of employment contracts, although it generally focuses on the determinants of 'atypical' contracts rather than 'typical' ones as we do in this paper. Most of the existing literature falls in three categories: supply-oriented arguments emphasize worker characteristics and hypothesize that certain types of workers may have a preference for more or less employment rigidity (e.g. Howe 1986; Canter 1988); demand-oriented explanations place firms' attempts to minimize costs at the center of analysis (e.g. Golden and Appelbaum 1992); while institutional arguments examine how employment protection legislation (EPL) creates cost differences between permanent and temporary contracts, thus altering firms' incentives at the margin, or focus on how trade unions influence the distribution of employment contracts in the economy (e.g. Bentolila and Dolado 1994; Polavieja 2006).

Surprisingly, the role of unemployment has not featured prominently in previous studies (a notable exception being Polavieja 2005; 2006). Part of the reason is methodological: most studies that we are aware of focus on workers in particular countries. Although in theory the impact of unemployment could be assessed in a single country framework by comparing different regions, to the best of our knowledge this type of analysis has not been conducted. The neglect of unemployment is unfortunate since it is well known that unemployment pushes workers to try and to escape joblessness by accepting positions that are less well-paid

than the ones they previously held (Arulampalam 2001; Gregg and Tominey 2005; Gangl 2006). It seems plausible that a similar mechanism would apply to the determination of contract type as well: when job opportunities are scarce, workers may be willing to settle for employment contracts carrying less job security than they would choose in the absence of constraints. In addition, unemployment is likely to have a larger impact on individuals whose socio-demographic characteristics place them far from the core, with less capacity for organization and a higher need for income. In brief, the type of contracts held by workers is likely to depend not just on the supply-, demand-, and institutional factors emphasized by previous research, but also on cross-country differences in unemployment.

In this paper we examine simultaneously the impact of demographic and organizational characteristics and of institutional and economic conditions by studying workers nested in different countries. We use data from 4 waves of the European Working Conditions Survey (EWCS) covering 15 European countries between 1995 and 2010, which we combine with country-level data on union density, unemployment, and EPL. The main focus is on 2010 but we also examine how effects change between 1995 and 2010.

Our main findings are that workers whose job tasks cannot be easily specified in advance by management, and involve a higher degree of autonomy and a lower degree of supervision by functional bosses, are more likely to hold open-ended contracts than equivalent workers without said features. However, the impact of individual and organizational factors, while statistically significant, is quantitatively less important than the impact of national-level economic conditions. Specifically, country differences in unemployment have a massive depressive impact on the probability of workers holding indeterminate duration contracts. Moreover, the effect of unemployment is asymmetric: worker types with lower market power are hit by it considerably more than others. For example, while a mature industrial worker has approximately the same chance of holding an indeterminate duration contract, close to 100

percent in all European countries including Greece, Portugal or Spain, for a female worker in personal services being employed in countries characterized by greater or lower unemployment can make a world of difference, changing her probability of landing an indeterminate-duration contract by more than 40 percentage points. Policy-wise, these results suggest that European policy-makers should be deeply worried by the high levels of unemployment currently prevailing in most European countries, and especially in Mediterranean ones, not just because unemployment has a negative impact on economic activity and worker well-being, but also because it makes the whole employment structure more precarious.

The remainder of the paper is organized as follows: we begin by framing our theoretical expectations against the backdrop of the existing literature (Section 2). We then move to a description of data and econometric approach (Section 3). We deliver our empirical results in two steps: first by showing multi-level logistic regression estimates (Section 4) and then by presenting predicted probabilities of holding open-ended contracts for different worker profiles (Section 5). We conclude with a compact discussion of main findings (Section 6).

FACTORS AFFECTING OPEN-ENDED CONTRACTS[1]

Under which conditions will a firm prefer a long-term contractual relationship to a spot contract with a worker? To address this question we rely here on a literature broadly inspired by the transaction costs perspective (e.g. Simon 1951; Williamson 1975; Marsden 2005). Stated briefly, we stipulate that if the firm is able to specify in advance the type, quantity, and (perhaps more importantly) quality of the labor services it requires from the worker, a spot contract is likely to be its preferred choice (e.g. Harrison and Kelley 1993). Otherwise, an indeterminate duration contract may be the more likely outcome.

Hiring workers on long-term contracts implies various types of risks for firms. They have to bear the costs of idle workers if demand suddenly falls (Golden and Appelbaum 1992). If workers' productivity turns out to be less than expected, workers on indeterminate duration contracts will be hard(er) to fire, the firms' cost structure will be negatively affected, and profits will decline (Abraham 1988). In addition, the costs of searching, screening, hiring, remunerating, and possibly training workers in house may be greater than the costs incurred by purchasing labor services on the external market (Matusik and Hill 1998). This is all the more likely to be the case the more the labor services required are highly specific and well-identified in advance (Marsden 1999; Cappelli and Keller 2013). Compared with a long-term employment contract a spot contract has several advantages: it expires when the need for labor services ends and can be renewed if a new need arises. In the latter case, it is easily renegotiated to take into account changing conditions.

However, when the firm is unable to predetermine exactly what kind of labor services it requires from the worker, the incentives for a long-term employment relationship increase. Indeed, the peculiarity of a long-term employment relationship is that it does not require firms to know in advance all the performance parameters specified above. With an open-ended employment relationship the firm buys the worker's availability to perform broadly-defined labor services for it, while keeping the employment contract conveniently incomplete (e.g. Davis-Blake and Uzzi 1993; Masters and Miles 2002; Bidwell 2009; Cappelli and Keller 2013).

The notion that the content of labor services may not be easily specified in advance by management and firms is widespread in the sociology of work literature, and so is the idea that management's ability to control the work process is intrinsically limited (Doeringer and Piore 1971; Abraham 1988). Neo-Marxists sociologists such as Friedman (1977) and macroeconomists like Akerlof (1984) both agree that it is very difficult if not impossible for

firms to manage workers solely through monetary incentives and tight supervision, and that it is important for management to find alternative ways to enlist the workers' voluntary cooperation and goodwill (Green 2008). The disruptive consequences of "working to rule" are clear indices of the limitations of management's reliance on formal control of workers (Dandeker 1990; Sewell and Wilkinson 1992). Numerous studies emphasize the distance between the formal organization as laid out in the rulebook, and the informal one as it is practiced on the shop or office floor (e.g. Crozier 1963; Doeringer and Piore 1971; Williamson 1975). In addition, the importance of "tacit skills" points to the existence of worker competences which are difficult to formalize but are nonetheless an indispensable component of a job well done (Polanyi 1957; Lautsch 2002).

Especially if work quality is difficult to monitor, firms are more efficiently managed if workers can be motivated to do their best on the job independently of sanctions. In turn, workers' voluntary cooperation is easier to produce in a "gift exchange" situation (Akerlof 1984), in which workers perceive they are being treated fairly by firms and reciprocate by showing loyalty and commitment in return.

The literature on gift exchange generally focuses on the firms' willingness to pay "efficiency" wages, i.e. wages higher than market-clearing levels, but in principle offering a long-term contractual relationship is likely to have a similar motivational effect on the worker especially when the external labor market is slack. Indeed, the motivational impact of an open-ended contract is likely to depend on general labor market conditions (see Polavieja 2005, 2006): in a labor market characterized by high unemployment, in which it is already a privilege to have a job independent of its form and duration, the worker will be willing to accept a lower degree of employment security all other things being equal. Vice versa, in a situation of or near full employment, workers will demand higher levels of employment security.

The argument can be summarized with the help of Figure 1. Depicted in the figure is the degree of worker's autonomy (right horizontal axis, direction from left to right), the unemployment rate (left horizontal axis, direction from right to left), and the degree of job security embedded in the contractual relationship (vertical axis). Curve F represents the firm's supply of job security, which is hypothesized to grow with worker autonomy as per previous discussion. In other words, it is assumed that the more labor services are difficult to specify in advance, the more the worker is autonomous in his work tasks, the more the firm is willing to offer job security to the worker (i.e. an open-ended contract) to motivate him/her to do her best on the job or to invest in firm-specific skills. Which point is chosen on curve F will depend on the worker's demand for job security, represented by curve W. In the graph the workers' demand for job security is independent from worker autonomy and skill content, and depends negatively on unemployment: when unemployment is high the worker is willing to accept less job security and vice versa.[2] Shifts in unemployment shift the equilibrium combination between worker autonomy and job security. When unemployment is at point U^A the worker's demand curve identifies the equilibrium combination A^A, characterized by more job security and more worker autonomy; when unemployment increases to U^B the worker's demand curve shift down to W' and this identifies a new equilibrium point A^B characterized by less job security and less worker autonomy. Thus the analysis pinpoints two expected empirical regularities:

[Figure 1 about here]

H1: There should be a negative relationship between the firm's ability to codify in advance the parameters of work performance and the likelihood of an open-ended contract.

Consequently, features like worker autonomy and extent of supervision (positive and negative proxies for how easy it is to codify job content) should be positively and negatively associated with the probability of an open-ended contract, respectively.

H2: Unemployment should be negatively related to the probability of open-ended contracts.

It would be, however, unrealistic to expect effects to be the same for all workers. A significant portion of the literature on determinants of contract types places the characteristics of labor supply at center stage. It has been argued that certain profiles, e.g. women (Berger and Piore 1980; Canter 1988) and young people (Howe 1986), are more likely to have a stronger preference for contingent work contracts than, say, mature men. Contingent contracts may make it easier to reconcile work and family obligations for women, and work and education for young people (Burgess and Connell 2006; Pulignano and Doerflinger 2013). In addition, workers of immigrant origins may be more willing to accept temporary work contracts than native workers. The problem with a naïve supply-side approach is that it is unclear whether employees are actually choosing to be temporary, or rather adapting to more difficult labor market conditions. The fact that the share of involuntary contingent work tends to be higher in times of job shortages would suggest that a high proportion of contingent work is involuntary (Gallagher and Sverke 2005; Bolton, Houlihan, and Laaser 2012). Hence, merely assuming that typical and atypical employment contracts reflect worker preferences seems disingenuous. An alternative interpretation is that certain categories of workers such as women, young people, and immigrants face a steeper trade-off between employment and job security; thus they are more willing to settle for lower levels of security than other workers at given levels of job scarcity. Although we are unable to distinguish between supply and demand determinants, the expected empirical effects converge:

H3: Certain demographic characteristics of workers (young age, female gender, and immigrant status) should be negatively associated with indeterminate duration contracts.

Combining the impact of unemployment with individual characteristics of workers generates an additional hypothesis:

H4: The negative impact of unemployment on the probability of regular contracts will be stronger for 'weak' worker profiles such as those involving young, female, or immigrant workers.

These four hypotheses constitute the core of our analysis. But to take full advantage of the richness of our data and to do justice to previous work, we propose additional tests, which may be seen as controls.

Skill specificity: Human capital theory as elaborated by Becker (1962) suggests that if worker skills are general, i.e. if there is an external market for them, the worker pays for them since s/he is able to capture the returns to the investment. However, if skills are entirely firm-specific, i.e. no one else but the firm in question is able to reap the benefits of the resulting improvement in worker's productivity, the firm pays for the investment. In practice skills are neither entirely general nor entirely firm-specific. It seems plausible to hypothesize that if firms have invested in the training of workers, and if the resulting skills are at least partially marketable, the firm will have an incentive to try and retain the trained workers by offering them job security. In addition, offering open-ended contracts to workers should increase their motivation to invest in firm-specific skills since it should assure them it will be more difficult for the firm to fire them if productivity increases (Estévez-Abe et al. 2001). In brief, the resulting expectation is that workers with firm-specific skills will be more likely to have indeterminate duration contracts.

Wages: The relationship between wages and employment contracts seems difficult to specify a priori. From the worker's point of view, higher wages may be a compensating factor that pushes workers to accept a lower level of job security than would be warranted by the level of slack in the labor market and the characteristics of the job. Similarly, workers who are able to command a high market price should be comparatively less willing to commit to long-term employment relations that might negatively interfere with their ability to maximize economic returns. For both reasons there would be a negative relationship between wages and the probability of open-ended contracts. From the firm's point of view, however, wages exceeding prevailing market rates may be offered exactly to reduce the probability of worker separation, as emphasized by the literature on efficiency wages (Stiglitz 1976; Weiss 1990). The end result will depend on how demand and supply considerations play out. Due to the unavailability of comparable wage data for all waves, we are unable to control for the effect of wage levels across all specifications. However, we are able to use a direct wage measure for the 2010 wave. In addition, as we discuss later in the paper, we include in the analysis some of the most common determinants of wages in wage equations, such as age, tenure, skills, firm size, industry, and other demographic characteristics. To the extent that these factors are causal determinants of wages, by entering them as controls we implicitly control for wages, at least partially, even in specifications omitting direct measures.

Demand volatility: Another factor which is hypothesized to affect the probability of open-ended contracts by the literature is the volatility of product demand faced by firms (Berger and Piore 1980; Osterman 1988; Golden and Appelbaum 1992). All other things being equal, if a firm demand was constant over time, the firms' willingness to hire long-term should be higher. In such a situation, the firm would be able to perfectly predict its labor requirements and by hiring long-term would save on transaction costs. Vice versa, if demand was

extremely volatile, the firm would prefer contingent contracts that would allow it to shift unto workers the risks associated with demand variability.[3] Unfortunately, we have no direct measure of firm-specific demand volatility in our survey data. However, we will proxy for it by using firm size-dummies, industry-level dummies, time dummies, and time-by-sector dummies. These should allow us to take into account that firms of different sizes, in different sectors, and subject to different time shocks may be subject to different conditions of demand volatility.

Employment protection legislation: Firms' choice of employment contracts may be influenced by institutional constraints such as rigid employment protection legislation (EPL). The role of EPL has been frequently discussed in the economic and sociological literatures. The basic argument has to do with the extent to which EPL institutions modify the relative costs of different contractual forms. All other things being equal, firms are expected to choose the contractual relation that is less costly for them. Thus, if EPL legislation on regular contracts increases the costs of this type of contractual relationship relative to temporary ones (for example by raising workers' "firing costs"), firms' preferences should shift away from regular contracts towards temporary ones (e.g. García-Serrano 1998; Polavieja 2005, 2006). By a similar logic, if the relative costs of EPL for temporary workers increase, firms should tend to use regular workers more often.

