Temporary job protection and productivity growth in EU economies

Damiani, Mirella and Pompei, Fabrizio and Ricci, Andrea

Department of Economics, Finance and Statistics, University of Perugia, Department of Economics, Finance and Statistics, University of Perugia, Italian Institute for the Development of Workers' Vocational Training

18 March 2011

Temporary job protection and productivity growth in EU economies

ABSTRACT

The present study examines national and sectoral differences in Total Factor Productivity (TFP) in fourteen European countries and ten sectors from 1995 to 2007. The main aim is to ascertain the influence of employment protection for temporary contracts on TFP by estimating its effects using a "difference-in-difference" approach. The results indicate that the deregulation of temporary contracts negatively influences TFP growth in European economies and that, within the sectoral analysis, the influence of this liberalisation is greater in industries in which firms are more used to opening short-term positions. Furthermore, we find that liberalising temporary employment discourages training and the acquisition of firm-specific skills.

1. **Introduction**

This paper analyses productivity disparities in European Union economies over a period (1995-2007) that has witnessed a marked slow-down in average European efficiency growth and significant intra-European cross-country differences. Other studies have shown that from the mid-1990s until 2005, EU countries lost ground relative to the US, not because of adverse changes in labour composition or insufficient rates of capital accumulation, but due to the lack of innovation capability (Inklaar et al. 2008, van Ark et al. 2008). These prior works also found that a prominent role in explaining cross-country labour productivity differences was played by growth in Total Factor Productivity (TFP), the efficiency component that reflects disembodied technical changes that are not embodied in the quality of inputs and are attributable to organisational and institutional determinants. In addition, it was also noted that the differentials

in the rates of efficiency improvement in the use of inputs among European economies mainly involved market services that indicated a widening of the productivity gap with respect to other sectors (Inklaar et al. 2008).

The issue of TFP growth and its heterogeneity within EU economies has been reconsidered in the present paper, whose main aim is to more closely examine the role of labour market reforms related to temporary jobs. The paper highlights the key role of labour regulation of temporary contracts in explaining TFP heterogeneity *within* the EU economies and accounting for the divergence of productivity growth among sectors.

After the mid-1990s, the liberalisation of labour markets was recorded in Europe; among the main policy reversals, new regulatory frameworks for temporary contracts were introduced. These types of reform have been applied in various countries, albeit at different speeds, and have been more frequently adopted than changes in rules for regular jobs. As a result, a steady increase of temporary employment has characterised several European economies and the current aggregate evidence indicates that approximately 14% of EU employees work on temporary contracts (OECD, 2011).

The deeper motives for the promotion of labour market flexibility are found in the theoretical literature on the potential costs and benefits of the protection of short-term positions.

Indeed, temporary contracts may exert two probable but opposing effects on productivity.

On the one hand, these contracts favour all reallocation processes triggered by technology or demand shocks, which call for faster adaptation and job changes. They may also have an incentive effect, assuming that fixed-term workers aim to obtain permanent positions. Hence, these arrangements may serve as screening devices for the selection of new employees (Engellandt and Riphahn, 2005, p. 2). In addition, in the case of rigid regulations for *permanent* contracts, *temporary* workers play a role as 'buffer stock' because firms can adjust their workforces by varying the number of temporary contracts, thus quickly responding to changes in demand and technology.

On the other hand, as theoretically argued by Blanchard and Landier (2002), the deregulation of temporary contracts may merely increase turnover in the labour market because permanent jobs remain costly to dissolve due to severe restrictions on dismissals. Indeed, firms will be reluctant to retain workers after their temporary contracts expire and hire them for regular jobs even if the 'match' is productive. This situation arises because firms cannot freely choose to separate later on, as such instances are normally subject to firing costs. The authors also offer evidence in the French case – over the period from 1983 to 2000 – that unambiguously confirms that partial reforms in employment protection may be perverse: when

firms are allowed to hire workers on fixed-term contracts, the outcomes are "more low productivity entry-level jobs, fewer regular jobs and, so, lower overall productivity and output" (Blanchard and Landier, 2002, p. F215).

In the same vein, Boeri and Garibaldi (2007) focus on the transitional 'honeymoon effect' of labour market reforms, which aim to allow some flexibility by implementing reforms 'at the margin'. Two-tiered reforms, as argued by the authors through a dynamic model of labour demand verified for the Italian case, produce an increase in short-term employment but also a slowdown in productivity caused by a decrease in the marginal returns of labour services (Boeri and Garibaldi, 2007).

Additional considerations concern human capital accumulation and productivity. Indeed, as shown by Belot and van Ours (2007), labour protection encourages employees to invest in match-specific human capital by increasing the probability of the survival of the match, and this beneficial effect is stronger in sectors where firm specialisation in competencies is more important. This outcome is also more relevant in all contexts where risk-averse employees are liquidity-constrained and cannot obtain insurance against dismissal. However, as argued by Belot and van Ours, there is a trade-off between these positive effects and the negative consequences of EPL, which also raises the costs of separation; this implies that there is a positive optimal level of employment protection such that increasing employment protection improves welfare over some ranges.

More general results that are not conditioned by the presence of risk-averse employees and financial imperfections are obtained by Ricci and Waldman (2010). In their matching model, which is similar to that of Mortensen and Pissarides (1994), workers are not able to influence the amount of training, which is chosen unilaterally by firms, and a well-designed policy that combines firing taxes for newly hired personnel and subsidies for hiring always increases the level of training and job tenure with unambiguous positive effects on welfare.

Concerning comparative empirical studies, there is limited empirical evidence thus far on the relationship between employment protection and productivity, and the regulation of temporary contracts has obtained even less attention.

Notice also that the few empirical analyses that have estimated the influence of measures of employment protection on productivity, such as the works of Nickell and Layard (1999) and Dew-Becker and Gordon (2012), have used aggregate regression analysis to examine the relationship between employment protection legislation (EPL) and productivity. However, the validity of these types of investigations may be limited by confounding factors that influence the cross-country effects of EPL. This problem is addressed by Micco and Pages (2006) and

Bassanini et al. (2009), who use a difference-in-difference approach to estimate the influence of national institutional variables by controlling for industry effects.

The present paper adopts the same difference-in-difference approach but gives special attention to the regulation of temporary jobs rather than focusing on aggregate measures of employment protection or the protection of regular jobs, which has already been done by the authors mentioned above. Indeed, the major contribution of this paper is to ascertain the role of the protection of this type of job in explaining the ample differentials in TFP recorded in EU economies. It finds that the deregulation of temporary workers negatively influences TFP growth and, within a sectoral analysis, that these effects are greater in industries in which firms are more used to making staff changes by opening short-term positions. In particular, in labour-intensive sectors such as services, fixed-term contracts, which imply shorter-term jobs and lower employment tenures, may discourage investment in skills and have detrimental effects on TFP.

This result represents the major contribution of the present paper. On the one hand, this paper integrates the only partially answered question of the poor performance of the tertiary sector, which has already been highlighted by Inklaar et al. (2008). On the other hand, it sheds light on the influence of regulations of short-term contracts on efficiency changes, thus it significantly contributes to broadening the available literature (Micco and Pages, 2006; Bassanini et al.2009), which is mainly focused on the regulation of permanent jobs. Notice that Bassanini et al. (2009) introduce in some specifications the employment protection for temporary workers as a control for their key explanatory variable (regulation of permanent contracts) and obtain that stricter protection for temporary workers positively influence TFP growth only when job turnover rates of the United States is used as a proxy for underlying propensity to use temporary contracts in the absence of EPLT.

Unlike these authors, we use the sectoral share of temporary workers in the UK as a proxy for underlying propensity to use temporary contracts and obtain always positive and significant effects of the stringency of protection for this category of workers on TFP growth.

This article also demonstrates that labour liberalisation negatively influences the provision of work-related *training* and thus offers additional support to the thesis that policies oriented toward flexibility through lower training are ultimately detrimental to improvements in efficiency.

The paper is organised as follows. Section 2 presents the data and their sources, and Section 3 offers some descriptive statistics concerning the key variables used in the econometric analysis. Section 4 discusses the econometric strategy and estimates, and Section 5 concludes.

2 Data and sources

Our empirical investigation relies on several databases: EU KLEMS accounts (see Timmer et al. 2007), the OECD indexes for employment protection and product market regulation (Venn, 2009; Conway and Nicoletti, 2006), EUROSTAT, the ICTWSS database of Visser (2011) and the Comparative Political Dataset III (Armingeon et al. 2011).

The key variables used to study the influence of employment protection on TFP growth, as well as other control variables, are provided by these different databases; thus, the first step of our research involved matching them and carrying out a disaggregated analysis at the sector and country levels. First, the availability of data and the need for a large and consistent sector and country profiles led us to select only 14 countries out of the 27 European Union members and to re-arrange the NACE rev.1 sections into 10 industries.

This approach made it possible to compare the following economies: Austria, Belgium, the Czech Republic, Denmark, Spain, Finland, France, Germany, Hungary, Ireland, Italy, the Netherlands, Sweden and the United Kingdom. This selection, as noted above, was dictated by data availability and includes two sets of countries: i) 12 Old Member States and ii) 2 New Member States. The second small set comprises Hungary and the Czech Republic, two "market-oriented" economies with some similarities to the Anglo-Saxon countries (European Commission, 2004).

The selected sectors consist of: 1) Agriculture, 2) Mining and Quarrying, 3) Manufacturing, 4) Energy, 5) Construction, 6) Wholesale and Retail Trade, 7) Hotels and Restaurants, 8) Transport, Storage and Communications, 9) Financial Intermediation, Real Estate and Business Services and 10) Community, Social and Personal Services.

We selected the dependent variable of our econometric estimates, TFP growth, from the EU KLEMS database. One of the main advantages of this database is its detailed breakdown of industries and service sectors and its decomposition of labour productivity; it is also worth noting that this decomposition was computed by considering differences in labour quality (highly skilled, medium-skilled and low-skilled, gender and different age classes) and a broad selection of asset types (distinction between ICT capital and non-ICT capital services).

In addition, we used EU KLEMS to estimate TFP levels, which allowed us to compute the distance of TFP from the technological frontier, i.e., the ratio of TFP in a specific country and industry to the TFP level of the leader in that industry (Aghion and Griffith, 2005; Griffith et al., 2004). For additional details on TFP growth and TFP levels, see the appendix.

From the OECD database, we selected the set of explanatory variables related to labour and product market regulation, i.e., employment protection legislation for regular and temporary workers (EPLR and EPLT, respectively) and the indicator of regulatory impact that measures the 'knock-on' effects of regulation in non-manufacturing sectors on all sectors of the economy (RI).

Union density and bargaining coverage are drawn from the ICTWSS database of Visser (2011).

The important explanatory variables of TFP used as controls, particularly sectoral R&D expenses, which were standardised to value added, were taken from EUROSTAT. This database was also used to compute the share of workers with temporary jobs to total employees at the sector and country levels. In the descriptive analysis, we used this indicator for information on the actual utilisation of labour market flexibility. We also introduced the sectoral average level of this ratio for the UK as a benchmark in our difference-in-difference model, i.e., as the underlying propensity to use temporary workers in the absence of EPLT[1].

In addition, the UK percentage ratio of annual lay-offs to total employment was introduced as a proxy for lay-off propensity in the absence of EPLR and was obtained from the waves of the UK Quarterly Labour Force Survey released by the Office of National Statistics. The indicators for formal training were obtained from the EUROSTAT Continuing Vocational Training Survey (CVTS). Finally, we used two indicators for the political orientation of governments and parliaments as instruments in IV estimates. These indicators are drawn from the Comparative Political Data Set III (Armingeon et al. 2011). A more detailed description of the data is presented in Table A1 in the appendix.

3 Descriptive statistics

Table 1 reports the summary statistics of all data introduced in the econometric analysis. Let us begin with the variables of main interest, TFP growth and employment protection. Between 1995 and 2007, there was a low average rate (0.65% per year) of TFP growth (at the sector and country levels) and a much lower median value (0.29%); this implies that the average figures were the result of huge country and sectoral differentials, as also signalled by the high value of the standard deviation (6.03). During the same period, the strictness of the protection of temporary workers reached a lower level than that offered to regular workers, as shown by the comparison between EPLT (1.76) and EPLR (2.26). The difference was also greater when we consider the indicator per permanent contract (EPLR refined), which includes provisions for collective dismissals (2.52). In addition, the variability in the degree of protection for temporary workers across countries was much greater than that registered for regular workers (the standard deviations were 1.12 and 0.64, respectively).

Additional information from the comparison between the beginning and the end of the period (see appendix, Table A.2) reveals that in 1995, the overall annual TFP growth rate (0.97%) was above the average (0.65%) as well as the value registered at the end of the period (- 0.11%). This result happened despite the slight increase in R&D intensity (from 0.87 to 1.07 %) and the improvement in pro-competitive policies (RI decreased from 0.19 to 0.13). Information from other control variables for the labour market shows the declining tendencies of union density and bargaining coverage, as well as those of all indicators of continuing vocational training in enterprises.

PLEASE INSERT TABLE 1 ABOUT HERE

A visualisation of the changes in the protection of temporary workers is provided in Figure 1, which compares EPLT indexes in 1995 and 2007 throughout the EU economies.

Spain, France, Italy and Belgium are in the group of persistently highly regulated countries, with EPLT values above the median either in 1995 and 2007. Italy, which in 1995 had the strictest regulations for temporary contracts, later implemented a large-scale liberalisation, and the EPLT index (which ranges from 0 to 6) fell by 3.5 points. Significant easing was also recorded in Belgium (but with a lower reduction of 2 points). Spain, in contrast, has slightly increased restrictions on temporary contracts; hence, its employment regulation in 2007 was were still more stringent than the EU median.

PLEASE INSERT FIGURE 1 ABOUT HERE

Germany shows an important reduction of EPLT and falls under the median in 2007, closely approximating the group of moderately regulated countries, Finland, Sweden, Austria, Denmark and the Netherlands, which are characterised by stability or slight reductions (notably, Sweden and the Netherlands).

The last group includes countries with low levels of regulation (with EPLT below the 1995 and 2007 medians); Anglo-Saxon economies and Eastern European countries (Hungary and Czech Republic) are included in this group. It is noteworthy that the UK is the country with the most flexible labour market over the entire sampled period; thus, the lowest protection levels for both regular workers (Venn, 2009) and temporary workers recorded in the UK make it plausible to assume that this country shows a 'natural' propensity to hire temporary workers, where only technological and other idiosyncratic factors matter, irrespective of protective legislation. The same reasoning holds for lay-offs in the UK, which, as we will discuss in the next section, is used as benchmark for other labour market control variables (EPLR, union density and coverage bargaining).

Additional confirmation for the validity of choosing the UK as the benchmark country, as in similar studies (Bassanini et al.2009; Cingano et al. 2010), is offered by data on the national and sectoral diffusion of temporary contracts (see Table 2 and A.3 in appendix). Indeed, in almost all sectors, the UK's propensity to employ fixed-term workers remains quite stable or slightly decreases between 1995 and 2007, whereas it increases in all other sectors and countries (see Table A.3 in appendix). Concerning the sectoral diffusion of temporary workers, we noticed that in almost all countries, Agriculture, Hotels and Restaurants, Public Administration and Other Services and Construction show propensities to employ temporary workers above their respective median values, whereas the opposite is true for Manufacturing and Transport and Communication (see Table 2).

PLEASE INSERT TABLE 2 ABOUT HERE

Finally, TFP growth rates at the sector and country levels are reported in Table 3. These data confirm the great variability in performance across countries and sectors mentioned above. Let us take, for example, the countries where EPLT levels decreased: Belgium, Italy, Germany, Sweden and the Netherlands. In all these countries, sectors with a low propensity to use temporary workers, such as Manufacturing, show an annual average TFP growth rate that is higher than that registered in Public Administration or in Hotels and Restaurants, which are sectors with high shares of fixed-term labour[2]. Obviously, many factors condition this descriptive result. However, this evidence also seems to suggest that a reduction in the protection of temporary workers mainly affects TFP growth in sectors that more intensively use this type of contracts and encourages us to further explore this issue.

PLEASE INSERT TABLE 3 ABOUT HERE

4. Econometric analysis

4.1 Estimation strategy

In this section, we focus on the causal relationship between the protection of temporary workers (EPLT) and TFP growth. To identify this effect, we focus on the within-country growth differences between industries and over time.