Trade unions: Strong trade unions both at the workplace level and in society at large may have a similar constraining effect on firm choice. Yet the impact of trade unions is a priori not univocal. On the one hand, if unions care about job security for all (or at least a majority) of workers, and if they have market power, union strength should be positively associated with the probability of open-ended contract (Abraham 1988; Golden and Appelbaum 1992;

Davis-Blake and Uzzi 1993; Cappelli and Keller 2013). On the other hand, the insider-outsider literature suggests that unions do not cater to the interests of all (or perhaps even most) workers. Union insiders may have an interest in keeping a buffer of contingent workers as a way to enhance their own job security (Bentolila and Dolado 1994; Saint-Paul 1997; Polavieja 2006). Thus, the empirical relationship between unions and types of contracts seems indeterminate.

DATA AND METHODS

We test our hypotheses using four waves of the European Working Conditions Survey (EWCS): 1995, 2000, 2005, and 2010. The EWCS is based on face-to-face interviews conducted with employees and self-employed people at their homes across 35 countries, although not all countries are sampled in all waves (Eurofound 2012).[4] EWCS data are based on national representative samples,[5] and have been used in prominent publications before (for instance Benavides et al 2000; Burchell and Fagan 2004; Tangian 2007; Roelen et al 2008; Giordanengo, Pasqua, and Richiardi 2008; Gallie 2009). Our analysis includes countries that are present in all waves.

The dependent variable is binary. It equates to 1 if respondents report having an indefinite contract and to 0 otherwise. The survey question is available in the last four waves of the EWCS only, thus we cannot use the 1991 wave. Due to the relatively small number of cases other than indefinite contract, we code all other answers (fixed term contract, temporary or employment agency contract, apprenticeship or other training scheme, or other) as 0. In addition, since we focus on dependent employment we exclude self-employed respondents. Furthermore, as we are not interested in part-time or marginal work and the determinants thereof, but only in whether individuals working full-time have an indeterminate duration

contract, we use a question on the number of hours usually worked in the main job to filter out employees working less than 30 hours per week.[6] After list wise deletion of missing values, we have a total of 46,663 observations over four cross sections covering 15 countries: Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden and United Kingdom (for descriptive statistics and correlation matrix see Appendix I).

The degree to which employers are able to specify in advance and monitor the content of work services provided by workers – a core construct for hypothesis H1 – is operationalized with the help of four variables. First, we construct a worker 'autonomy' scale by adding the responses to seven related yes/no survey questions about work content and rescaling the resulting measure to range between 0 and 100. The Cronbach alpha of the autonomy scale is 0.72 (in all of our data sets), which is quite high given the size of the dataset and the number of countries covered. Workers who report working autonomously are presumably workers whose tasks are difficult to specify in advance for the employer. Thus we expect a positive relationship with the probability of having an indefinite contract.

Second, we rely on a 7-point "contact with outsiders" variable. Workers in frequent contact with outsiders, eg. customers, business associates or regulatory authorities, are workers whose tasks are in principle difficult to standardize and monitor for the firm. Yet the goodwill and intrinsic motivation of these workers is often very important for firm performance since they represent the firm to the outside world. Following the logic of the argument articulated above, we expect these workers to be more likely to receive indeterminate duration contracts all other things being equal.

Third, we introduce a dichotomous 'depend on boss' variable using a question on supervision by the immediate boss. This variable is not highly negatively correlated with the measure of worker autonomy (the correlation coefficient is only - 0.11) and therefore seems to capture a different dimension of worker control. Workers who are under direct control by supervisors presumably perform tasks whose parameters can be easily formulated in advance. Therefore we expect a negative association with indeterminate duration contracts. However, due to the cross-sectional nature of the data, in this and other cases we are unable to produce a causal interpretation of statistical associations. In fact an alternative interpretation is that temporary employment generates demotivation that needs to be counterbalanced by greater supervision, i.e. the causal arrow may be reversed. For this reason here and elsewhere we prefer to talk of co-occurrence.

Fourth, we isolate the dimension of technological control over work through a dichotomous 'depend on machine' measure. An employee whose pace of work is controlled by machines should be more easily expendable and replaceable (see Braverman 1998 [1974]) and therefore there should be a negative association with indeterminate duration contracts.

To test hypothesis H2 we include in all specifications yearly unemployment rates for every country in our sample. The demographic characteristics featuring in hypothesis H3 are operationalized through three individual-level variables capturing gender, age, and immigrant background (the latter only available in the 2010 wave). To test hypothesis H4 we exploit the non-linear nature of logit estimation and we calculate predicted probabilities of open-ended contracts. We expect the impact of unemployment on the predicted probability to be greater for 'weak' worker profiles.

Additionally, we control for other factors that may influence the type of employment contracts held by workers. We include a continuous 'tenure' variable measuring the duration (in years) of the working relationship with the current employer. Workers with higher tenure should have a greater probability of holding an open-ended contract than others, partly because of accumulated firm-specific skills. Furthermore, we rely on a more direct measure of firm-specific skills: a dichotomous "training by employer" variable. Employers who invest in worker skills should be interested to retain them by offering open-ended contract. Thus the hypothesized sign of the variable is positive.

To control for workers' general skills, and in the absence of direct measures of general worker skills in the surveys, we construct skill families by cross-tabulating two-digit ISCO codes providing information on respondents' occupations and (seven) ISCED categories providing information on the workers' educational achievement. We assume that occupations with statistically indistinguishable educational distributions require similar skill sets. Hence by performing chi-square tests and merging occupations with statistically indistinguishable educational distributions, we generate 4 separate skill sets (see Appendix II for details on the procedure). *Skill.1* largely refers to the ISCO category of "professionals." This set is also the reference category in the analysis due to its homogeneous structure. *Skill.2* is common among technicians, associate professionals, senior officials and managers. *Skill.3* is prevalent among clerks, service workers, shop and market sales workers. *Skill.4* is the common denominator for skilled agricultural, fishery workers, craft and related trades workers, plant and machine operators, assemblers, and people who perform elementary occupations. Thus the four skill categories appear to be in decreasing order of skill content.

The ability of employees to use computers should be regarded as a relatively scarce worker skill, and as such it may be linked to open-ended contracts. We introduce a 7-point growing 'using computer' scale in the specifications and we expect employers to want to retain people with scarce computer skills by offering them indefinite contracts.

Our wage variable is derived from a survey question which is only available in the last wave of EWCS. As argued before, we are unsure about the likely impact of wages. In order to ensure comparability of wages across countries, we define the wage variable in relation to median wages. Thus if respondent i from country j has wage I_{ij} and the median wage in his country is M_j our wage variable is:

$$wage_{ij} = 100\left(\frac{I_{ij} - M_j}{M_j}\right)$$

To account for the impact of organizational restructuring, we add two variables capturing 'restructuring' and the introduction of 'new process/technology', respectively. The underlying questions are only available in the last wave of the EWCS. We do not have strong priors about the signs of these variables. If reorganization aims to cut costs (e.g. reengineering), and if non-standard employment contracts carry a cost advantage (Golden and Appelbaum 1992), then one would expect the restructuring variables to be negatively associated with the probability of open-ended contracts since restructuring would tend to eliminate the more expensive regular contracts. Vice versa, if the workers who survive organizational restructuring or the introduction of new technology are more likely to hold regular contracts, then a positive relationship should emerge.

We also add a 'teamwork' indicator available from 2000 on. The existing literature reports inconclusive findings about the relationship between teamwork and employment contracts.

Teamwork may be associated with tasks that are relatively unstructured and which are therefore more conducive to open-ended contracts. But it may also introduce a form of social control and facilitate the monitoring of individual work tasks, thereby making workers more easily replaceable (Sewell & Wilkinson 1992:281; Caldwell & O'Reilly 2003: 512; Heywood & Jirjahn 2004:768-69; Minssen 2006:110; Green 2008; Bikfalvi 2011).

We add industry, firm-size, and time dummies, the latter capturing unobserved shocks affecting all countries simultaneously. Different sectors may be characterized by different conditions which are more or less conducive to the use of indeterminate duration contracts. For example, it is well known that work in the agricultural and in some portions of the service sector (e.g. hotels and restaurant) is of a seasonal nature and therefore conducive to flexible employment contracts. We have dummies for agriculture, industry, private services (the reference category), public services, and construction. Although we do not have direct measures of demand volatility, sector-year dummies should proxy for it under the assumption that volatility varies across sectors and time. Dummy variables related to firm size should pick up additional heterogeneity across different types of establishments.

In addition to variables measured at the individual level our analyses feature three-country level controls: the EPL OECD index for regular contracts (OECD 2013), the EPL OECD index for temporary contracts (OECD 2013), and the country's union density rate. The latter is a measure of union strength for the country as a whole. The expected effects of the country-level factors have been discussed in the previous section. For 2010 only, the EWCS also includes a dichotomous indicator of employee representation at the establishment level. Unfortunately, this indicator does not distinguish between union representation and other forms of worker representation such as works councils, personnel delegates, etc., but it nonetheless permits to assess the impact of worker representation at the workplace level as

opposed to society as a whole. Table 1 presents the variables, the underlying survey questions, and the expected signs.

Since the dependent variable is binary and the dataset has a hierarchical structure (individuals nested in countries) we analyze our data by constructing multi-level logistic regression models with random intercepts that vary across countries. We use the R-package lme4 for model estimations. In addition to showing log odds ratios, we also calculate average partial effects of predictors (APEs). This is because logistic regression coefficients should not be directly compared across models due to the fixed value used for error variance that causes coefficients to be scaled by the real underlying variance. This scaling factor changes across models as new independent variables are added even if they are not correlated with the already included independent variables, and thus coefficients across models may be scaled differently (Winship and Mare 1984:517; Mood 2010). Average partial effects, which are obtained by averaging the marginal effects estimated at each data point separately, enable us to circumvent this problem and produce estimates that may be compared across models and datasets (Cramer 2006:5-8; Mood 2010:75-80; Karlson et al 2012:299).[7]

In our view, random intercept models are a reasonable compromise between imposing full uniformity of parameters across countries and letting all parameters vary freely across countries. The chosen estimator allows us to take into account unmeasured country-level heterogeneity, captured by the random intercepts, while retaining an acceptable number of degrees of freedom.

We first estimate models with pooled waves and then focus on the 2010 wave which is the only one for which the full set of predictors is available. In unreported models we have tested the stability of coefficients over time by running the same specifications separately for different waves from 1995 to 2010. We have also analyzed a more complicated nested

structure with randomized intercepts both across countries and across waves. However, the variance accounted by this modeling choice is extremely small and does not justify the complexity it generates. It is worthwhile mentioning that we scrutinize country-level variables meticulously in all models to be sure that they capture real underlying institutional and contextual dynamics. For this purpose, after running our models on relevant datasets, we re-evaluate them fifteen more times, excluding a single country in each case and using only the remaining fourteen for estimation. This is to distinguish the robust country level effects from the contingent ones which may depend on the presence or absence of particular countries.

[Table 1 about here]

ANALYSIS AND RESULTS

Table 2 reports results from pooled specifications. The first model in the table uses all data available between 1995 and 2010; the second model covers the 2000-to-2010 period and includes predictors – teamwork and firm size dummies – that were not available in previous waves.[8] The final model, which is also the one we focus upon, only covers 2010 and features the full specification including immigrant background, presence of worker representatives, organizational restructuring and new technology. The set of sector-time dummies varies in accordance with the time span of the analysis. We defer inclusion of the wage variable, which is only available for 2010 for a smaller sample, to the specification in Table 3.

[Table 2 about here]

We focus here on individual-level and country-level predictors. In the next section we present evidence of how the random country effects (capturing unobserved heterogeneity at the country level) affect the predicted probability of independent duration contracts. By comparing models (including from unreported estimations of separate years) we aim to determine the extent to which coefficient changes are due to changes in specifications or to time heterogeneity of the effects.

Four individual-level variables: `worker autonomy,' `dependence on boss,' `dependence on machine,' and `contact with outsiders,' are crucial for testing hypothesis H1 on the relationship between a priori codification and monitoring of work services and the probability of workers holding open-ended contracts. `Autonomy' is positively signed and significant as expected: the more autonomous the worker in performing his/her work tasks, the greater the likelihood of an open-ended contract. The magnitude of the average partial effect – 0.1 percent in 0-100 scale (0.72 in 0-7 scale) – is rather small compared to for example tenure, as we show below.

Again confirming expectations, `dependence on boss' is negatively associated with the probability of open-ended contracts with an APE of 2.2 percent. Surprisingly, there is no statistical association with `depend on machines' variable. This variable is negatively signed as expected but it is never possible to reject the hypothesis of a zero coefficient. `Contact with outsiders' has a positive and significant impact on the probability of secure contracts with a 0.3 percent APE for a 7-point scale variable.

We had hypothesized that labor market slack would reduce the probability of regular contracts. This hypothesis (H2) was largely confirmed by the analysis. In fact the

unemployment rate is the only country-level factor to show a robust positive association with the probability of secure contracts. The effect of unemployment seems to be greater in the post-crisis period than in previous years: by 2010 every additional percentage point of unemployment is estimated to decrease the probability of indeterminate-duration contracts by 1.1 percent on average, a non-negligible amount.

The demographic predictors featuring in hypothesis H3: gender, age, and demographic origin, are all signed as expected and statistically significant. On average, male workers are more likely to receive an open-ended contract than female workers by about 2 percent in 2010. Each additional year of age (controlling for tenure) is associated with a probability increase of 0.13 percent in 2010. The effect declines by adding controls to the specification and seems slightly smaller in 2010 than in previous years. The finding on immigrant status suggests that the probability of an indeterminate duration contract declines by almost 3 percent for an immigrant worker compared with a native. As discussed in Section 2 these socio-demographic effects could be due to a mixture of worker choice and employer preference or even discrimination. On one hand female and young workers may prefer more temporary employment contracts, and immigrant workers may demand less employment security; on the other hand employers may be less willing to hire them on a long-term basis. In the next section we also show through model-based simulations that the quantitative impact of unemployment varies according to worker profile and thus provide evidence for the validity of hypothesis H4.