Indeed, this empirical strategy is based on the assumption that EPLT influences efficiency growth in sectors that show higher propensities to use temporary workers and that adjust employment more than others. More precisely, following Rajan and Zingales (1998) and Bassanini et al. (2009), we assume that the difference in TFP growth between any pair of industries (h and k) is equal to the expected value (E) of a function of EPLT and its change multiplied by the difference between the propensity to employ temporary workers that we find between the two industries. This propensity is

measured, as mentioned above, in the UK because this country has the lowest employment protection levels for both temporary and regular workers. We thus exploit differences across sectors to implement a difference-in-difference method for our sample of 10 industries in 14 EU economies. We obtain the following equation:

$$E(\Delta lnTFP_{ikt} - \Delta lnTFP_{iht}) = (\Lambda_k - \Lambda_h) \cdot f(EPLT_{i,t-1}, \Delta EPLT_{i,t}) \text{ (1)}$$

where TFP$_{ikt}$ and TFP$_{iht}$ denote TFP in country i and time t; k and h reference the pair of industries; and Λ is the average sectoral propensity to use temporary workers over the period from 1995 to 2007 in the benchmark country (the UK). In other words, the difference in the 'natural' propensity to employ temporary workers among various industries, multiplied by the different stringencies of EPLT across our sample countries, explains the differences in TFP growth rates at the sector and country levels.

Therefore, in the baseline specification, we estimated the following equation:

$$\Delta logTFP_{i,j,t} = \beta_1(\Lambda_j^1 EPLT_{i,t-1}) + \beta_2(\Lambda_j^1 \Delta EPLT_{i,t}) + \gamma_1(\Lambda_j^2 EPLR_{i,t-1}) + \gamma_2(\Lambda_j^2 \Delta EPLR_{i,t}) + D_j + D_{i,t} + \varepsilon_{i,j,t} \quad (2)$$

where $i = 14$ countries; $j = 10$ sectors; $t = 1995,\ldots2007$; $EPLT, EPLR$ and $\Delta EPLT, \Delta EPLR$ are the country- and time-varying indexes of employment legislation in level and annual variation, respectively; Λ_j^1, Λ_j^2 are the indicators of the average industrial propensity to use temporary contracts and lay-off workers, respectively, in the UK.

β_1 and β_2 are our key coefficients that refer to the interaction terms and capture the actual impact of EPLT (in level and variation) on TFP growth. γ_1 and γ_2 are related to the interaction terms of our main control variable, EPLR. We also included sector dummies (D_j) and country-by-time dummies (D_{it}) to control for country- and sector-specific factors that most likely influence TFP growth and that cannot be captured by the labour policy control variables included in our analysis.

We then gradually added other controls that relate either to other labour and product market institutions or to the technological context. We can write the following augmented equation:

$$\Delta logTFP_{i,j,t} = \beta_1(\Lambda_j^1 EPLT_{i,t-1}) + \beta_2(\Lambda_j^1 \Delta EPLT_{i,t}) + \gamma_1(\Lambda_j^2 EPLR_{i,t-1}) + \gamma_2(\Lambda_j^2 \Delta EPLR_{i,t}) + \delta_1(\Lambda_j^2 X_{i,t-1}) + \varphi_1 RI_{i,j,t-1} +$$
$$\varphi_2 \Delta RI_{i,j,t} - \vartheta logRelTFP_{i,j,t-1} + \omega RD_{i,j,t-1} + D_{i,t} + D_{jt} + \varepsilon_{i,j,t} \quad (3)$$

where, in addition to the variables discussed above, we find X, a matrix containing other labour market institutions at the country level, such as union density and bargaining coverage, that we treat

as EPLR (because we assume that these variables are more binding with a higher sectoral propensity to lay-off workers); RI, the regulatory product market indicator (in level and variation) at the sector and country levels; and research and development expenditures (R&D) and the distance from the technological frontier, (RelTFP), two indicators describing innovation that are discussed in sections 2 and 3.

In Equation (3) too, our key explanatory variable is the interaction term concerning EPLT (in level and variation). In contrast to Equation 2, we inserted, in addition to other dummies, a sector by time term (D_{jt}) that allows us to control for the growth rate of the industrial productivity frontier.

As we will see in the next section, Equation 3 has been subjected to several robustness checks and endogeneity tests by means of instrumental variable methods on both $EPLT$ and $\Delta EPLT$. All estimations have been run with pooled OLS because, according to Wooldrige (2002), this estimator is still unbiased and efficient if we use robust and clustered standard errors that are not serially correlated, as guaranteed by a proper test.

Finally, we also checked whether EPLT affects the accumulation of firm-specific human capital, measured by the indicator of continuing vocational training (*CVT*). The specification is as follows:

$$CVT_{i,j,t} = \beta_1\big(\Lambda_j^1 EPLT_{i,t-1}\big) + \mu_i + \varepsilon_{i,j,t} \qquad (4)$$

where *i*=1, …14 countries; *j*= 1, …10 sectors; *t* = 1999 and 2005 (the EUROSTAT survey has only been performed for these two years); μ_i are dummies that capture the specific effects of pro-training policies at the country level. The hypothesis behind Equation (4) is that the influence of EPLT on TFP growth might also reflect the fact that when restrictions on temporary contracts are more stringent, firms and employees have an incentive to increase training. Estimates of Equation 4 test this hypothesis.

4.2 Econometric results

4.2.1 Effects of the regulation of temporary workers

This subsection presents our main results for the baseline specifications summed up by Equation 2. We first test the role of the protection of temporary workers in levels (Table 4, column 1) and then gradually add our main controls with regard to the protection of regular workers (EPLR) and annual variations in EPLT and EPLR (Table 4, columns 2, 3 and 4, respectively)[3].

Notice that the impact of EPLT on TFP is likely to differ across industries and that we thus need to estimate the impact of the degree of its stringency on cross-industry differences by adopting the difference-in-difference method described above. With this strategy, we rule out the potential confounding factors that influence cross-country variations. Thus, we insert EPLT interacted with the share of temporary contracts in the benchmark economy, the UK, i.e., the interaction term EPLT

*TWS_Bench$_i$ (column 1). Analogously, we also control for the role of EPLR on TFP growth including the interaction term EPLR *Lay off Bench$_i$ (column 2).

PLEASE INSERT TABLE 4

The results suggest that TFP growth tends to be higher in industries with greater propensities to use temporary contracts, the more stringent the level of EPLT.

Additionally, by introducing the annual variations in EPLT and EPLR (columns 3 and 4), we can further verify our main results and find that the estimated effect of EPLT *TWS_Bench$_i$ is positive and significant.

Conversely, no significant impacts are found for EPLR, meaning that the stringency of the protection of regular workers does not play a significant role in industries where the propensity to lay off is higher. Additionally, annual changes in EPL (ΔEPLT and ΔEPLR) do not induce significant differences in TFP growth between binding and non-binding sectors. Especially for ΔEPLT, this means that we cannot identify the short-run effects of the easing of regulation on TFP growth (Bassanini et al, 2009).

To illustrate our key result for the role of EPLT, let us consider an example.

According to our estimates (last specifications in columns 3 and 4 of Table 4), a one-point restriction on this legislation should increase by 0.126 percentage points the difference in the annual TFP growth between two industries whose average rate of the propensity to employ temporary workers differs by 1 percentage point. Note that even if the estimated effect for EPLT appears to be small, it is not negligible because it depends on both the magnitude of the cumulative change in the EPLT indicator over the 1995-2007 period and on sectoral propensities to employ temporary workers. To better evaluate the meaning of our key result (i.e., the coefficient of EPLT*TWS_Bench$_i$), let us consider, for example, the Hotels and Restaurants and Manufacturing sectors. As discussed above (see section 3), in the benchmark country, the UK, the former is an industry with a high propensity to use fixed-term contracts, whereas the latter exhibits the opposite characteristic.

We can now quantify the difference in TFP growth between these two sectors recorded in different countries (those that have implemented the liberalisation of temporary contracts in our sample period) and explain them according to their respective EPLT stances.

In Table 5 (Panel A), columns 1, 2 and 3 report the values of cumulative TFP growth rates in Hotels and Restaurants and Manufacturing, and their difference in each economy, respectively. Column 4 shows the estimated β coefficient for EPLT*TWS_Bench$_i$ in the baseline specifications (columns 3 and 4 of Table 4), whereas column 5 of Table 5 reports the different natural propensities to use temporary contracts, $\Delta\Lambda$ (obtained from the values of the UK), and column 6 presents the

cumulative reduction of EPLT ($\Delta EPLT^c$) in our sample period. Finally, columns 7 and 8 show the values (absolute and percentage, respectively) of the difference in TFP growth explained by a lower level of labour protection.

Taking our estimates at face value, the result is especially important for economies showing high EPLT levels at the beginning of the sample period (Germany, Belgium and Italy). In Italy in particular, more than 22% of the difference in TFP changes between Hotels and Restaurants and Manufacturing is explained by the weakening of EPLT.