The control variables generally behave as expected. The `tenure' variable is positively signed as expected, statistically significant, and quantitatively very important: in 2010 for each year of additional tenure the probability of holding an open-ended contract increases by 1.1 percentage points.

The effect of receiving `employer training' – a proxy for skill specificity – seems to depend on specification: when the two restructuring variables, `organizational restructuring' and `new technology/process,' are included, `employer training' is insignificant and `organizational restructuring' positively and significantly associated with open-ended contracts. When the restructuring variables are instead omitted, the coefficient of employer training is bigger and clears standard thresholds of statistical significance.[9] This suggests a complex pattern of interrelationship between restructuring and employer training. It may be that much of employer training happens at times of restructuring, and when a company is restructured or reengineered, the workers that remain with the company are more likely to be on indeterminate duration contracts. In this way, when restructuring is controlled for the statistical association between employment training and open ended contracts disappears.

The other skill variable, `using computer,' also has a positive impact on the dependent variable: the APE is 0.5 percent in our preferred model (column 3).[10] As regards the general skill families, if all waves are pooled, each skill family is more likely to be associated with indefinite contracts than the reference group of professional workers. It seems plausible that professional workers would be less willing to commit to long-term employment relations than other workers, since this would limit their ability to exploit their market power. However, the predictive ability of skill families declines progressively, and by 2010 only the Skill 2 category, which captures the skills required by managerial and technical workers, remains significantly different from the reference group of professionals (APE = 2.2 percent in 2010), while there is no longer any statistical difference with clerks, service workers, shop, and market sales workers (Skill 3); or agricultural, fishery workers, craft and related trades workers, plant and machine operators, assemblers, and workers performing elementary occupations (Skill 4). In brief, the impact of the skill families appears to be declining over time.

Confirming the non-conclusive results of previous studies, the effect of teamwork (available from 2000 on) is unclear. This predictor is positive and weakly statistically significant only for the final 2010 model which controls for organizational and technological restructuring and for the presence or absence of worker representation, but is insignificant if these additional predictors are omitted.[11] The worker representative variable, only available in 2010, suggests no impact on open-ended contracts.

Like the skill categories, the firm-size dummies, too, display a pattern of declining relevance over time. Here the reference category is firms employing between 50 and 99 people. The model pooling all four periods suggests that open-ended contracts tend to be less prevalent in in micro firms with 2-to-4 and 5-to-9 employees than in the reference groups. Firms with 10-to-49 employees and large firms with more than 500 employees are also associated with a reduced probability of open-ended contracts, although to a lesser extent. By 2010, however, firm-size no longer seems to matter.

The time dummies follow a U-shaped trajectory: the probability of open-ended contracts declines from 1995 to 2000 to 2005 (the reference category), but then rises again in 2010. One possible interpretation of this pattern is that in 2010, after the financial crisis, workers on temporary contracts were dismissed more frequently than others, such that among remaining full-time workers, indeterminate-duration contracts were more prevalent than before.

In terms of sectors, not surprisingly agricultural workers turn out to be considerably less likely to hold a secure contract than the reference category of private sector workers (APE of 8.9 percent in 2010). The manufacturing sector used to be associated with a higher probability of open-ended contracts than the private service sector. However, as the 2010 sector-time dummy in Table 2 indicates, it was hit by an unfavorable shock in 2010. This

finding indicates that the crisis had particularly harsh consequences for industrial workers with open-ended contracts.

Public sector and construction workers are also significantly less likely (APE of -3.8 and -2.6 percent in 2010, respectively) and the penalty seems to grow slightly over time. The negative coefficient for the public sector is surprising since this sector is often considered a bastion of secure employment. We also estimated a model in which open-ended contracts were solely explained by sector dummies and random intercepts (not shown here). In this case, public service had a positively significant effect. This suggests that the positive association between open-ended contracts and the public sector washes out when other characteristics are controlled for.

With regard to country-level predictors capturing the institutional structure of the labor markts, we find no robust statistical associations between both EPL for regular workers and EPL for temporary workers and the dependent variable. In addition these variables are sometimes 'wrongly' signed relative to predictions. For example, EPL regular comes out as weakly positively significant in the model pooling all waves (see Table 2), indicating – contrary to prevailing theories – that more stringent EPL would increase the prevalence of open-ended contracts, but the point estimate becomes negative, albeit insignificant, in 2010. Conversely, EPL temporary is negatively signed in the pooled models and positive and weakly significant in the 2010 one, suggesting in the latter case – again against prevailing theory – that more stringent limitations on temporary employment contracts would increase the individual probability of holding an open-ended contract. However these findings are not robust. When we re-estimate our 2010 model 15 more times, in each case excluding a single country and using remaining 14 for the analysis, we see that EPL temporary becomes

insignificant in all these models except for the one that excludes Greece (when it is positively significant), and that EPL regular becomes negatively significant when excluding Ireland.[12] These results indicate that the coefficients of EPL for both temporary and regular contracts are both volatile and non-robust, and thus we avoid making conclusive statements about their relationship with open-ended contracts.

The results for country-level union density are similarly unstable. The model pooling all waves suggests that union density is significantly associated with an increase in the prevalence of indeterminate duration contract. However, this finding disappears in wave-specific models, and by 2010 there seems to be no statistical association between the two variables.[13] This result dovetails with the finding about the individual-level variable capturing the impact of worker representation at the workplace level in 2010, which also suggests no effect. There are two possible explanations for this lack of union effect. One interpretation is that there are two opposing tendencies within unions: a 'sword of justice' effect that brings about more secure working conditions for all workers (Flanders 1970), and an 'insider' effect that predominantly favors core union constituents, and that these two opposing tendencies tend to counterbalance each other. Another interpretation is that due to their long-term decline, trade unions no longer have the power to modify market outcomes (Baccaro 2011).

Finally, we we estimate a model including the wage variable. Adding the wage control forces us to drop a large number of observations due to missing values: the sample is reduced by 28 percent. In addition, the pattern of missing values does not seem entirely at random, as discussed below. For these reasons, the specification including the wage variable is not our preferred one but we consider it to check the robustness of our findings to explicitly controlling for workers' wage levels. In Table 3 we report our preferred model (column 1), a

model with the wage variable (column 2), and a model without the wage variable estimated on the same sample for which the wage variable is available (column 3). In this way we are able to distinguish between effects coming from the shifting sample and effects resulting from the inclusion of the wage indicator.

[Table 3 about here]

Controlling for other determinants, higher wages turn out to be positively and significantly associated with the probability of open-ended contracts: if the worker's wage exceeds the country median by 1 percentage point, the resulting increase in probability is 0.1 percent on average. Thus low (high) pay and insecure (secure) contracts tend to go together on average; higher wages are not a compensating characteristic that makes up for lower levels of security. The sign, significance, and magnitude of our core independent variables are unaffected by the inclusion of the wage variable. Most of the additional variables do not change much either. One exception is the gender variable, which turns from positive and significant to negative and insignificant when controlling for wage levels. After controlling for wages, being a male worker is no longer associated with a greater likelihood of open-ended contract. However, this effect is at least in part due to the shifting sample as revealed by the specification without the wage variable estimated on the wage sample (column 3), in which the male coefficient is positive but is cut by more than half and no longer clears statistical thresholds. This suggests that male workers with independent duration contracts are less likely to answer the wage question than others. Another noteworthy change concerns the 'training by employer' variable, which regains statistical significance when controlling for wages. This effect does not seem to be due to sample selectivity (compare columns 2 and 3). Thus, controlling for

wages workers receiving training have a higher probability of being on an indeterminate duration contract as had been hypothesized.

ANALYSIS OF PREDICTED PROBABILITIES

In order to assess the impact of country-level factors and appreciate the contingent effects of unemployment, in this section we calculate the predicted probabilities of holding an open-ended contract for ideal typical worker profiles with different demographic and job-related characteristics. In a logistic model predicted probabilities depend on the coefficients and values of all other variables in the model. We engage in counterfactual exercises in which certain characteristics are kept constant and others are allowed to vary.

Before we run these simulations, we present in Table 4 a rough goodness of fit test by comparing the predicted country-by-country average probability of workers holding an indeterminate duration contract in 2010 with the weighted country-by-country sample proportions of open-ended contracts in the same year.[14] This exercise suggests that the model does a reasonable job of accounting for cross-country variation and provides therefore an acceptable basis for the simulations. For example, the average estimated probability is: 0.595 for Greece against a (weighted) sample proportion of 0.599; 0.725 for Spain against 0.710; 0.867 for Finland against 0.853, and 0.688 for Ireland against 0.699.

[Table 4 about here]

To isolate the impact of job quality on the probability of indeterminate duration contracts, Table 5 reports the results of a simulation in which all job quality variables: 'autonomy,' 'training by employer,' 'contact with outsiders,' 'using computers,' 'depend on boss,' 'depend on machine,' and 'teamwork,' are set to their minimum and maximum values,

respectively, while all other variables are kept to their historical values.[15] Average predicted probabilities are then calculated by averaging across all workers in each country. The goal of the exercise is to understand what difference moving from "worst" to "best" work characteristics makes for the probability of holding a secure contract in different countries. The change in predicted probability suggests that the increase would be less than 15 percent in Luxembourg, Belgium, Germany, and France; less than 20 percent in Sweden, Denmark, Austria, Netherlands, UK, Italy, and Finland; less than 25 percent in Portugal; and less than 30 percent in Spain, Ireland, and Greece (Table 4). Clearly these estimated improvements in probabilities are far from negligible, especially for the Mediterranean countries and for Ireland. However, at least for some typologies of workers they are quantitatively less important than the potential change associated with a reduction in unemployment, as we now illustrate.

[Table 5 about here]

We create ideal typical worker profiles, characterized by different demographic and task-related characteristics. To facilitate interpretation, we give these worker profiles fictitious names: 'sales representative,' 'personal service worker,' 'teacher,' 'mature industrial worker,' 'young industrial worker,' and 'young educated professional.' We set the country random effects and the unemployment rate to 0 and then to historical 2010 values based on the model in Table 2, column 3, and we calculate how the predicted probability changes.

The characteristics of the different worker profiles are reported in Table 6. For example, the 'personal service worker' profile contains all the individual features that would be conducive to a low probability of indefinite contract. This is a young female worker of 25 years, of

immigrant background, recently hired (1-year tenure), with low autonomy (30 out of 100), and no employer training. Her job implies minimal contact with outsiders (perhaps she cleans offices after working hours), no computer use, and no teamwork. She depends on her boss (e.g. for instructions) but does not depend on machines. She is employed in the private service sector by a firm with between 100 and 249 employees, and her skill family is Skill 4 corresponding to elementary occupations. An interesting contrast is provided by 'mature industrial worker' and 'young industrial worker.' These two profiles correspond to two relatively skilled industrial workers (75 out of 100 on the autonomy scale) with exactly the same individual and task-related characteristics, except for age (50 vs. 20) and tenure (30 vs. 0).

In Table 7, we report predicted probabilities for the 6 worker profiles for each country.[16] The first row of the table sets all random country effects and the four country level variables to zero. It suggests that abstracting from country-level factors and based solely on individual characteristics, the 2010 predicted probabilities range between 0.578 for 'personal service worker' and 0.992 for 'mature industrial worker.' The exercise suggests a difference of 26.5 percent in the predicted probability of an indefinite contract between 'mature' and 'young industrial worker' which is solely due to the difference of age and (especially) tenure.

[Table 6 about here]

In the second row of Table 7 we focus on the impact of unobserved country-level heterogeneity captured by the random intercepts. Specifically, we set the values of the country intercepts to their historic values and set all four macro variables counterfactually to zero. This exercise estimates the probabilities for the six worker profiles in different national

contexts, assuming the unemployment rate is nil everywhere. It suggests that country effects increase predicted probabilities in all countries except Greece.

Row 3 of Table 7 focuses on the impact of unemployment and shows how the predicted probability for a worker profile in a particular country changes when the unemployment rate rises from 0 to its historic value in 2010, which ranges between a minimum of 4.4 percent in Austria (4.5 in the Netherlands) and a maximum of 20.1 percent in Spain (13.9 in Greece). This exercise shows that unemployment has a sizeable effect on the probability of holding an open-ended contract, but its impact is unequally distributed not just across countries but also across worker profiles. The probability of holding an open-ended contract for 'mature industrial workers' ranges from 96.3 percent in Greece to 99.4 in Belgium, i.e. is very high everywhere. Vice versa, the same probability for 'personal service worker' ranges from 21.2 percent in Greece to 65 percent in Luxembourg. In other words, the same worker would treble its predicted probability simply by moving to another labor market characterized by lower unemployment. The countries in which the probability of a secure contract is most negatively affected by unemployment are Spain, Ireland, Greece, and Portugal, i.e. the countries most heavily hit by the Euro crisis.[17]

[Table 7 about here]

The predicted probabilities of `young professional' deserve a separate discussion. This is a rather qualified male private sector worker with an autonomy score of 75 out of 100, 4 out of 7 on contact with outsiders and computer use, and no dependence on either boss or machine. However, he has three features that weaken his labor market position: immigrant origin, young age (25 years old), and low tenure (1 year). Solely based on individual characteristics and unobserved country effect, his predicted probability of an indeterminate duration contract

in Spain is 88.9 percent, essentially the same as in Germany and Belgium and higher than in the Netherlands (see Table 7). However, the probability in Spain drops to 48.3 percent when unemployment is factored in, a decline of more than 40 percentage points; in Greece, the decline is from 67.7 to 35.4 percent; while in a low unemployment country like the Netherlands, the decline is only 7.9 percent (from 82.4 to 74.5). Clearly the impact of unemployment can be devastating even for relatively qualified workers if their demographic characteristics place them outside the core.

OVERVIEW OF FINDINGS AND CONCLUDING REMARKS

While a large amount of research has explored the determinants 'atypical' contracts in particular countries and organizational contexts, surprisingly there has not been so far a systematic attempt to investigate how demographic, organizational, institutional, and economic determinants contribute to influence the probability of workers holding 'typical' jobs across countries. In this paper we have sought to provide such a comprehensive cross-country assessment. Drawing on an extensive literature, our theoretical frameworkwe stipulated that the probability of holding open-ended contracts for employees working full-time would depend on job characteristics. Specifically, firms which would find it difficult to specify in advance the parameters of work services required (H1) would have incentives to offer open-ended contracts to employees as a motivational device, i.e. as a tool to elicit worker loyalty and commitment. However, our theoretical framework also implied that, holding job characteristics and other determinants constant, labor market conditions would play a crucial role: workers would select a point on the firm's 'supply curve' based on their personal assessment of the employment/security trade-off, i.e. of how difficult it would be for them to find a job of any kind. This trade-off would depend on the amount of excess supply in the labor market, i.e. on the unemployment rate (H2), but would also vary across worker

profiles. Workers with weaker labor market profiles such as young workers, women, immigrants, would not only be associated with a lower probability on average (H3) but would also be more severely affected by high unemployment than other categories closer to the core (H4).

The econometric analysis has largely confirmed these expectations. The firm's ability to predetermine the content of work services was operationalized negatively with the degree of worker autonomy on the job and the frequency of contacts with outsiders, and positively with the extent of boss and machine supervision. The econometric tests have found that worker autonomy and contacts with outsiders are significantly positively associated with open-ended contracts as expected, and that direct boss supervision is negatively correlated, again as anticipated. However, machine supervision has turned out not to be significantly associated with the type of employment contracts. Overall, H1 was supported by the data.

Confirming H2, unemployment was found to exert a powerful depressing effect on the probability of workers holding open-ended contracts; the probability would decline by 1.1 percentage points on average in 2010 for each additional percentage point of unemployment at the country level.

Consistent with H3, female workers, young workers, and workers with immigrant background have been found to be penalized in terms of probability of indeterminate-duration contracts. However, the gender effect has disappeared when controlling for wage levels. We suspect that the disappearing gender effect is at least partly due to patterns of non-response to the wage question among male workers with independent duration contracts.

The strongest and most surprising results concerned the contingent impact of unemployment. This has been found to vary dramatically not just by country but also, and perhaps most importantly, by worker profiles, thus supporting H4. Profiles with little market power, either

because of young age (such as ‘young professional’ or ‘young industrial worker’), or because of both young age, female sex, and low skill (in the case of ‘personal service worker’) seem dramatically affected by unemployment. Changing the value of unemployment from 0 to the historical country value in in 2010, the probability of an open-ended contract for ‘personal service worker’ was estimated to decline by at least 10 percent in all countries; more than 20 percent in Sweden, Italy, Finland, France, Portugal, Greece; more than 30 percent in Ireland, and a whopping 48 percent in Spain.

The analysis has also revealed that worker tenure is not only significantly and positively associated with long-term contracts, but is also quantitatively a very important predictor: on average the probability increases by 1.1 percentage points with each additional year of tenure. Instead, the effect of employer-provided training, a proxy for skill specificity, which we hypothesized would lead firms to want to retain workers by offering them long-term contracts, was positive but insignificant in models controlling for organizational and technological restructuring, while reemerging as significant in models controlling for relative wage levels as well. Overall, we cannot state with certainty that skill specificity matters for getting an open-ended contract (see Bidwell 2009 for a similar result), but this may be a consequence of the imperfect nature of our empirical proxy.

One unexpected result of the analysis has been the absence of any robust effect of EPL, either regular or temporary. This finding is surprising given the focus on labor market rigidities in both academic and policy debates (e.g. Nicoletti, Scarpetta, and Boylaud 1999; Cahuc and Postel-Vinay 2002), but we hesitate to draw strong policy conclusions about the likely effects of structural labor market reforms from this result. It may be said that the impact of EPL on the probability of open-ended contracts would be moderated by country-level institutions (such as collective bargaining structures or others), which we we were unable to control for due to the small number of country-level observations. Additionally, it may be argued that the

existing measures of EPL, while widely used in econometric analysis, may fail to adequately capture the cost differences between regular and temporary employment contracts. One thing that we may confidently exclude is that EPL increases contract precariousness indirectly by increasing unemployment levels. In fact, theoretical and empirical analyses fail to associate EPL with levels of unemployment (Bertola 1990; Pissarides 2001; OECD 2013).

The theoretical model illustrated graphically in Figure 1 has another non-trivial implication which we have not discussed so far: it suggests there should be a negative relationship between unemployment and worker autonomy (see Figure 1). The mechanism may be that since high unemployment implies longer searches for suitable jobs, job-conscious workers in high unemployment countries would presumably shorten searches by settling for jobs carrying less job security but also less autonomy than they would obtain if labor supply was less in excess relative to demand.

While an analysis of the influence of unemployment on worker autonomy is beyond the scope of this paper, to check the plausibility of the hypothesis, and hence the robustness of our theoretical framework, Figure 2 plots country-by-country unemployment levels in 2010 against average worker autonomy scores in the same year. Although the relationship is far from perfect and the linear functional form is only a first approximation, the expected negative association shows up: countries with higher (lower) rates of unemployment are characterized by lower (higher) worker autonomy on average.[18] To our knowledge, that unemployment would negatively impact worker autonomy is a novel hypothesis that has not been considered by research on the determinants of worker autonomy (see Green 2008 for a comprehensive review) and which deserves to be explored fully in future research. The implications of this hypothesis are especially interesting if one considers that worker autonomy is a component of post-Fordist high-commitment/high-performance work systems which the literature argues are associated with greater productivity (see in a large literature

Huselid 1995; Ichniowski et al. 1996). If unemployment really has a depressing impact on worker autonomy as Figure 2 suggests, then the estimates we have presented above of the impact of unemployment on open-ended contracts controlling for worker autonomy would represent a lower bound, since part of the total effect of unemployment would be carried through lower worker autonomy.

[Figure 2 about here]

Overall, the strongest conclusion emerging from our analysis has to do with the need to update the long list of 'scarring' effects of unemployment (Gangl 2009) by adding that unemployment also contributes to render the whole structure of employment contracts more precarious. When jobs are scarce, workers are pushed to settle for less secure jobs, even when job characteristics such as autonomy and functional supervision would justify higher levels of employment security. The effect is especially pronounced among young workers, women, and immigrants – demographic groups whose profiles are furthest from the ideal-typical `mature industrial worker.' For policy-makers concerned about the deterioration of European labor market conditions in the post-crisis period the main implication is that lack of jobs and precariousness of jobs are closely related phenomena, and that policies favoring the return to full employment would go a long way towards addressing the problem of precarious contracts as well.

Notes

[1] We use the terms ‘open-ended contract’, ‘indefinite contract’, ‘indeterminate contract’ and ‘regular contract’ interchangeably to imply formal employment relationships whose duration is not limited by any specific termination date.

[2] The thrust of the argument would not change if it was assumed that the worker’s demand for job security was negatively shaped, i.e. that workers would be willing to trade a bit of security for more autonomy. Here we assume that the trade-off is infinite and that workers are overwhelmingly concerned with job security.

[3] On the other hand, with high demand variability firms may also tend to increase functional flexibility as a way to adapt to continuous change in demand. The complementarity of functional and contractual flexibility is highlighted by Cappelli and Keller (2013).

[4] Across the waves the sampling procedure has been somewhat changed: while the first three were based on multi-stage, random walk procedures, the 2005 wave was conducted by using multi-stage stratified and clustered designs which are combined with random walk or phone register selection. The last wave on the other hand used multi-stage stratified random sampling in all countries. All these waves have been harmonized in 2013 in order to facilitate pooled analysis.

[5] Details about the EWCS may be found at http://www.eurofound.europa.eu/surveys/ewcs/index.htm (last accessed 30 June 2014).

[6] This is the threshold recommended by the OECD for international comparisons of full-time vs. part-time work; see: http://www.oecd-ilibrary.org/docserver/download/5lgsjhvj7t7c.pdf?expires=1404291524&id=id&accname=guest&checksum=E8F8E368370D2F017D738D0C5676B4DD (last accessed 2 July 2014)

[7] It would also be possible to use a linear probability model to address this problem (see for example Delhey, Newton, and Welzel 2011; Jann, Jerke, and Krumpal 2012) but this would imply assuming linearity of the impact of determinants on the probability of open-ended contract – an assumption which is not borne out by the data as the section on worker profiles will show.

[8] For each pooled model we also estimated a separate model for each wave. These time-point models may be provided on request.

[9] These exploratory models may be provided on request.

[10] Our time-point models suggest that the effect of using computers has declined over time.

[11] This model may be provided on request.

[12] We also run a model with only two macro variables: EPL temporary and unemployment. In this model EPL temporary had a positive but insignificant effect. The robustification protocol revealed that excluding Greece made EPL temporary positively significant. In all other cases this variable remained insignificant.

[13] The robustification analysis applied to each single wave of EWCS shows that the effect of trade union density depends on presence /absence of particular countries.

[14] The predicted country-by-country average probability of workers holding an indeterminate duration contract in 2010 is calculated on the basis of model 3 in Table 2, by estimating the predicted probability for each worker in a given country and then averaging out.

[15] This means that for each respondent in each country we estimate the probability of having indefinite contract by setting the mentioned variables to worst and best values and in order to keep the simulation close to reality so as to capture cross country differences, retain the actual values for remaining variables, then obtain country scores by averaging probabilities estimated for respondents from the same country.

[16] For the sake of maximizing the predictive capacity of the model, we generate the predicted probabilities by using the model in its entirety. Running the simulation by using only the statistically significant predictors does not change the conclusions we report here. This analysis may be provided on request.

[17] The impact of other country level predictors (whose effects are generally non robust) is ignored here since it is minimal in terms of magnitude. An analysis setting all country variables to their historical levels may be provided on request.

[18] The corresponding regression is: autonomy = 82.25 (19.84) - 0.93 (-2.24) x unemployment, R-squared = 0.28, t-statistics in parentheses.

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Tables

Table 1: Main Variables and Corresponding Survey Questions and Other Sources

variables	survey questions/sources	scale	expected sign
male	gender-respondent	binary (1= male 0 = female)	+
age	age-respondent	continuous	+
tenure	"How many years have you been in your company or organisation?"	continuous	+
immigrantBackground	"Were you and both of your parents born in this country?"	binary (1= yes 0 = no)	-
autonomy	"does your main job involve: assessing yourself the quality of your own work; solving unforeseen problems; complex tasks; learning new things; are you able to choose or change your order of tasks; your methods of work, your speed or rate of work"	continuous (0-100)	+
trainingByEmployer	"have you undergone in past 12 months any training paid for or provided by your employer, or by yourself if you are self-employed (yes/no)"	binary (1= yes 0 = no)	+
contactWithOutsiders	"does your job involve dealing directly with people who are not employees at your workplace?"	increasing from 1 to 7	+
UsingComputer	"does your job involve working with computers, PCs, network, mainframe"	increasing from 1 to 7	+
dependOnBoss	"on the whole, is your pace of work dependent, or not, on the direct control of your boss?"	binary (1= yes 0 = no)	-
dependOnMachine	"on the whole is your pace of work dependent, or not, on automatic speed of a machine or movement of a product?"	binary (1= yes 0 = no)	-
teamwork	"do you work in a group or team that has common tasks and can plan its work?	binary (1= yes 0 = no)	+ -
wage	"how much are your net monthly earnings from your main paid job?"	continuous	+ -
workerRepresentative	"at your workplace is there an employee acting as an employee representative?	binary (1= yes 0 = no)	+ -
new technology/process	"[during] the last 3 years new processes or technologies were introduced "	binary (1= yes 0 = no)	+ -
restructuring	"[during] the last 3 years changes occurred at your current workplace: substantial restructuring or reorganization carried out"	binary (1= yes 0 = no)	+ -
unemployment	source : OECD	continuous (0-100)	-
employment protection legislation for temporary contracts	source : OECD	continuous	+
employment protection legislation for regular contracts	source : OECD	continuous	-
union density	source : Database on Institutional Characteristics of Trade Unions, Wage Setting and State Intervention (ICTWSS version.4)	continuous (0-100)	+ -