PLEASE INSERT TABLE 5 ABOUT HERE

We replicated the same exercise (Panel B of Table 5) by comparing Finance (a typical knowledge-intensive sector that includes many business services) with Manufacturing.

The difference in the propensity to employ temporary workers ($\Delta\Lambda$) between these two sectors is lower than that observed in the previous comparison, but it is still important (2.14 %). From our estimates, we obtain that if EPLT had not been reduced in Italy, the difference in the cumulative TFP growth rate between Finance and Manufacturing would have been 3.59 rather than 2.65, which is a difference of 36%. Notice also that this percentage reaches even higher values, approximately 50%, when the β coefficient for EPLT is obtained in the augmented model that takes technology into account (see Table 7 below).

4.2.2. Sensitivity to inclusion of controls for institutions and technology

In the next step, we reconsider the impact of the degree of EPLT stringency on cross-industry differences (EPLT *TWS_Bench$_i$), augmenting the model with other institutional and technological factors, as suggested by Equation (3). With these additional estimates, we relate to the broad literature that explores the role of the main determinants of TFP and obtain a confirmation that sectors with higher propensities to use temporary contracts record higher TFP growth in countries with more stringent EPLT. Furthermore, the magnitude of this effect is not negligible and is rather stable, ranging from 0.084 to 0.185 (see Tables 6 and 7). Notice that Bassanini et al., (2009) introduce EPLT, interacted with the UK lay-off rates or the US job turnover rates, as controls. These authors find that only EPLT interacted with turnover rates has a positive and significant influence on TFP growth. Conversely, we use the sectoral fraction of temporary workers in the UK as a proxy of the intrinsic propensity to hire temporary workers and obtain that the influence of EPLT on TFP growth is always significant and positive. Notice also that protection for regular workers in levels and variations remains insignificant. It is conceivable that in our sample period,

which was characterised by high recourse to temporary contracts, the main driving force has been represented by provisions concerning short-term jobs that likely capture all effects of labour regulation on efficiency changes.

We begin our analysis by considering the degree of competition, which is captured by the regulatory indicator, i.e., RI and its annual variations, ΔRI. Indeed, there is now a consensus that two main effects may operate: i) competition stimulates incumbent companies to increase their TFP by adopting new technologies and innovations, and ii) competition favours a process of creative destruction generated by the entry of new innovators and exit of former innovators, as clearly shown in the new Schumpeterian approach proposed by Aghion and Griffith (2005). Our results confirm that improvements in TFP are likely to be adopted when firms operate in product markets that are experiencing liberalisation because TFP improvements are positively associated with changes in RI (columns 1 and 6 of Table 6), whereas the level of RI has the expected negative sign, although it is not significant.

PLEASE INSERT TABLE 6 ABOUT HERE

We also estimate the role of labour market characteristics, such as union density (UD), collective bargaining coverage (COV) and their interaction[4], but find that these factors are not significant (Table 6). One plausible reason for this finding is that in confrontational environments, defensive clauses (due to greater labour power, captured by our institutional variables) encourage pro-productivity practices but also reinforce workers' rent-seeking behaviours, with inconclusive results (Freeman and Medoff, 1984).

With an additional set of estimates (Table 7) we consider technology: i) the ratio of R&D expenditures on value added at the sector and country levels (columns 1, 2, and 3); ii) the distance from the technological frontier (RelTFP) of a given industry (columns 4, 5, and 6); and iii) both variables (columns 7, 8, and 9).

The introduction of RelTFP allows us to take the convergence hypothesis into account: country-sectors lagging behind the country leader in a given industry are motivated to shorten the distance from the technological frontier by adopting technological innovations such as those developed by the industry leaders. Thus, according to these catching-up processes, TFP growth increases when the distance from the frontier is larger. Our findings support this hypothesis, as shown by the negative and significant coefficient for RelTFP in all specifications, in line with evidence presented by other studies (Griffith et al., 2004; Bassanini et al., 2009).

R&D intensity is another important determinant of TFP growth. Indeed, we expect that R&D, which is also a proxy for the entire set of intangibles not computed in input expenses, such as

knowledge and organisational capital, may contribute to determining the 'residual' aggregate of TFP, as clearly reported by Inklaar et al. (2008, pp. 148-149). Our estimates for R&D confirm this hypothesis (columns 1, 2, and 3 of Table 7). However, interestingly, the significance of this variable vanishes when we account for the distance to the frontier (columns 4-9 of Table 7). One reason for this result is that R&D not only stimulates innovation but also plays an additional role in facilitating 'the imitation of other discoveries', as shown by Griffith et al. (2004). Thus, when we introduce the productivity frontier, we also likely take the influence of research and development on TFP into account, i.e., its stimulus to speed up the pace of innovation, thus explaining the non-significant coefficient for R&D.

PLEASE INSERT TABLE 7 ABOUT HERE

4.2.3. Other robustness checks

Thus far, we have tested the role of the protection of regular workers, focusing only on firing costs for individual dismissals and finding that they are irrelevant in terms of TFP growth. A robustness check has been performed by including a refined indicator of EPLR that also takes collective dismissals into account (further details about this index are in Table A.1 in the appendix).

After replacing EPLR with the new and more comprehensive indicator, the estimated effects of regulations on individual and collective dismissals remain non-significant in 7 out of the 9 regressions reported in Table 8, whereas temporary protection is still positive and significant. Notice that the availability of the refined EPLR index from 1998 only, leads us to change the estimation period; a different time span (1998-2007) represents a further step in the sensitivity analysis of our results.

Additional estimates for different time periods (1995-2004; 1997-2006; 1998-2007) have been performed to test the role of our key variable, i.e., temporary protection, and almost all these estimates led to estimated coefficient values that are similar to those obtained in previous regressions (see the appendix, Tables A.5, A.6, A.7).

PLEASE INSERT TABLE 8 ABOUT HERE

Our findings appear to be robust to the last sensitivity test, which was performed by excluding the aggregate of 'Community, Social, Personal Services and No-Market Services' (Table 9, columns 1-4). The elimination of this sector, which includes government, health and education, is attributable to measurement problems that make calculations of output and productivity highly problematic and

14

justify its exclusion, as was done in similar analyses (see also Timmer et al., 2007). Our findings, which are restricted to the market economy, confirm the significant and positive effects of EPLT: lower restrictions on temporary jobs have negative effects on efficiency in market economy industries in which, in the absence of regulations, firms tend to rely on short-term positions to make workforce changes.

PLEASE INSERT TABLE 9 ABOUT HERE

4.2.4 Endogeneity

The possible endogeneity of labour regulations deserves further attention. It is conceivable that economies that exhibit poor performance in terms of TFP have a high demand for the revision of their employment protection legislations. Notice, however, that in our estimates using the difference-in-differences approach, the introduction of lagged regressors and country fixed effects should mitigate potential endogeneity.

In any case, to remove all doubts concerning the identification of causal effects, we carried out instrumental variable estimates and implemented an endogeneity test for our key variables. This method requires finding instruments that can predict the level and annual changes in EPLT without directly affecting the impact on TFP growth. Following Wooldridge (2002), it is plausible to assume that if the main effects (EPLT and ΔEPLT in our case) are correlated with instruments, this is also true for the interaction terms, EPLT *TWSBench$_i$ and ΔEPLT *TWSBench$_i$.

First, we introduce as instruments some key variables related to political institutions and some labour market characteristics that are not correlated with our dependent variable. These external instruments are: i) the Schmidt Index of Cabinet Composition (which ranges from 0 to 5, from the lowest to highest percentages of seats of left-wing parties in the cabinet), ii) the percentage of left-wing party parliamentary seats relative to all governmental parties (weighted by the number of days the government was in office in a given year); and iii) union density. The last variable may be a valid instrument because it is not correlated with TFP growth, as shown by its non-significance in all previous estimates (see Tables 6, 8 and 9). At the same time, it may influence our key regressor EPLT.

In addition, we also performed a robustness check of instrumental variable estimations by repeating the endogeneity tests with internal instruments, namely, the same interaction terms taken at time t-1 and t-2.

We ran two baseline specifications in which we separately tested endogeneity for EPLT *TWSBench $_i$ and ΔEPLT *TWSBench $_i$[5].