Table 2: Pooled Models

	pooled model I (1995-2000-2005-2010)						pooled model II (2000-2005-2010)						2010 model					
	b	*APE*	sd	z	p		b	*APE*	sd	z	p		b	*APE*	sd	z	p	
individual level																		
male	0.201	*2.5*	0.0284	7.07	0.000	***	0.1689	*2.1*	0.0341	4.96	0.000	***	0.1912	*1.9*	0.0654	2.92	0.004	**
age.N	0.015	*0.2*	0.0014	10.77	0.000	***	0.0158	*0.2*	0.0017	9.36	0.000	***	0.0134	*0.1*	0.0032	4.23	0.000	***
tenure	0.085	*1.1*	0.0024	35.25	0.000	***	0.0883	*1.1*	0.0029	30.09	0.000	***	0.1100	*1.1*	0.0061	18.13	0.000	***
immigrantBackground													-0.2892	*-2.9*	0.0750	-3.85	0.000	***
autonomy	0.005	*0.1*	0.0005	9.09	0.000	***	0.0055	*0.1*	0.0006	9.08	0.000	***	0.0050	*0.1*	0.0012	4.33	0.000	***
trainingByEmployer	0.313	*4.0*	0.0311	10.07	0.000	***	0.1562	*1.9*	0.0362	4.31	0.000	***	0.1105	*1.1*	0.0676	1.63	0.102	
contactWithOutsiders	0.035	*0.4*	0.0059	5.87	0.000	***	0.0372	*0.5*	0.0072	5.17	0.000	***	0.0344	*0.3*	0.0139	2.47	0.014	**
UsingComputer	0.077	*1.0*	0.0068	11.29	0.000	***	0.0705	*0.9*	0.0080	8.82	0.000	***	0.0478	*0.5*	0.0154	3.11	0.002	**
dependOnBoss	-0.185	*-2.3*	0.0282	-6.56	0.000	***	-0.1983	*-2.5*	0.0336	-5.91	0.000	***	-0.2204	*-2.2*	0.0628	-3.51	0.000	**
dependOnMachine	0.007	*0.1*	0.0346	0.20	0.840		-0.0320	*-0.4*	0.0413	-0.77	0.439		-0.1099	*-1.1*	0.0777	-1.42	0.157	
teamwork							-0.0044	*-0.1*	0.0333	-0.13	0.894		0.1138	*1.1*	0.0624	1.82	0.068	*
workerRepresentative													0.0653	*0.7*	0.0695	0.94	0.348	
new technology/process													0.1619	*1.6*	0.0713	2.27	0.023	**
restructuring													0.0494	*0.5*	0.0723	0.68	0.494	
between2and4							-0.2314	*-2.9*	0.0643	-3.60	0.000	***	-0.0704	*-0.7*	0.1257	-0.56	0.576	
between5and9							-0.1323	*-1.6*	0.0607	-2.18	0.029	**	0.0615	*0.6*	0.1177	0.52	0.602	
between10and49							-0.0916	*-1.1*	0.0541	-1.69	0.090	*	-0.0113	*-0.1*	0.1026	-0.11	0.913	
between100and249							-0.0407	*-0.5*	0.0678	-0.60	0.548		0.0461	*0.5*	0.1284	0.36	0.720	
between250and499							0.0789	*1.0*	0.0838	0.94	0.346		0.0790	*0.8*	0.1610	0.49	0.624	
moreThan500							-0.1159	*-1.4*	0.0693	-1.67	0.094	*	-0.1325	*-1.3*	0.1345	-0.98	0.325	
SKILL.2	0.192	*2.4*	0.0504	3.81	0.000	***	0.1769	*2.2*	0.0581	3.05	0.002	**	0.2198	*2.2*	0.1061	2.07	0.038	**
SKILL.3	0.184	*2.3*	0.0475	3.88	0.000	***	0.1821	*2.2*	0.0559	3.26	0.001	***	0.1083	*1.1*	0.1029	1.05	0.293	
SKILL.4	0.107	*1.4*	0.0524	2.05	0.040	**	0.1329	*1.6*	0.0625	2.13	0.034	**	0.1008	*1.0*	0.1194	0.84	0.399	
AGRICULTURE	-0.682	*-8.6*	0.2027	-3.36	0.001	***	-0.7073	*-8.7*	0.2119	-3.34	0.001	***	-0.8893	*-8.9*	0.2018	-4.41	0.000	***
INDUSTRY	0.436	*5.5*	0.0818	5.34	0.000	***	0.4193	*5.2*	0.0861	4.87	0.000	***	0.0683	*0.7*	0.0988	0.69	0.489	
PUBLIC.SERVICE	-0.147	*-1.9*	0.0996	-1.48	0.140		-0.1873	*-2.3*	0.1051	-1.78	0.075	*	-0.3807	*-3.8*	0.1116	-3.41	0.001	***
CONSTRUCTION	-0.146	*-1.8*	0.1006	-1.45	0.148		-0.1707	*-2.1*	0.1058	-1.61	0.107		-0.2636	*-2.6*	0.1111	-2.37	0.018	**
year1995	0.223	*2.8*	0.0677	3.30	0.001	***												
year2000	0.189	*2.4*	0.0481	3.93	0.000	***	0.2577	*3.2*	0.0515	5.00	0.000	***						
year2010	0.322	*4.1*	0.0489	6.57	0.000	***	0.3040	*3.8*	0.0530	5.73	0.000	***						
AGRICULTURE.year1995	-0.120	*-1.5*	0.2563	-0.47	0.641													
AGRICULTURE.year2000	0.219	*2.8*	0.2557	0.86	0.392		0.2216	*2.7*	0.2673	0.83	0.407							
AGRICULTURE.year2010	-0.062	*-0.8*	0.2594	-0.24	0.810		-0.0996	*-1.2*	0.2708	-0.37	0.713							
INDUSTRY.year1995	-0.137	*-1.7*	0.1099	-1.25	0.211													
INDUSTRY.year2000	0.096	*1.2*	0.1031	0.93	0.351		0.0862	*1.1*	0.1074	0.80	0.422							
INDUSTRY.year2010	-0.290	*-3.7*	0.1093	-2.65	0.008	**	-0.3450	*-4.3*	0.1135	-3.04	0.002	**						
PUBLIC.SERVICE.year1995	-0.015	*-0.2*	0.1299	-0.12	0.906													
PUBLIC.SERVICE.year2000	-0.117	*-1.5*	0.1301	-0.90	0.369		-0.1352	*-1.7*	0.1363	-0.99	0.321							
PUBLIC.SERVICE.year2010	-0.015	*-0.2*	0.1375	-0.11	0.910		-0.0131	*-0.2*	0.1449	-0.09	0.928							
CONSTRUCTION.year1995	-0.140	*-1.8*	0.1402	-1.00	0.319													
CONSTRUCTION.year2000	0.045	*0.6*	0.1293	0.35	0.726		0.0128	*0.2*	0.1342	0.10	0.924							
CONSTRUCTION.year2010	-0.051	*-0.6*	0.1304	-0.39	0.697		-0.0526	*-0.7*	0.1362	-0.39	0.699							
country level																		
unemploymentRate	-0.034	*-0.4*	0.0071	-4.71	0.000	***	-0.0323	*-0.4*	0.0087	-3.73	0.000	***	-0.1068	*-1.1*	0.0268	-3.99	0.000	***
EPL.regular	0.234	*3.0*	0.1331	1.76	0.079	*	0.0428	*0.5*	0.1185	0.36	0.718		-0.1645	*-1.6*	0.1576	-1.04	0.297	
EPL.temporary	-0.042	*-0.5*	0.0293	-1.43	0.153		-0.0083	*-0.1*	0.0438	-0.19	0.849		0.1836	*1.8*	0.1050	1.75	0.080	*
union.density	0.035	*0.5*	0.0057	6.18	0.000	***	0.0011	*0.0*	0.0046	0.24	0.811		-0.0008	*0.0*	0.0056	-0.14	0.892	
model statistics																		
individual observations			46663						34229						11767			
log-likelihood			-18987						-13563						-3888			

***: 0.05<p<0.1 | **: 0.01<p<0.05 | ***: p<0.001**

Table 3: 2010 Models With and Without the Wage Variable

	2010 model						2010 model (with wage variable)						2010 model (with wage sample)					
	b	*APE*	sd	z	p		b	*APE*	sd	z	p		b	*APE*	sd	z	p	
individual level																		
male	0.191	*1.9*	0.0654	2.92	0.004	**	-0.1026	*-1.0*	0.0805	-1.28	0.202		0.0845	*0.8*	0.0774	1.09	0.275	
age.N	0.013	*0.1*	0.0032	4.23	0.000	***	0.0124	*0.1*	0.0037	3.30	0.001	***	0.0173	*0.2*	0.0037	4.66	0.000	***
tenure	0.110	*1.1*	0.0061	18.13	0.000	***	0.1121	*1.1*	0.0075	14.95	0.000	***	0.1172	*1.2*	0.0075	15.58	0.000	***
immigrantBackground	-0.289	*-2.9*	0.0750	-3.85	0.000	***	-0.2910	*-2.8*	0.0897	-3.25	0.001	***	-0.3020	*-3.0*	0.0888	-3.40	0.001	***
autonomy	0.005	*0.1*	0.0012	4.33	0.000	***	0.0036	*0.0*	0.0014	2.58	0.010	**	0.0047	*0.1*	0.0014	3.42	0.001	***
trainingByEmployer	0.110	*1.1*	0.0676	1.63	0.102		0.2102	*2.1*	0.0812	2.59	0.010	**	0.2230	*2.2*	0.0806	2.77	0.006	**
contactWithOutsiders	0.034	*0.3*	0.0139	2.47	0.014	**	0.0339	*0.3*	0.0168	2.02	0.044	**	0.0348	*0.4*	0.0167	2.09	0.037	*
UsingComputer	0.048	*0.5*	0.0154	3.11	0.002	**	0.0154	*0.2*	0.0184	0.84	0.404		0.0366	*0.4*	0.0182	2.01	0.045	*
dependOnBoss	-0.220	*-2.2*	0.0628	-3.51	0.000	**	-0.1580	*-1.5*	0.0757	-2.09	0.037	**	-0.2029	*-2.0*	0.0749	-2.71	0.007	**
dependOnMachine	-0.110	*-1.1*	0.0777	-1.42	0.157		0.0379	*0.4*	0.0945	0.40	0.688		0.0277	*0.3*	0.0939	0.30	0.768	
teamwork	0.114	*1.1*	0.0624	1.82	0.068	*	0.1045	*1.0*	0.0748	1.40	0.162		0.0959	*1.0*	0.0742	1.29	0.196	
workerRepresentative	0.065	*0.7*	0.0695	0.94	0.348		-0.0029	*0.0*	0.0830	-0.04	0.972		-0.0056	*-0.1*	0.0824	-0.07	0.945	
new technology/process	0.162	*1.6*	0.0713	2.27	0.023	**	0.1417	*1.4*	0.0847	1.67	0.095	*	0.1763	*1.8*	0.0841	2.09	0.036	*
restructuring	0.049	*0.5*	0.0723	0.68	0.494		0.0753	*0.7*	0.0851	0.88	0.376		0.0821	*0.8*	0.0846	0.97	0.332	
wage							0.0103	*0.1*	0.0013	8.24	0.000	***						
between2and4	-0.070	*-0.7*	0.1257	-0.56	0.576		0.1415	*1.4*	0.1524	0.93	0.353		0.0457	*0.5*	0.1510	0.30	0.762	
between5and9	0.061	*0.6*	0.1177	0.52	0.602		0.1882	*1.8*	0.1408	1.34	0.181		0.1460	*1.5*	0.1400	1.04	0.297	
between10and49	-0.011	*-0.1*	0.1026	-0.11	0.913		-0.0318	*-0.3*	0.1220	-0.26	0.794		-0.0507	*-0.5*	0.1214	-0.42	0.676	
between100and249	0.046	*0.5*	0.1284	0.36	0.720		-0.0112	*-0.1*	0.1513	-0.07	0.941		0.0244	*0.2*	0.1503	0.16	0.871	
between250and499	0.079	*0.8*	0.1610	0.49	0.624		-0.0967	*-0.9*	0.1838	-0.53	0.599		-0.0594	*-0.6*	0.1832	-0.32	0.746	
moreThan500	-0.132	*-1.3*	0.1345	-0.98	0.325		-0.2419	*-2.4*	0.1616	-1.50	0.135		-0.1258	*-1.3*	0.1600	-0.79	0.432	
SKILL.2	0.220	*2.2*	0.1061	2.07	0.038	**	0.3246	*3.2*	0.1297	2.50	0.012	**	0.2287	*2.3*	0.1277	1.79	0.073	*
SKILL.3	0.108	*1.1*	0.1029	1.05	0.293		0.3192	*3.1*	0.1287	2.48	0.013	**	0.0527	*0.5*	0.1240	0.42	0.671	
SKILL.4	0.101	*1.0*	0.1194	0.84	0.399		0.3491	*3.4*	0.1476	2.36	0.018	**	0.0746	*0.7*	0.1434	0.52	0.603	
AGRICULTURE	-0.889	*-8.9*	0.2018	-4.41	0.000	***	-0.6910	*-6.8*	0.2519	-2.74	0.006	***	-0.6834	*-6.8*	0.2499	-2.73	0.006	***
INDUSTRY	0.068	*0.7*	0.0988	0.69	0.489		0.0148	*0.1*	0.1165	0.13	0.899		0.0272	*0.3*	0.1155	0.24	0.814	
PUBLIC.SERVICE	-0.381	*-3.8*	0.1116	-3.41	0.001	***	-0.5332	*-5.2*	0.1321	-4.04	0.000	***	-0.4976	*-4.9*	0.1310	-3.80	0.000	***
CONSTRUCTION	-0.264	*-2.6*	0.1111	-2.37	0.018	**	-0.2412	*-2.4*	0.1327	-1.82	0.069	*	-0.1623	*-1.6*	0.1315	-1.23	0.217	
country level																		
unemploymentRate	-0.107	*-1.1*	0.0268	-3.99	0.000	***	-0.1185	*-1.2*	0.0287	-4.12	0.000	***	-0.1073	*-1.1*	0.0275	-3.90	0.000	***
EPL.regular	-0.164	*-1.6*	0.1576	-1.04	0.297		-0.3133	*-3.1*	0.1671	-1.87	0.061	*	-0.2629	*-2.6*	0.1599	-1.64	0.100	
EPL.temporary	0.184	*1.8*	0.1050	1.75	0.080	*	0.1555	*1.5*	0.1139	1.37	0.172		0.1863	*1.9*	0.1092	1.71	0.088	*
union.density	-0.001	*0.0*	0.0056	-0.14	0.892		-0.0016	*0.0*	0.0059	-0.27	0.785		-0.0021	*0.0*	0.0056	-0.37	0.714	
model statistics																		
individual observations			11767						8496						8496			
log-likelihood			-3888						-2749						-2789			

***: 0.05<p<0.1 | **: 0.01<p<0.05 | ***: p<0.001**

Table 4: Model Predictions (of the 2010 model) and Sample Proportions for Open-Ended Contracts

proportion of open-ended contracts		
countries	**model predictions**	**sample proportions**
Belgium	0.912	**0.875**
Denmark	0.908	**0.872**
Germany	0.905	**0.865**
Greece	0.595	**0.599**
Spain	0.725	**0.710**
France	0.899	**0.866**
Ireland	0.688	**0.699**
Italy	0.851	**0.863**
Luxembourg	0.914	**0.892**
Netherlands	0.898	**0.846**
Austria	0.889	**0.872**
Portugal	0.786	**0.748**
Finland	0.867	**0.853**
Sweden	0.908	**0.877**
UK	0.876	**0.885**

Table 5: Predicted Probability of Open-Ended Contract in 2010 with 'Worst' and 'Best' Work Characteristics

	Worst	**Best**	**Change**
Luxembourg	0.819	0.951	0.132
Belgium	0.816	0.950	0.134
Germany	0.811	0.948	0.138
France	0.802	0.945	0.143
Sweden	0.787	0.938	0.151
Denmark	0.779	0.937	0.158
Austria	0.775	0.934	0.159
Netherlands	0.768	0.931	0.163
United Kingdom	0.752	0.928	0.176
Italy	0.732	0.917	0.185
Finland	0.724	0.913	0.190
Portugal	0.660	0.882	0.223
Spain	0.571	0.838	0.267
Ireland	0.496	0.787	0.291
Greece	0.456	0.755	0.298

('autonomy,' 'training by employer,' 'contact with outsiders,' 'using computers,' 'depend on boss,' 'depend on machine,' and 'teamwork') are set to (1, 0, 1, 1, 1, 1, 0) in the 'worst' column, and to (100, 1, 7, 7, 0, 0, 1) in the 'best' column.