In the first column of Table 10, EPLT*TWSBench$_i$ has been instrumented with the external instruments discussed above. From the endogeneity tests, we cannot reject the null hypothesis that our key regressor can be treated as an exogenous variable. In addition, the coefficient of our instrumented variable, EPLT*TWSBench$_i$, shows the expected sign but is not significantly different from zero. This result most likely occurs because the external instruments are weak, as signalled by the value of the Wald F Statistic of Kleibergen-Paap[6].

For this reason, we also used internal instruments, i.e., the lagged values of EPLT *TWSBench$_i$ at time t-1 and t-2. The second column presents the results of this strategy. In this case, all tests confirm the validity of the internal instruments[7]. The coefficient of interest (0.144) is now positive, significant and not so different from the value obtained with the OLS estimates. Again, the endogeneity test tells us that EPLT*TWSBench$_i$ can be treated as an exogenous variable; in this context, OLS is an unbiased estimator and more efficient than the IV/GMM estimator (Wooldridge, 2002; Baum, 2003; 2007).

PLEASE INSERT TABLE 10 ABOUT HERE

In the third and fourth columns, we apply the same strategy for ΔEPLT*TWSBench $_i$, obtaining the same results. As in the OLS estimates, the coefficient of this regressor is not significant.

To summarise, all the results of the IV strategy confirm our previous results and verify that our key regressors are exogenous.

4.2.5 Employment protection legislation and training

All our main findings suggest, but do not directly prove, that EPLT liberalisation causes an inadequate accumulation of human capital, which, in turn, negatively influences organisational capabilities and all disembodied technological changes within firms, thus leading to disappointing TFP performance. Indeed, we expect that the progressive deregulation of short-term contracts and the consequential diffusion of these flexible contracts exert negative effects on the accumulation of human capital. Conversely, workers can afford to invest in firm-specific skills when the employment relationship is expected to last (Wasmer, 2006). Indeed, according to the human capital approach, as shown by Arulampalam and Booth (1998), the probability of investing in work-related training is higher the longer the post-training period over which agents can amortise their investments is.

Notice that empirical investigations usually only partially capture these types of associations because training recorded in available surveys is typically formal, whereas informal training, which takes place especially in small firms, is not registered.

In any case, we offer additional evidence for our sampled countries by testing the influence of EPLT on four measures of formal training provided by the Eurostat Continuing Vocational Training Survey (CVTS), one of the most important sources of internationally comparable data for the European Community, conducted for 1999 and 2005. The data are only available for two years, which led us to be very cautious. In any case, we exploit all available information and thus use four different indicators for the incidence and intensity of training as dependent variables: i) percentage of employees participating in CVT courses (CvtEmpl); ii) hours in CVT courses per employee (CvtHempl); iii) hours in CVT courses per 1,000 hours worked (CvtHwor); and iv) training enterprises as percentage of all enterprises (CvtFirm).

The results reported in Table 11 show, as we expected, that the incidence of training is affected by EPLT: the difference-in-difference estimates suggest that training tends to be lower in industries with greater propensities to use temporary contracts when the level of EPLT is less stringent. The rationale behind this finding is that lower degrees of EPLT likely cause the shortening of agents' time horizons and negatively affect the incidence and intensity of formal training programmes. This result is obtained for employees, hours and firms involved in CVT and is also present when controlling for country effects.

PLEASE INSERT TABLE 11 ABOUT HERE

Conclusions

We find that since 1995, EU countries have not followed homogenous patterns of growth, and additional heterogeneity has been caused by sectoral diversity: between-sector gaps are crucial, and the worst performance in terms of total factor productivity is recorded in some service sectors.

We have analysed these country-sector disparities in 14 EU economies and have then focused on some driving forces, such as the stringency of the employment protection of temporary jobs. Our empirical results show that liberalisation has had a detrimental influence on TFP, especially in sectors in which firms are more used to opening short-term positions.

These findings have been validated by various robustness checks. We have controlled for the employment protection of regular workers, considering restrictions on individual and collective dismissals; furthermore, we have controlled for other institutional variables (unions, bargaining

coverage, product market regulation) and technological factors that might have exerted a simultaneous impact on TFP. Our regressions cover all the industries in each economy, but are also restricted to market sectors, whose growth accounting is affected by minor measurement problems. One interpretation of these findings is that low levels of employee protection discourage long-term relationships and thus cause low investments in training because they do not offer incentives for workers to upgrade their skills. Thus, it is likely that the agents that should bear the training costs (firms or employees) do not find convenient work-related training when they expect job positions to be short-term, confirming that more stable employment prospects positively influence vocational training. Our supplementary estimates for training, which is negatively affected by labour flexibility policies, support these considerations: liberalising temporary work employment may discourage training and the acquisition of firm-specific skills.

Concerning policy implications, pro-competitive product market policies may play a positive role in efficiency growth, whereas the liberalisation of the labour market for temporary contracts negatively offsets this positive influence. In addition, our results suggest that the scope of two-tiered reforms seems to be limited, not only in terms of non-lasting employment growth (as shown in other studies, e.g., Boeri and Garibaldi, 2007) but also in terms of efficiency. Countries can reach the *same level* of aggregate labour flexibility, but they exhibit different TFP performance when they choose a different *composition* of regular and temporary restrictions. If firms in high-EPL countries can circumvent strict regulations by hiring workers for short-term jobs, they pay for this form of liberalisation with poor TFP improvements.

References

Aghion, P. and Griffith, R., 2005. Competition and Growth, Reconciling Theory and Evidence. Cambridge, MA, MIT Press.

Armingeon, K. et al., 2011. Comparative Political Data Set III 1990-2009. Institute of Political Science, University of Berne.

Arulampalam, W. and Booth, A.L., 1998. Training and labour market flexibility, is there a trade-off?. British Journal of Industrial Relations, 36, 521-536.

Baum, C. F., Schaffer, M.E., Stillman, S., 2003. Instrumental variables and GMM: Estimation and testing. The Stata Journal, 3: 1-31.

Baum, C. F., Schaffer, M.E., Stillman, S., 2007. Enhanced routines for instrumental variables/generalized method of moments estimation and testing. The Stata Journal, 7, 465-506.

Bassanini A., Nunziata L. and Venn D., 2009. Job Protection Legislation and Productivity Growth in OECD Countries. Economic Policy, 24, 349-402.

Belot, M., J. Boone and van Ours J.C., 2007. Welfare-Improving Employment Protection. Economica, 74, 381-396.

Blanchard, O. and Landier, A., 2002. The Perverse Effects of Partial Labour Market Reforms: Fixed Duration Contracts in France. The Economic Journal, 112, F214 -F244.

Boeri, T. and Garibaldi, P., 2007. Two Tier Reforms Of Employment Protection: A Honeymoon Effect?. The Economic Journal, 117, F357–F385.

Cingano, F., Leonardi, M., Messina, J., Pica, G., 2010.The Effects of Employment Protection Legislation and Financial Markets Imperfections on Investment: Evidence from a Firm Level Panel of EU Economies. Economic Policy, 25,117-163.

Conway, P. and Nicoletti, G., 2006. Product Market Regulation in the Non-Manufacturing Sectors of OECD Countries: Measurement and Highlights. OECD Papers, 6, 1-63.

Dew-Becker I. and Gordon R.J., 2012. The Role of Labor Market Changes in the Slowdown of European Productivity Growth. Review of Economics and Institutions, 3, 1-45.

Engellandt, A. and Riphahn R., 2005. Temporary Contracts and Employee Effort. Labour Economics, 12, 281-299.

European Commission 2004. Industrial Relations in Europe. European Commission Directorate-General for Employment and Social Affairs Unit D, Brussels.

Griffith, R., Redding, S. and Van Reenen J., 2004. Mapping the two faces of R&D: productivity growth in a panel of OECD industries. The Review of Economics and Statistics, 86, 883–95.

Inklaar, R., Timmer, M.P. and van Ark, B., 2008. Market services productivity across Europe and the US. Economic Policy 53, 139-194.

Nickell, S. and Layard, J., 1999. Individual Employment Contracts, in Ashenfelter O. and Card D. eds., Handbook of Labor Economics, Amsterdam, North Holland.

Micco, A. and Pages, C., 2006. The Economic Effects of Employment Protection: Evidence from International Industry-Level Data. IZA Discussion Paper , No.2433.

Mortensen, D.T. and Pissarides, C.A., 1994. Job creation and job destruction in the theory of unemployment. Review of Economic Studies, 61, 397–415.

Nickell, S.J. and Layard, R. 1999., Labour market institutions and economic performance. In Ashenfelter O. and Card D. eds. Handbook of Labor Economics, Amsterdam, North-Holland.