Table 6: Worker Profiles

	sales representative	service worker	teacher	industrial worker	young industrial worker	young professional
male	1	0	0	1	0	1
age.N	40	25	40	50	20	25
tenure	8	1	8	30	0	1
immigrantBackground	0	1	0	0	0	1
autonomy	100	30	75	75	75	75
trainingByEmployer	1	0	1	1	1	0
contactWithOutsiders	7	1	7	1	1	4
UsingComputer	7	1	4	3	3	4
dependOnBoss	0	1	0	1	1	0
dependOnMachine	0	0	0	1	1	0
TeamWORK.01	1	0	0	1	1	0
workerRepresentative	1	0	1	1	1	0
newProcess	1	0	0	1	1	0
bigReform	0	0	0	0	0	0
between2and4	0	0	0	0	0	0
between5and9	0	0	0	0	0	0
between10and49	0	0	1	0	0	0
between100and249	0	1	0	0	0	0
between250and499	1	0	0	0	0	0
moreThan500	0	0	0	1	1	0
SKILL.2.LegisManagTechAscProf	0	0	1	0	0	0
SKILL.3.ClerksServiceWorkArForce	1	0	0	0	0	0
SKILL.4.SkilAgriCraftPlantMachineElementary	0	1	0	1	1	0
AGRICULTURE	0	0	0	0	0	0
INDUSTRY	1	0	0	1	1	0
PUBLIC.SERVICE	0	0	1	0	0	0
CONSTRUCTION	0	0	0	0	0	0

Table 7: Predicted Probability of Open-Ended Contract for Different Worker Profiles in 2010

(Based on Table 2, Model 3)

included variable groups							
	Belgium						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.988	0.784	0.961	0.997	0.876	0.884	0.213
individual level variables+intercept+unemployment	0.970	0.599	0.910	0.993	0.744	0.758	0.394
	Denmark						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.985	0.747	0.953	0.997	0.852	0.861	0.249
individual level variables+intercept+unemployment	0.967	0.572	0.901	0.992	0.722	0.736	0.421
	Germany						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.988	0.786	0.961	0.997	0.877	0.885	0.212
individual level variables+intercept+unemployment	0.974	0.633	0.921	0.994	0.770	0.783	0.361
	Greece						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.956	0.501	0.872	0.990	0.661	0.677	0.489
individual level variables+intercept+unemployment	0.851	0.208	0.640	0.962	0.338	0.354	0.754
	Spain						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.988	0.792	0.963	0.997	0.881	0.889	0.205
individual level variables+intercept+unemployment	0.907	0.309	0.752	0.977	0.465	0.483	0.668
	France						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.985	0.757	0.955	0.997	0.859	0.867	0.240
individual level variables+intercept+unemployment	0.960	0.525	0.882	0.991	0.682	0.698	0.466
	Ireland						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.972	0.611	0.914	0.993	0.754	0.767	0.382
individual level variables+intercept+unemployment	0.886	0.263	0.708	0.972	0.410	0.427	0.709
	Italy						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.979	0.681	0.936	0.995	0.806	0.817	0.314
individual level variables+intercept+unemployment	0.950	0.465	0.855	0.988	0.629	0.645	0.523
	Luxembourg						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.980	0.694	0.939	0.995	0.815	0.826	0.301
individual level variables+intercept+unemployment	0.968	0.582	0.904	0.993	0.730	0.744	0.411
	Netherlands						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.980	0.692	0.938	0.995	0.814	0.824	0.304
individual level variables+intercept+unemployment	0.968	0.582	0.904	0.993	0.731	0.745	0.410
	Austria						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.977	0.664	0.931	0.995	0.793	0.805	0.331
individual level variables+intercept+unemployment	0.964	0.552	0.893	0.992	0.706	0.721	0.439
	Portugal						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.983	0.723	0.947	0.996	0.836	0.845	0.273
individual level variables+intercept+unemployment	0.946	0.447	0.845	0.987	0.611	0.628	0.541
	Finland						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.978	0.668	0.932	0.995	0.797	0.808	0.327
individual level variables+intercept+unemployment	0.947	0.451	0.848	0.987	0.615	0.632	0.536
	Sweden						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.985	0.757	0.955	0.997	0.858	0.867	0.240
individual level variables+intercept+unemployment	0.964	0.555	0.894	0.992	0.708	0.723	0.437
	United Kingdom						
	salesRepresentative	serviceWorker	teacher	industrialWorker	YoungIndustrialWorker	YoungProfessional	range
individual level variables	0.968	0.578	0.903	0.992	0.727	0.742	0.414
individual level variables+intercept	0.985	0.749	0.953	0.997	0.853	0.862	0.247
individual level variables+intercept+unemployment	0.966	0.565	0.898	0.992	0.717	0.731	0.427

Figures

Figure 1: Hypothesized Relationship between Worker Autonomy, Degree of Job Security, and Unemployment

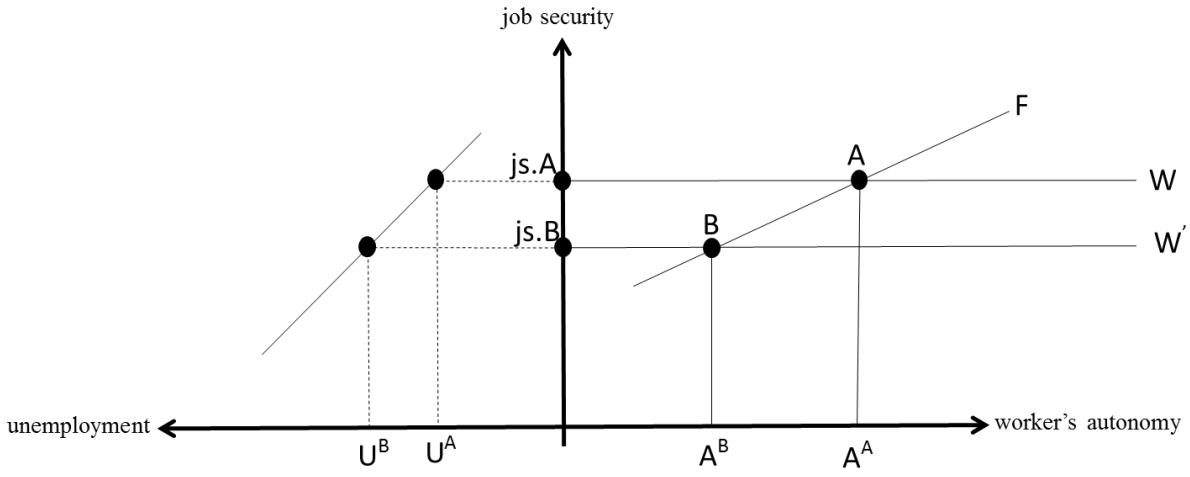
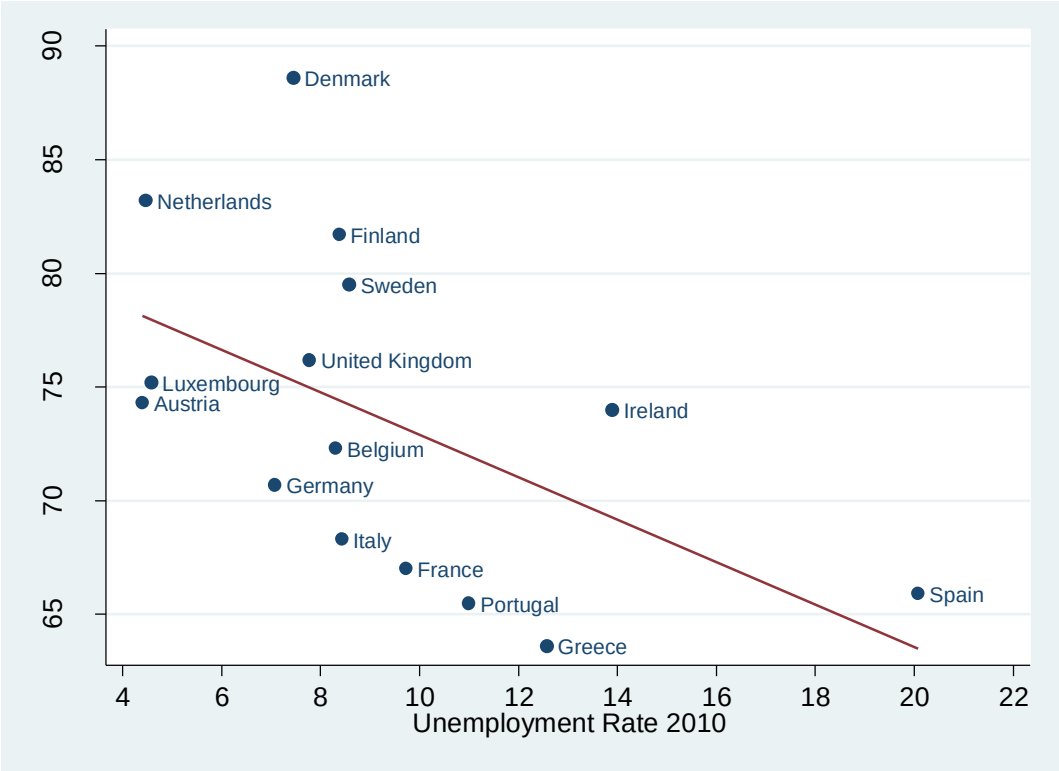


Figure 2: Cross-Country Association between Unemployment and Average Worker Autonomy in 2010



APPENDIX

Appendix-A: Descriptive Tables

A-1: Average Value Tables

A-1.1

	age				tenure				autonomy			
	1995	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**
Belgium	37.9	38.3	39.8	40.6	11.3	11.6	12.3	10.7	73.3	70.9	73.6	72.3
Denmark	38.7	40	41.3	42.6	9	9.1	8.4	9.3	82.6	83.4	86.1	88.6
Germany	39.1	39.9	40.4	41.5	12.2	11	10.9	11	73.2	72.1	67.9	70.7
Greece	41.4	39.6	40	41.5	15.3	13.7	11.4	11.9	61.8	58.1	65.3	63.6
Spain	38.8	38.7	39.1	40.1	11.5	10.2	9.2	9.6	66.2	64.7	60.3	65.9
France	38.7	39.5	39.8	40.4	10.7	10.6	10.5	10.7	72.9	71.8	72.8	67
Ireland	37.7	37.3	37.8	40	11.8	10.8	9.7	10.7	69.9	68.4	75.2	74
Italy	39.1	39.3	40.9	41.5	12.6	11.8	12.5	11.9	71.1	67.2	72.2	68.3
Luxembourg	37.4	38.1	39.4	39.6	12.2	11.9	11	10.5	70.7	66.4	74.1	75.2
Netherlands	36.8	37.9	40.5	41.3	10.3	11.3	10.6	10.3	82	84.3	81.6	83.2
Austria	37.1	37.9	38.3	39.5	12.5	11.2	10.6	11.1	70.7	73.4	75	74.3
Portugal	40.6	39.7	39.4	41.6	12.9	11.6	10.2	11.3	67.2	58.4	66.4	65.5
Finland	39.8	40.4	41.5	42.6	11.1	10.5	10.8	10.9	80.3	78.6	79.8	81.7
Sweden	41	41.8	42.8	43.4	10.7	11.4	10.7	11.6	81.9	79.6	82.8	79.5
United Kingdom	38.4	39.2	39.4	40.4	8.5	9.2	8.4	9	82.1	75.4	71	76.2

A-1.2

	male				training by employer				depend on boss				depend on machine			
	1995	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**
Belgium	64.9	66.4	64.7	61.9	16.3	25.9	37	32	34.6	36.7	33.1	34.9	17.8	17.8	20.7	19.6
Denmark	58.4	57.3	56.9	55	44.3	48	37.7	44.7	20.4	17.5	20.2	14.2	14.8	13	14.9	8.9
Germany	61.6	64.8	60.7	61.3	29.3	27.4	25.4	35.1	30.4	28.2	31.1	31.2	18.6	20.1	21.4	18.9
Greece	65.9	65.2	65.6	62.9	9.1	8.1	11.7	11.2	51.6	35.6	42.8	67	30.4	22.4	19.1	22
Spain	69	67.7	64.8	61.4	14.3	15.4	16.9	29.5	43.8	39.1	39	39.7	24.5	28.1	20.4	21.9
France	59.3	60.5	57	56	21.1	21.8	22.2	23.1	44.6	36.6	36.8	41.6	22.1	20.6	18.2	19.6
Ireland	65.6	65.4	68	64.4	20	31.8	35.1	41	48.8	45.3	34.7	49.5	25.2	25.4	12.1	25.3
Italy	69	67.5	68.2	66	11.1	17	13.3	21.8	34.2	28	25.7	31.3	23.7	21.8	21.6	20.1
Luxembourg	70.4	70.8	65.8	62.9	21.9	24.2	34.6	30.7	37.2	36.8	39	38.1	24.3	24.1	16.6	21.1
Netherlands	72.5	73	71.3	74.3	41.7	49.7	31	46.3	22.3	10.1	18.8	17.4	22.9	16.7	16.4	13.9
Austria	60	62.6	59.6	61.2	23.9	27.2	31.6	35.3	36	28.4	31.2	25.5	21.4	19.7	23.1	15.3
Portugal	57.7	58.1	55.3	54.8	11.4	9.2	13.2	28.3	41.7	38.5	48.5	45.4	24.2	22.7	26.8	19.8
Finland	53.6	55.3	53.6	54.1	49.2	47.2	50.1	48	18.4	12.8	15.6	17.7	20.6	20.1	20.3	23.2
Sweden	56.2	54.7	57	55.8	43.8	43.3	51.9	47.7	17.8	16.3	16.7	21.6	13.3	8.8	8.9	11.8
United Kingdom	66.5	65.8	65.8	65.9	48.8	47	38.4	43.5	40.7	43.2	47.2	54.9	26.4	20.7	21.3	20.7