OECD 2011. Employment Outlook, Paris.

Rajan, R. and Zingales, L., 1998. Financial dependence and growth. American Economic Review, 88,559–86.

Ricci, A. and Waldmann, R., 2010. Firm Financed Training and Pareto Improving Firing Taxes, mimeo.

Timmer, M.P. et al., 2007. EU KLEMS Growth and Productivity Accounts. Version 1.0, PART I Methodology, on behalf of the EUKLEMS consortium.

van Ark, B., OMahony, M., Timmer, M.P., 2008. The productivity gap between Europe and the United States: trends and causes. Journal of Economic Perspectives, 22, 25-44.

Venn, D., 2009. Legislation, collective bargaining enforcement: Updating the OECD employment protection indicators. OECD Social, Employment and Migration Working Papers 89, OECD Publishing.

Visser, J., 2011. ICTWSS: Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts in 34 countries between1960 and 2007. Amsterdam Institute for Advanced Labour Studies AIAS, University of Amsterdam, Version 3 – May 2011, http://www.uva-aias.net/208.

Wasmer, E., 2006. General versus Specific Skills in Labor Markets with Search Frictions and Firing Costs. American Economic Review, 96, 811-831.

Wooldridge, J.M., 2002. Econometric Analysis of Cross Section and Panel Data. Cambridge, Massachussets, the MIT Press.

NOTES

[1] We provide further details about the benchmark identification in the next sections.

[2] The only exception is the Public Administration TFP growth in Italy, whose negative value is, in absolute terms, lower than that recorded in Manufacturing.

[3] We calculated robust standard errors that are clustered at the sector-country level, to account for heteroskedasticity and intra-panel correlation. The Wooldridge test guarantees that our pooled OLS estimations are not affected by other forms of serial correlation: the p-value reported in the table shows that we cannot reject the null hypothesis of the absence of serial correlation.

[4] Notice that UD and COV are available only at the country level; we thus adopt a difference-in-difference strategy and test the hypothesis that their protective roles are higher in sectors that are more exposed to threats of dismissals, i.e. with higher layoff rates.

[5] The first stage estimates are reported in Table A.8.

[6] Both the J statistic of Hansen (the over-identification test) and the Kleibergen-Paap LM Statistic (the under-identification test) show that the instruments are valid and the model is well-specified. However, the Wald F Statistic of Kleibergen-Paap is below 10, which indicates that the correlation between the regressor and the instruments is weak (Baum, 2003; 2007).

[7] The p-values of the over- and under-identification tests confirm that the instruments are valid; in addition, the Wald F Statistic of Kleibergen-Paap confirms that the instruments are not weak.

TABLES, FIGURES AND APPENDIX

Table 1 Descriptive statistics of the variables used in the empirical analysis

All years (1995-2007)						
Variables	Mean	St.Dev	Median	Min	Max	Obs
TFP (annual growth rate, %)	0.65	6.03	0.29	-42.23	58.23	1670
EPLT	1.76	1.12	1.50	0.25	5.38	1670
EPLR	2.26	0.64	2.33	0.95	3.31	1670
EPLR (refined)	2.52	0.46	2.52	1.50	3.21	1400
RI	0.16	0.13	0.10	0.01	0.70	1670
Union Density (%)	38.87	22.57	33.41	7.62	85.06	1670
Coverage Bargaining (%)	76.05	20.04	84.50	32.50	99.00	1670
TWS_Bench (%) (UK)	6.84	2.55	6.64	3.67	11.96	1670
Lay Off rate (%) (UK)	3.59	1.54	3.93	0.38	6.42	1670
R&D (%)	1.01	2.08	0.22	0.00	15.59	1486
RelTFP	-0.54	0.56	-0.40	-3.23	0.00	1428
Trained employees (%)	39.97	15.38	39.50	8.50	81.50	1452
Training per employee (hours)	12.19	6.21	11.00	2.00	33.00	1452
Share of training hours (%)	7.44	3.41	7.00	1.50	16.00	1512
Share of firms with training (%)	71.09	20.31	76.00	16.00	100.00	1452
Schmidt Index	2.88	1.46	3.00	1.00	5.00	1670
Parliament Composition	49.20	38.60	49.80	0.00	100.00	1670

Table 2 Proportion of temporary workers at sector and country level

	AUT	BEL	CZE	DNK	ESP	FIN	FRA	GER	HUN	IRL	ITA	NLD	SWE	UK
							All years (average 1995-2007)							
re	12.28	16.68	6.67	18.64	60.73	24.69	22.91	22.60	9.72	10.54	40.13	25.96	26.51	7.24
			3.73		21.86			7.86						8.70
turing	7.04	6.11	6.60	5.82	26.51	10.02	11.88	9.50	6.35	3.11	6.53	10.97	7.38	3.90
y&Gas	7.12	10.50	3.83		15.07	11.87	6.60	8.81	3.50		4.12	14.72		7.78
tion	11.33	4.24	6.81	12.49	59.49	16.77	15.00	13.82	10.75	5.68	12.72	7.65	11.22	5.18
le&RetailTrade		6.70	7.42	9.98	31.09	12.06	11.44	11.65	5.61	7.50	9.33	14.27	14.38	3.67
Restaurants	16.67	11.57	10.26	14.48	44.43	19.35	18.06	17.78	10.02	13.15	20.25	32.41	34.37	9.29
ts&Communications	4.34	4.19	3.99	5.44	23.74	9.11	8.17	8.19	3.49	4.41	6.23	11.93	11.98	4.63
RealEstate	4.43	6.72	7.43	5.92	26.38	14.22	10.58	11.06	5.40	5.31	8.90	12.92	12.64	6.04
lmin&OtherServices	8.29	11.07	9.79	13.06	27.03	25.58	16.82	15.60	7.93	7.87	10.18	11.28	17.91	8.97
	7.71	*6.72*	*6.74*	*11.24*	*26.77*	*14.22*	*11.88*	*11.36*	*6.35*	*6.59*	*9.33*	*12.92*	*13.51*	*6.64*

Note: all values are in percentage points

Table 3 Annual Average TFP growth rates at sector and country level

Sectors	AUT	BEL	CZE	DNK	ESP	FIN	FRA	GER	HUN	IRL	ITA	NLD	SWE	UK
						All years (annual average 1995-2007)								
Agriculture	3.34	0.00	1.92	-0.91	1.19	4.24	1.71	5.20	6.07	3.35	1.25	-0.20	3.81	2.19
Mining	4.85	0.20	-0.53	1.01	0.44	-0.65	-0.32	1.14	4.72	-1.69	-1.65	-2.10	-3.61	-2.20
Manufacturing	3.88	1.00	3.47	0.40	-0.42	4.88	1.96	2.27	3.52	1.64	-0.43	2.02	3.82	1.86
Electricity&Gas	4.65	2.56	-0.99	-2.15	1.37	2.82	3.76	1.88	-0.62	2.68	0.10	2.37	-2.03	0.83
Construction	2.26	0.91	-1.96	0.17	-2.16	0.43	-0.76	-0.39	1.03	-2.07	-1.56	-0.86	-0.65	0.32
Wholesale&RetailTrade	0.94	-1.60	5.08	0.89	-0.75	3.34	0.41	1.45	2.69	0.80	-0.88	3.22	2.31	1.13
Hotels&Restaurants	0.20	-1.25	-8.04	-3.86	-2.37	-0.86	-0.09	0.17	-1.53	1.72	-1.31	0.32	0.21	-0.39
Transports&Communications	1.53	-0.62	-0.69	1.13	-1.38	2.96	3.30	3.11	4.87	1.17	1.23	3.24	0.50	2.89
Finance&RealEstate	-1.46	-0.38	-0.83	-0.73	-0.08	-0.73	0.27	-1.06	1.36	1.68	-0.21	-0.40	-0.45	0.40
PublicAdmin&OtherServices	-0.69	-0.61	-0.91	-0.64	-0.61	-1.22	-0.22	0.33	2.20	-2.13	-0.01	-0.65	-0.33	-1.10
Median	*1.25*	*-0.22*	*0.13*	*-0.43*	*-0.84*	*1.86*	*0.79*	*0.81*	*2.58*	*0.17*	*-0.26*	*0.27*	*0.01*	*0.53*

Note: all values are in percentage points

Figure 1 Employment protection legislation index for temporary workers in 1995 and 2007
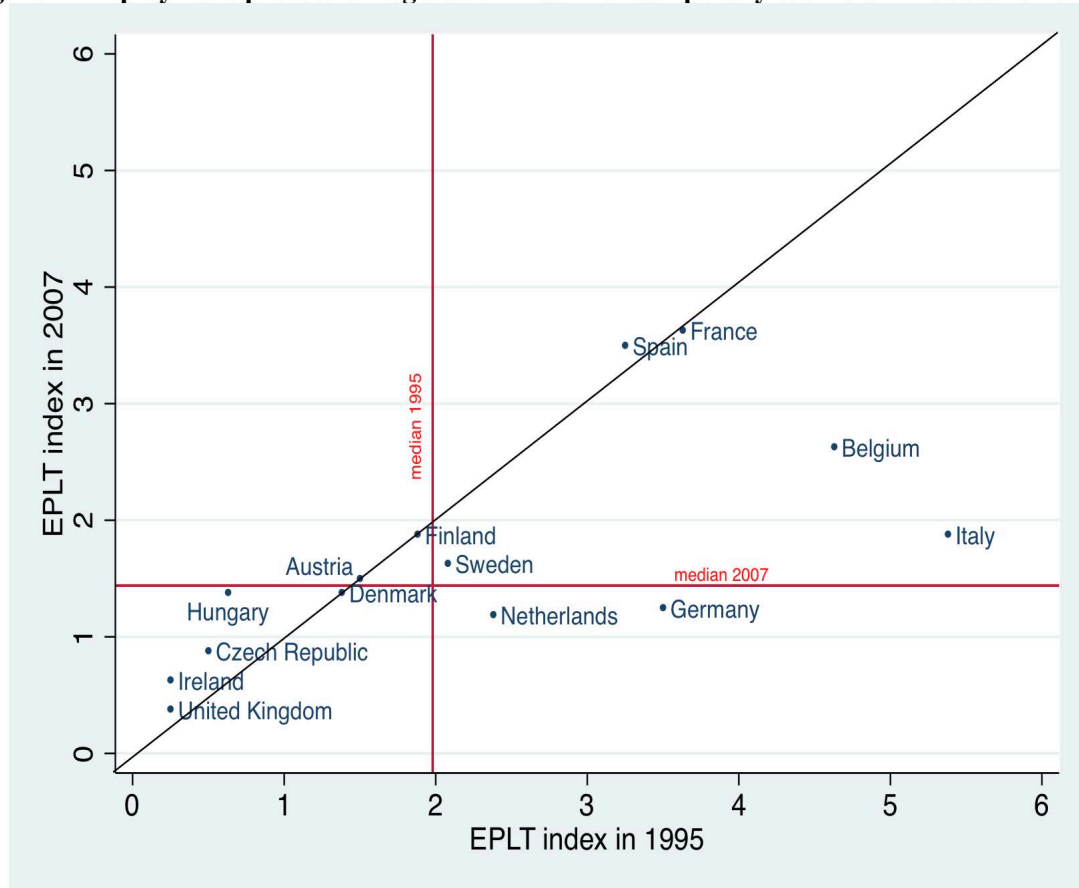
Table 4: TFP estimates for period 1995-2007, the role of Employment Protection for Temporary Workers (baseline specification)

Explanatory variables	Dependent variable TFP (annual growth rate)			
	1	2	3	4
EPLT * TWS_Bench	0.106***	0.106***	0.126***	0.126***
	(0.041)	(0.041)	(0.044)	(0.042)
EPLR * Lay Off_Bench		-0.073	-0.075	-0.155
		(0.098)	(0.097)	(0.168)
ΔEPLT * TWS_Bench			0.005	0.001
			(0.005)	(0.006)
ΔEPLR * Lay Off_Bench				-0.486
				(0.402)
Country x Time Dummies	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes
R_Squared	0.175	0.175	0.176	0.178
Wooldridge test for autocorrelation (p_value)	*0.252*	*0.257*	*0.346*	*0.353*
Obs	1670	1670	1670	1670

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: *OLS estimates. Robust standard errors in parentheses are clustered at sector-country level. All regressors reported in levels are taken at time t-1. The null hypothesis in the Wooldrige test is the absence of serial correlation.*

Table 5: Sectoral differences in the TFP growth explained by EPLT changes

A: Hotels and Restaurants versus Manufacturing

Country	TFP growth in H&R	TFP growth in M	Difference (1)-(2)	β_2	$\Delta\Lambda$	$\Delta EPLT^c$	$\beta_2*\Delta\Lambda*\Delta EPLT^c$	Proportion(%) (7)/(3)
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Belgium	-13.76	11.05	-24.81	0.126	5.39	-2.00	-1.36	5.47
Germany	2.04	27.23	-25.19	0.126	5.39	-2.25	-1.53	6.07
Italy	-15.70	-5.17	-10.53	0.126	5.39	-3.50	-2.38	22.57
Netherlands	3.86	24.23	-20.37	0.126	5.39	-1.19	-0.81	3.97
Sweden	2.55	45.79	-43.24	0.126	5.39	-0.45	-0.31	0.71

B: Finance and Real Estate versus Manufacturing

Country	TFP growth in F&RE	TFP growth in M	Difference (1)-(2)	β_2	$\Delta\Lambda$	$\Delta EPLT^c$	$\beta_2*\Delta\Lambda*\Delta EPLT^c$	Proportion(%) (7)/(3)
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Belgium	-4.17	11.05	-15.22	0.126	2.14	-2.00	-0.54	3.54
Germany	-12.76	27.23	-39.99	0.126	2.14	-2.25	-0.61	1.52
Italy	-2.52	-5.17	2.65	0.126	2.14	-3.50	-0.94	35.61
Netherlands	-4.86	24.23	-29.09	0.126	2.14	-1.19	-0.32	1.10
Sweden	-5.35	45.79	-51.14	0.126	2.14	-0.45	-0.12	0.24

Note: TFP growth is the cumulated growth rate over the period 1995-2007 in Manufacturing (M), Hotels and Restaurants (H&R), Finance and Real Estate (F&RE); $\Delta EPLT^c$ is the cumulated change of EPLT over the same period; $\Delta\Lambda$ is the difference between the sectoral propensity to employ temporary workers in the country benchmark (UK).

Table 6: TFP estimates for period 1995-2007, EPLT and other institutions

	Dependent variable TFP (annual growth rate)					
Explanatory variables	1	2	3	4	5	6
EPLT *TWSBench	0.118***	0.125***	0.132***	0.136***	0.136***	0.129***
	(0.045)	(0.045)	(0.046)	(0.046)	(0.046)	(0.046)
ΔEPLT * TWSBench	0.005	0.005	0.005	0.005	0.006	0.008
	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)
RI	-0.026					-0.022
	(0.028)					(0.027)
ΔRI	-0.108***					-0.107**
	(0.041)					(0.041)
Union Density*Lay-Off		-0.001		-0.003	-0.026	-0.019
		(0.003)		(0.003)	(0.025)	(0.024)
Coverage*Lay-Off			0.005	0.006	-0.001	0.000
			(0.004)	(0.004)	(0.007)	(0.007)
Union Density *Coverage *Lay-Off					0.000	0.000
					(0.000)	(0.000)
EPLR *Lay-Off	-0.071	-0.070	-0.102	-0.129	-0.167	-0.153
	(0.092)	(0.098)	(0.101)	(0.102)	(0.116)	(0.106)
ΔEPLR*Lay-Off	0.010	0.011	0.015	0.014	0.014	0.012
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.019)
Country*Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
R_Squared	0.138	0.138	0.176	0.138	0.138	0.176
Wooldridge test for autocorrelation (p_value)	0.420	*0.406*	*0.388*	*0.388*	*0.392*	*0.407*
Obs	1670	1670	1670	1670	1670	1670

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: *OLS estimates. Robust standard errors in parentheses are clustered at sector-country level. All regressors reported in levels are taken at time t-1. The null hypothesis in the Wooldrige test is the absence of serial correlation.*