A-1.3

	contact with outsiders				using computers			
	1995	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**
Belgium	4.4	4.2	3.9	4.5	2.8	3.2	3.7	4.2
Denmark	4.2	4.2	4.4	4.4	2.8	3	3.9	4.3
Germany	4.2	3.6	3.7	4.1	2.7	2.7	3.3	3.4
Greece	4.3	4.3	4.1	4.4	1.5	1.9	2.4	2.9
Spain	4.7	4	4.1	4.5	2.3	2.5	2.8	3.4
France	4.8	4.4	4.5	4.8	2.7	2.8	3.7	3.8
Ireland	4.4	4.4	4.4	4.7	2.5	3	3.4	4.1
Italy	4.4	4.1	4.1	3.9	2.3	2.6	2.9	3.1
Luxembourg	4.1	3.8	4.1	4.6	2.9	2.9	4	4.4
Netherlands	4.4	4.3	3.7	3.7	3.8	4.1	4.6	4.4
Austria	4.4	4.3	4.3	4.5	2.6	2.8	3.5	3.9
Portugal	3.9	3.1	4	3.9	2	2.1	2.6	2.8
Finland	4.1	4.1	4.4	4.1	3	3.1	3.6	3.9
Sweden	4.8	4.6	4.6	4.6	2.7	3.1	3.9	4.3
United Kingdom	4.8	4.6	4.4	4.5	3.5	3.5	3.5	4.3

A-2: Percentage Value Tables

A-2.1

	worker representative	new process/technology	restructuring	immigrant background
	2010	**2010**	**2010**	**2010**
Belgium	61.9	45.4	32.6	21.3
Denmark	76.2	55.6	51.7	10.2
Germany	43.8	47.8	33.5	11.9
Greece	29.1	30.9	26	15
Spain	46.8	38.8	26.3	19.8
France	53.5	38.1	36.7	18.4
Ireland	54.1	48.7	42.3	18.7
Italy	42.3	34.1	23.9	9.2
Luxembourg	66.1	49.3	34.2	58.4
Netherlands	60.9	51.3	39.6	12.6
Austria	50	46.9	34.2	15.8
Portugal	22	42.3	32.4	9.1
Finland	75.9	57.3	53.1	5.6
Sweden	68.9	57.4	51.1	17.6
United Kingdom	54.8	53.6	44.8	17.5

A-2.2

	agriculture				industry				public service				construction				private service			
	1995	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**
Belgium	1.8	1.6	3.4	2.1	24.6	21.3	20.7	15.6	11.3	13.1	12.4	7.5	7.1	7.1	5.5	8.3	55.3	56.9	58	66.5
Denmark	3.4	1.7	1.7	2.2	21	22.6	17.2	14.4	7.5	7.1	8.9	7.1	6.7	6.7	8.5	8.9	61.4	61.8	63.7	67.4
Germany	3.1	3	1.7	2.1	22	22.9	24	21.7	11	9.3	10.4	6.7	13	13.5	10.1	8.1	50.8	51.4	53.8	61.4
Greece	19.6	19.1	12.4	12.6	15.8	16.4	13.5	11.1	7.3	9.5	9.1	11.5	8.3	4.5	10.8	9.3	49	50.5	54.3	55.4
Spain	7.6	7.7	5.6	5.7	24.3	21.8	15.1	14.8	7.7	7.1	8.2	6.3	7	9.9	16.6	10.7	53.4	53.4	54.6	62.6
France	6.7	5.1	2	3.3	18.1	21.3	19.8	13.6	9.8	10.6	15.3	12.1	7.6	6.1	4.6	7.9	57.8	56.9	58.3	63
Ireland	14.3	6.2	6.8	4.5	17.5	22	15.9	14.2	6.8	6.8	6.6	6.6	8.2	10.3	16.7	9.2	53.2	54.7	54	65.5
Italy	4.6	5	2.1	3.2	26.1	28.1	29.2	22	8.8	8.1	6.7	8.5	8.1	5.8	8.1	8.4	52.5	53.1	53.9	58
Luxembourg	3.4	2.5	2.2	1.7	13.7	12.7	11.7	6.6	11.9	12.2	13.4	9.1	8.4	11.8	9.5	8.2	62.6	60.7	63.2	74.5
Netherlands	3.7	2	2.9	6.1	19.8	19.5	20.8	11.5	9.8	9.6	10.1	8.8	8.1	8.4	4.7	10.7	58.5	60.5	61.6	63
Austria	5	4.3	4.9	2.6	21.1	23.4	21.5	19	9.2	6.6	8.3	7.7	11.8	10.7	8	10.3	52.9	55	57.2	60.4
Portugal	10.5	7.3	2.4	5.3	24.5	24.6	26.1	18.4	8.4	8.1	7.7	7.3	9.9	15.8	15.3	12.2	46.8	44.2	48.5	56.9
Finland	6.9	6.5	4.3	3.8	22.6	21.5	19.5	16.4	33.6	7.4	6.7	5.1	5.2	6	5.2	8.3	31.8	58.6	64.3	66.4
Sweden	2.5	2.1	2.6	1.5	20	19.6	17.7	14.2	6.5	6.1	6.9	8.3	6.4	6.6	5.6	5.9	64.6	65.6	67.3	70.1
United Kingdom	1.9	1.7	2.3	2.4	22.4	18.7	16.2	11.3	8.6	7.8	10.3	9	7.2	9.9	9.7	10.4	59.9	61.9	61.5	66.9

A-2.3

	firm sizes																				
	between2and4			between5and9			between10and49			between50and99			between100and249			between250and499			moreThan500		
	2000	**2005**	**2010**	**2000**	**2005**	**2010**	**2000**	**2005**	**2010**	**2000**	**2005**	**2010**	**2000**	**2005**	**2010**	**2000**	**2005**	**2010**	**2000**	**2005**	**2010**
Belgium	15.7	12	13.1	11.8	14.6	14.5	26.9	25.5	29.4	12	12.4	12	11.1	11.9	11.8	6.8	9.5	6.6	15.7	14.1	12.6
Denmark	7.6	5.9	7.8	9.6	8.5	14	31.2	32.6	37.9	14.9	15.3	14.3	13.7	12.1	11	6.1	7.6	4.8	16.9	18	10.2
Germany	12.8	12.1	11.1	14.2	14.5	24.1	31.8	33.7	29.2	9.8	13.7	10.8	9.9	9.7	11.1	5.9	5.3	6.3	15.6	10.9	7.5
Greece	41.8	30.8	35.4	13.3	19.5	13.9	22.1	27.5	29.1	7	5.2	7.6	8.4	7.5	7	2.8	3.5	2	4.7	6.1	5.1
Spain	22.7	21.2	22	14.8	20	18.9	27.8	32	34.1	9.7	7.5	10.2	8.5	6.5	7.9	5	4.9	2.2	11.6	7.9	4.7
France	17.3	12.4	16.2	14.6	13	16.2	26.3	26.5	27	10.7	11.6	11.9	11.8	12.8	10.8	8.3	7.1	7.9	11.2	16.5	10
Ireland	17.3	14.7	13.3	18.8	15.1	12.1	32.8	35.7	28.6	8.9	11.7	10.8	9	6.6	10.8	6.6	5	9.1	6.7	11.2	15.3
Italy	24.5	27.3	20.5	14.2	14.4	19	26.7	29.2	30.3	9.9	7.7	11.3	10.5	8.7	6.5	3.6	4	4.4	10.5	8.7	7.9
Luxembourg	14.7	10.2	12.6	10.9	13.5	11.7	25.4	26.8	28.6	8	11.3	11.6	10.3	12.8	12.6	7.9	7.5	6	22.8	17.8	16.8
Netherlands	4.9	12.3	14.1	8.1	12.2	13	24.9	33.5	28.1	12.3	14.1	13.6	19.6	12.5	11.2	8.4	5.6	7.2	21.9	9.9	12.8
Austria	20	17.7	13.9	16	16	16.9	29.5	31.1	28.5	9.5	9.3	11.5	10.2	7.6	10.6	6.7	7.2	6.3	8.1	11	12.3
Portugal	22.8	18.6	18.4	19.7	15.9	19.9	27	30.3	34.3	10.5	10.7	9.7	7	9.7	9.7	4.4	8.4	3.5	8.5	6.4	4.5
Finland	18.8	16.2	13.8	18	15.2	15.2	33.3	40	37	10.3	8.7	10.2	9.6	7.4	9.8	5.5	5.4	6.7	4.5	7.2	7.4
Sweden	9.9	7.1	10	12.4	11.2	10	39.2	33.4	41.2	13.4	14.7	10.5	9.2	12.7	12.1	6.1	5.9	6.7	9.8	15.1	9.5
United Kingdom	9.3	8	8.7	14.6	8.5	12.1	29.2	29.4	28.7	11.5	10.6	13.4	12.5	16.4	13.4	7.2	9.4	6.8	15.8	17.7	16.9

A-2.4

team work		
2000	**2005**	**2010**
49.9	61.5	57.7
63.7	62.3	69.7
53.6	61.2	62.2
51.5	54.1	39.8
52.7	41.1	57.4
53.9	47.2	54.6
74.5	67.5	67.4
38.5	38.6	53.3
70.2	69.6	55.2
70.5	80.1	62.6
65	56.7	64.6
52.5	47.1	45.2
63.2	73.4	66.6
60.8	70.6	72.4
76.6	71.6	66.8

A-2.5

	open-ended contracts			
	1995	**2000**	**2005**	**2010**
Belgium	84.4	90.5	91.2	87.5
Denmark	80.7	81.1	82.7	87.2
Germany	86.9	86	86.6	86.5
Greece	78.8	54.6	59.1	59.9
Spain	60.1	70.5	69.9	71
France	76	84.8	85.2	86.6
Ireland	86.3	82.4	61.3	69.9
Italy	80.6	87.6	80.5	86.3
Luxembourg	83.8	87.9	88.5	89.2
Netherlands	80.8	89	84.2	84.6
Austria	87.9	87.1	75.3	87.2
Portugal	80.5	76.6	76	74.8
Finland	79.7	76.9	81	85.3
Sweden	88	88.9	85.7	87.7
United Kingdom	94.2	85.3	69.7	88.5

A-3: Country Values

country level variables in 2010				
country	**EPL. Regular**	**EPL.temporary**	**unemployment**	**union density**
Austria	2.37	1.31	4.40	28.40
Belgium	2.00	2.38	8.31	50.60
Denmark	2.13	1.38	7.45	68.50
Finland	2.17	1.56	8.38	70.00
France	2.38	3.63	9.73	7.90
Germany	2.87	1.00	7.08	18.60
Greece	2.80	2.75	12.57	25.40
Ireland	1.27	0.63	13.90	36.60
Italy	2.76	2.00	8.43	35.50
Luxembourg	2.25	3.75	4.58	37.30
Netherlands	2.82	0.94	4.47	19.30
Portugal	4.13	1.94	11.00	19.30
Spain	2.36	3.00	20.08	15.60
Sweden	2.61	0.81	8.58	68.90
UK	1.20	0.38	7.78	27.10

Appendix B: Correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	1.00																													
2	0.03	1.00																												
3	0.05	0.61	1.00																											
4	0.00	0.07	0.07	1.00																										
5	-0.02	0.00	0.03	0.26	1.00																									
6	-0.20	-0.08	-0.08	0.06	0.06	1.00																								
7	-0.12	0.01	0.05	0.36	0.23	0.08	1.00																							
8	0.02	-0.11	-0.07	-0.11	-0.05	-0.07	-0.05	1.00																						
9	0.13	-0.04	-0.01	-0.14	-0.06	-0.18	-0.13	0.17	1.00																					
10	0.00	0.00	0.03	0.12	0.13	0.00	0.03	0.02	0.03	1.00																				
11	0.03	0.12	0.18	0.14	0.19	-0.08	0.13	-0.03	0.04	0.12	1.00																			
12	0.02	0.05	0.10	0.23	0.24	-0.02	0.25	0.00	0.05	0.12	0.19	1.00																		
13	0.00	0.07	0.10	0.19	0.16	-0.02	0.21	0.01	0.04	0.11	0.19	0.45	1.00																	
14	0.05	-0.09	-0.11	-0.08	-0.05	-0.02	-0.05	0.06	0.06	0.00	-0.01	-0.03	-0.02	1.00																
15	-0.06	-0.06	-0.10	-0.08	-0.11	0.11	-0.09	-0.02	-0.03	-0.09	-0.25	-0.13	-0.14	0.02	1.00															
16	-0.01	-0.07	-0.08	-0.06	-0.09	0.08	-0.09	-0.02	-0.02	-0.02	-0.26	-0.10	-0.11	0.00	-0.15	1.00														
17	-0.02	0.01	-0.02	0.00	-0.01	0.03	-0.04	-0.01	-0.01	0.00	-0.04	-0.03	-0.02	-0.02	-0.24	-0.30	1.00													
18	0.01	0.04	0.04	0.00	0.01	-0.03	0.01	0.00	0.01	0.00	0.13	0.04	0.02	0.01	-0.13	-0.16	-0.26	1.00												
19	0.03	0.03	0.03	0.03	0.05	-0.07	0.04	0.03	0.02	0.01	0.17	0.07	0.08	0.00	-0.12	-0.16	-0.25	-0.13	1.00											
20	0.03	0.03	0.06	0.03	0.06	-0.07	0.07	0.01	0.03	0.03	0.15	0.05	0.06	-0.01	-0.09	-0.11	-0.18	-0.10	-0.09	1.00										
21	0.03	0.04	0.10	0.09	0.12	-0.08	0.15	0.01	0.02	0.07	0.19	0.14	0.14	0.00	-0.12	-0.15	-0.24	-0.13	-0.13	-0.09	1.00									
22	-0.07	0.02	0.00	0.22	0.15	0.08	0.19	-0.09	-0.11	0.07	0.12	0.10	0.06	0.01	-0.10	-0.09	0.01	0.05	0.02	0.04	0.09	1.00								
23	-0.03	0.04	0.04	0.22	0.12	0.03	0.31	-0.06	-0.10	0.02	0.06	0.12	0.11	-0.06	-0.05	-0.03	0.00	-0.01	0.02	0.04	0.05	-0.24	1.00							
24	-0.24	-0.07	-0.04	-0.13	-0.07	0.19	0.07	0.01	-0.09	-0.03	-0.10	-0.07	-0.05	-0.02	0.10	0.07	-0.01	-0.03	-0.05	-0.05	-0.05	-0.27	-0.38	1.00						
25	0.33	0.02	0.00	-0.24	-0.17	-0.28	-0.51	0.11	0.27	-0.04	-0.05	-0.12	-0.10	0.07	0.03	0.03	0.00	0.00	0.01	-0.02	-0.07	-0.27	-0.38	-0.43	1.00					
26	0.03	0.00	0.01	-0.05	-0.04	-0.10	-0.08	0.01	0.04	0.00	-0.05	-0.03	-0.04	-0.01	0.06	0.02	0.00	-0.01	-0.02	-0.02	-0.03	-0.04	-0.05	-0.06	0.14	1.00				
27	0.13	0.03	0.06	-0.03	-0.04	-0.30	-0.06	0.04	0.24	-0.01	0.09	0.07	0.07	0.00	-0.08	-0.07	-0.05	0.03	0.09	0.07	0.06	-0.09	-0.02	-0.16	0.25	-0.05	1.00			
28	0.04	0.08	0.15	0.05	0.07	-0.05	0.12	0.02	-0.06	0.04	0.11	0.04	0.04	-0.04	-0.06	-0.07	-0.02	0.02	0.04	0.06	0.08	-0.03	0.07	0.05	-0.09	-0.04	-0.14	1.00		
29	0.20	-0.02	-0.03	-0.02	-0.08	-0.12	-0.18	0.09	0.03	0.01	-0.09	-0.08	-0.08	0.05	0.03	0.07	0.03	-0.02	-0.04	-0.04	-0.07	-0.09	-0.09	-0.15	0.30	-0.04	-0.12	-0.10	1.00	
30	-0.24	-0.06	-0.12	0.02	0.04	0.35	0.09	-0.09	-0.17	-0.02	-0.07	-0.02	-0.03	0.00	0.07	0.06	0.03	-0.02	-0.06	-0.06	-0.04	0.15	0.04	0.19	-0.34	-0.17	-0.59	-0.46	-0.41	1.00

variables																														
															firm sizes								skills			sectors				
male	age	tenure	autonomy	trainingByEmployer	contactWithOutsiders	UsingComputer	dependOnBoss	dependOnMachine	teamwork	workerRepresentative	new process/technology	restructuring	immigrantBackground	between2and4	between5and9	between10and49	between50and99	between100and249	between250and499	moreThan500	SKILL.1	SKILL.2	SKILL.3	SKILL.4	AGRICULTURE	INDUSTRY	PUBLIC.SERVICE	CONSTRUCTION	PRIVATE.SEVICE
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	

Appendix C: Skill Categories and Their Distribution

C-1-Deriving Skill Categories

Step 1: Under the assumption that skills are developed through education, in order to find out similarities across occupational categories in terms of the skills that they require we cross tabulate ISCO occupational and ISCED educational categories, and convert this cross-tabulation into percentage scale

ISCO and ISCED categories cross-tabulation (percentages)	Education Categories	Pre-primary education	Primary education or first stage of basic education	Lower secondary or second stage of basic education	(Upper) secondary education	Post-secondary non-tertiary education	First stage of tertiary education	Second stage of tertiary education
ISCO occupations		**1**	**2**	**3**	**4**	**5**	**6**	**7**
isco1 - Legislators, senior officials and managers	**1**	*1*	*6*	*15*	*30*	*7*	*41*	*3*
isco2 - Professionals	**2**	*1*	*1*	*2*	*10*	*4*	*76*	*10*
isco3 - Technicians and associate professionals	**3**	*1*	*2*	*11*	*32*	*10*	*45*	*2*
isco4 - Clerks	**4**	*1*	*3*	*18*	*43*	*9*	*28*	*1*
isco5 - Service workers and shop and market sales workers	**5**	*1*	*6*	*24*	*46*	*7*	*18*	*1*
isco6 - Skilled agricultural and fishery workers	**6**	*4*	*27*	*27*	*32*	*5*	*6*	*1*
isco7 - Craft and related trades workers	**7**	*2*	*13*	*29*	*46*	*6*	*8*	*1*
isco8 - Plant and machine operators and assemblers	**8**	*2*	*12*	*33*	*44*	*6*	*6*	*1*
isco9 - Elementary occupations	**9**	*3*	*18*	*33*	*37*	*5*	*6*	*1*
isco0 - Armed forces	**10**	*1*	*2*	*21*	*42*	*7*	*30*	*1*

Step 2: We obtain chi-square values from this percentage table for all rows (i.e. occupations) by using each and every row as observed and expected values.

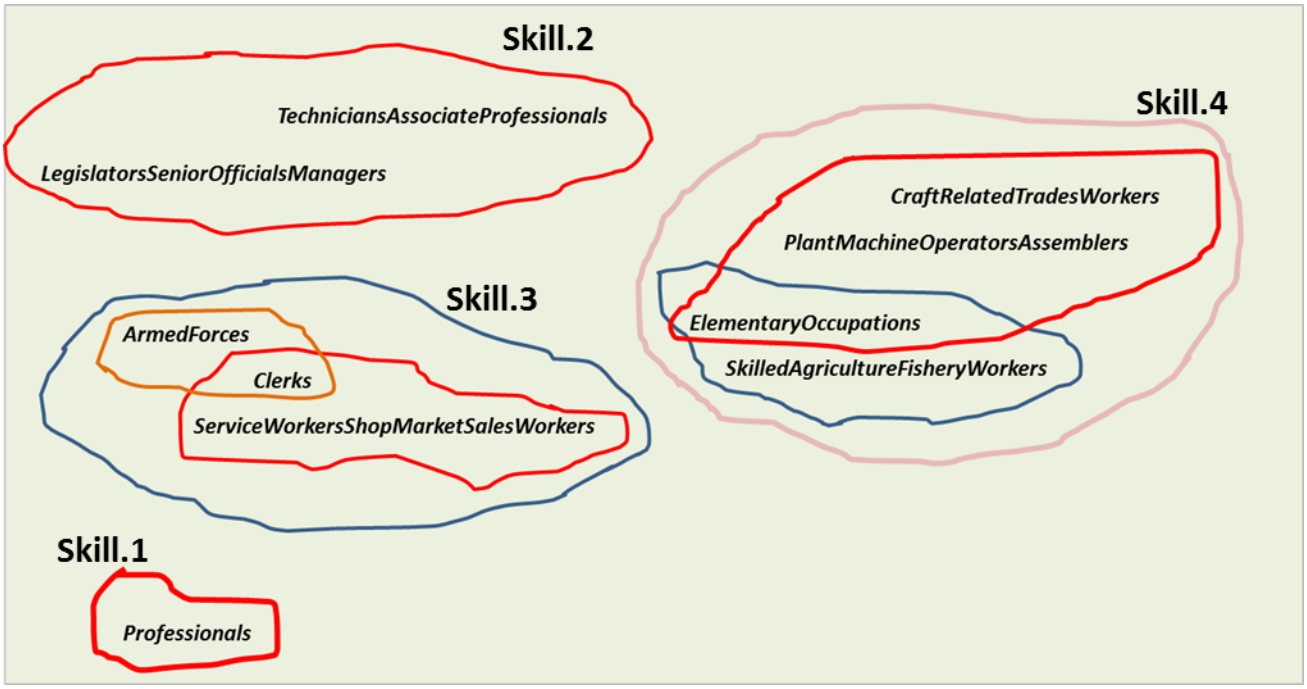
chi-square values	ISCO occupations									
ISCO occupations	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
isco1 - Legislators, senior officials and managers	0	173	11	18	42	233	157	226	229	21
isco2 - Professionals	76	0	80	207	322	963	725	964	964	195
isco3 - Technicians and associate professionals	6	118	0	17	57	294	200	284	290	17
isco4 - Clerks	14	286	16	0	9	114	64	96	105	2
isco5 - Service workers and shop and market sales workers	28	451	47	9	0	50	18	30	39	14
isco6 - Skilled agricultural and fishery workers	124	1119	382	227	96	0	22	25	7	345
isco7 - Craft and related trades workers	59	709	130	57	16	15	0	1	5	81
isco8 - Plant and machine operators and assemblers	66	792	135	59	19	15	1	0	4	77
isco9 - Elementary occupations	83	919	214	111	42	5	5	5	0	159
isco0 - Armed forces	14	322	19	1	11	127	73	109	117	0

Step 3: We obtain probabilities associated with each chi-square value. These p-values in fact show the probability of two occupations being statistically identical in terms of the skills that they require.

probabilities	ISCO occupations									
ISCO occupations	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
isco1 - Legislators, senior officials and managers	1	0	0.08	0.006	0	0	0	0	0	0.002
isco2 - Professionals	0	1	0	0	0	0	0	0	0	0
isco3 - Technicians and associate professionals	0.437	0	1	0.008	0	0	0	0	0	0.01
isco4 - Clerks	0.032	0	0.02	1	0.156	0	0	0	0	0.948
isco5 - Service workers and shop and market sales workers	0	0	0	0.161	1	0	0.007	0	0	0.034
isco6 - Skilled agricultural and fishery workers	0	0	0	0	0	1	0.001	0	0.359	0
isco7 - Craft and related trades workers	0	0	0	0	0.014	0.017	1	0.97	0.511	0
isco8 - Plant and machine operators and assemblers	0	0	0	0	0.005	0.018	0.976	1	0.696	0
isco9 - Elementary occupations	0	0	0	0	0	0.498	0.493	0.572	1	0
isco0 - Armed forces	0.028	0	0.01	0.963	0.077	0	0	0	0	1

In order to identify common skills across occupations this probability table should be examined both vertically and horizontally. For example, in column 1 there is only one statistically insignificant value that appears in third row, hinting that isco.1 and isco.3 have some common skills. Looking at the second row, one can see that all probabilities hint at significant differences between isco.2 and other occupations. In the same way examining column 2 and row 2 indicates that there are no common skills between isco.2 and other occupations. On the other hand row 9 shows that isco.9 has common skill requirements with isco.6, isco.7 and isco.8.

Step 4: The information revealed by the probability table is used to draw a Venn representation of occupations. Common areas show shared skills. Consequently, we observe four distinct skill categories. One of these only contains isco.2, i.e. professionals.



C-2-Distribution of Skill Categories

These skill categories (in terms of percentages) change over time and across countries as follows:

	skill 1				skill 2				skill 3				skill 4			
	1995	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**
Belgium	15.3	14.1	16.9	20	22.1	23.7	26	24.5	27.4	27	27.1	25.8	35.2	35.2	29.9	29.8
Denmark	12.8	13.6	15.7	18.9	24.5	27.8	31.2	31.9	27.5	24.9	21.3	21.7	35.3	33.7	31.8	27.5
Germany	11	12.3	14.3	16.4	27	27.9	28.1	29.2	24.5	22.3	23	22.3	37.5	37.5	34.5	32.1
Greece	7.3	8.7	10.3	10.2	17.5	17.6	19.4	20.6	23.7	26.1	28.3	28.1	51.5	47.7	42	41
Spain	10.9	11.6	11.5	13	16.7	17.7	18.5	20.5	24.5	24.1	23.8	25	47.9	46.6	46.2	41.5
France	8.9	9.3	12.1	12.7	25	26.7	27	30	26.9	25.4	26.4	24	39.2	38.6	34.4	33.3
Ireland	14.3	12.8	16.4	21.3	13.9	24.6	25.5	27	31.8	26.9	22.9	25.8	40	35.7	35.2	25.9
Italy	7.9	7.4	9.6	8	14.5	22.6	24	28.3	31.2	28.2	31.4	24.5	46.4	41.8	35	39.2
Luxembourg	11.4	10.6	19.8	25.8	22.5	23.8	25.8	26.9	27.9	26.8	23.2	21.2	38.1	38.8	31.3	26.2
Netherlands	16.4	16.6	32.6	22.3	31.5	35.6	20.1	33.7	21.5	18	23.8	17.9	30.7	29.8	23.6	26.1
Austria	1.1	9.3	4.2	9.3	27	21.9	35.1	27.3	30.1	26.2	25.1	27.3	41.9	42.6	35.6	36
Portugal	4	5.5	7.8	10.2	19.5	14.5	16.5	16.2	27.2	24.1	24.1	28.7	49.2	55.9	51.5	44.9
Finland	17.4	18	19.3	17.5	23.5	25.4	26.5	29.4	22.1	20	23	20.5	36.9	36.6	31.2	32.7
Sweden	15.5	17.3	20.4	20.4	25	25.9	25.5	27.1	28	26.8	25.9	24.4	31.5	29.9	28.3	28.2
United Kingdom	16.1	15.2	15.1	17.2	25.8	27.9	31.1	32	26.8	25.4	22.8	22.5	31.4	31.4	31	28.2