Table 7: TFP estimates for period 1995-2007, EPLT and technology

Explanatory variables	Dependent variable TFP (annual growth rate)								
	1	2	3	4	5	6	7	8	9
EPLT *TWSBench	0.158***	0.185***	0.184***	0.110**	0.084*	0.084*	0.129**	0.101*	0.101*
	(0.051)	(0.061)	(0.061)	(0.050)	(0.048)	(0.048)	(0.062)	(0.062)	(0.062)
ΔEPLT * TWSBench		0.006	0.006		-0.009	-0.009		-0.01	-0.01
		(0.006)	(0.006)		(0.007)	(0.007)		(0.007)	(0.007)
R&D	0.240**	0.231**	0.231**				0.157	0.163	0.159
	(0.096)	(0.096)	(0.097)				(0.142)	(0.140)	(0.143)
Rel TFP				-0.012***	-0.012***	-0.012***	-0.011*	-0.010*	-0.010*
				(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)
EPLR*Lay-Off			-0.071			-0.078			-0.091
			(0.096)			(0.096)			(0.099)
ΔEPLR*Lay-Off			0.008			0.009			0.007
			(0.020)			(0.020)			(0.020)
Country *Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	No	No	No	No	No	No
Sector * Time Dummies	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
R_Squared	0.201	0.203	0.203	0.199	0.202	0.202	0.221	0.224	0.224
Wooldridge test for autocorrelation (p_value)	*0.631*	*0.880*	*0.888*	*0.871*	*0.866*	*0.856*	*0.552*	*0.533*	*0.525*
Obs	1471	1471	1471	1418	1418	1418	1257	1257	1257

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: *OLS estimates. Robust standard errors in parentheses are clustered at sector-country level. All regressors reported in levels are taken at time t-1. The null hypothesis in the Wooldrige test is the absence of serial correlation.*

Table 8: TFP estimates for period 1998-2007 – refined EPLR

Explanatory variables	Dependent variable TFP (annual growth rate)								
	1	2	3	4	5	6	7	8	9
EPLT*TWSBench	0.191***	0.117**	0.139**	0.167***	0.162***	0.172***	0.174***	0.175***	0.182***
	(0.073)	(0.054)	(0.056)	(0.056)	(0.055)	(0.056)	(0.056)	(0.056)	(0.057)
ΔEPLT * TWSBench	0.008	-0.004	-0.006	0.007	0.007	0.007	0.007	0.007	0.007
	(0.006)	(0.007)	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
EPLR(refined) * Lay-Off	-0.043	-0.130	-0.112	-0.091	-0.071	-0.165	-0.181	-0.292*	-0.321**
	(0.117)	(0.123)	(0.125)	(0.121)	(0.117)	(0.125)	(0.115)	(0.149)	(0.155)
Δ EPLR(refined) * Lay-Off	0.009	0.004	0.004	0.009	0.013	0.015	0.014	0.011	0.008
	(0.031)	(0.027)	(0.026)	(0.032)	(0.031)	(0.032)	(0.031)	(0.032)	(0.033)
R&D	0.227**		0.113						
	(0.104)		(0.162)						
Rel TFP		-0.011***	-0.011**						
		(0.004)	(0.004)						
RI					0.015				0.02
					(0.026)				(0.026)
ΔRI					-0.095*				-0.094*
					(0.051)				(0.050)
Union Density *Lay-Off						0.001		-0.001	-0.039	-0.041
						(0.003)		(0.003)	(0.033)	(0.033)
Coverage *Lay-Off							0.005*	0.006*	-0.004	-0.004
							(0.003)	(0.003)	(0.009)	(0.010)
Union Density *Cover.*Lay-Off									0.000	0.000
									(0.000)	(0.000)
Country *Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Sector * Time Dummies	No	Yes	Yes	Yes	No	No	No	No	No
R_Squared	0.185	0.310	0.321	0.17	0.167	0.168	0.168	0.168	0.171
Wooldridge test for autocorrelation	0.939	0.918	0.908	0.907	0.908	0.928	0.907	0.908	0.928
Obs	1135	1061	975	1250	1250	1250	1250	1250	1250

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: *OLS estimates. Robust standard errors in parentheses are clustered at sector-country level. All regressors reported in levels are taken at time t-1. The null hypothesis in the Wooldridge test is the absence of serial correlation.*

Table 9: TFP estimates for period 1995-2007 – Market Economy

Explanatory variables	Dependent variable TFP (annual growth rate)								
	1	2	3	4	5	6	7	8	9
EPLT *TWSBench	0.209***	0.109**	0.137*	0.121**	0.128**	0.130**	0.131***	0.132***	0.126**
	(0.075)	(0.051)	(0.071)	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)
ΔEPLT * TWSBench	0.008	-0.005	-0.007	0.005	0.006	0.006	0.006	0.006	0.005
	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
EPLR(refined) * Lay-Off	-0.146	-0.187	-0.184	-0.146	-0.15	-0.178	-0.225	-0.282	-0.267
	(0.166)	(0.171)	(0.169)	(0.157)	(0.171)	(0.181)	(0.182)	(0.210)	(0.193)
Δ EPLR(refined) * Lay-Off	0.008	0.018	0.014	0.01	0.01	0.015	0.013	0.013	0.011
	(0.032)	(0.028)	(0.031)	(0.030)	(0.031)	(0.030)	(0.030)	(0.030)	(0.030)
R&D	0.212**		0.141						
	(0.106)		(0.161)						
Rel TFP		-0.010**	-0.008						
		(0.004)	(0.005)						
RI					-0.026				-0.02
					(0.028)				(0.027)
ΔRI					-0.111***				-0.110**
					(0.042)				(0.042)
Union Density *Lay-Off						-0.002		-0.005	-0.040	-0.033
						(0.003)		(0.004)	(0.034)	(0.033)
Coverage *Lay-Off							0.006	0.008	-0.004	-0.003
							(0.006)	(0.007)	(0.010)	(0.010)
Union Density * Coverage*Lay-Off									0.000	0.000
									(0.000)	(0.000)
Country *Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Sector * Time Dummies	No	Yes	Yes	Yes	No	No	No	No	No
R_Squared	0.211	0.315	0.339	0.186	0.183	0.184	0.184	0.184	0.187
Wooldridge test for autocorrelation (p_value)	0.989	0.884	0.536	0.478	0.466	0.446	0.450	0.452	0.469
Obs	1310	1275	1119	1503	1503	1503	1503	1503	1503

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: *OLS estimates. Robust standard errors in parentheses are clustered at sector-country level. All regressors reported in levels are taken at time t-1. The null hypothesis in the Wooldridge test is the absence of serial correlation.*

Table 10: IV estimates of TFP and endogeneity tests (period 1995-2007)

Explanatory variables	Dependent variable TFP (annual growth rate)			
	External Instruments	Internal Instruments	External Instruments	Internal Instruments
EPLT *TWSBench	0.265	0.144**		
	(0.413)	(0.071)		
ΔEPLT * TWSBench			0.082	-0.09
			(0.079)	(0.145)
Country x Time Dummies	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes
R_squared	0.167	0.164	0.152	0.150
Obs	1670	1390	1670	1390
Underidentification Test _ p value (Kleibergen-Paap rk LM Statistic)	0.000	0.000	0.042	0.011
Weak Identification Test _ Wald F Stat. (Kleibergen-Paap rk Wald F Satistic)	9.925	1403.85	2.533	2.504
Overidentification Test _ p value (Hansen J Statistic)	0.511	0.677	0.876	0.244
Endogeneity test of EPLTxTWSBench_p value	*0.670*	*0.753*		
Endogeneity test of ΔEPLTxTWSBench_p value			*0.253*	*0.472*

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. *Note: All IV estimations are provided with the two-step GMM estimator that is robust to heteroskedasticity. Robust standard errors in parentheses. All regressors reported in levels are taken at time t-1.* **External Instruments:** *CabinetComposition(SchmidtIndex)*TWSBench; LeftWeight*TWSBench; UnionDensity* TWSBench;* **Internal Instruments**: *both EPLT*TWSBench and DEPLT*TWSBench are instrumented with their own values at time t-1 and t-2.*

Table 11: Effects of EPLT on different Continuing Vocational Training (CVT) indicators

Dependent variables	CvtEmpl	CvtEmpl	CvtHEmpl	CvtHempl
	1	2	3	4
EPLT *TWSBench	2.095***	0.539**	0.647***	0.128*
	(0.193)	(0.221)	(0.062)	(0.072)
Country Dummies	No	Yes	No	Yes
R_Squared	0.514	0.856	0.457	0.758
Obs	247	247	247	247
Dependent variables	CvtHwork	CvtHwork	CvtFirm	CvtFirm
	5	6	7	8
EPLT *TWSBench	0.401***	0.075**	3.577***	1.350***
	(0.036)	(0.037)	(0.324)	(0.465)
Country Dummies	No	Yes	No	Yes
R_Squared	0.475	0.8	0.52	0.9
Obs	252	252	247	247

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: *OLS estimates. Robust standard errors in parentheses. All regressors reported in levels are taken at time t-1.***CvtEmpl***: percentage of employees participating in CVT courses*; ***CvtHempl***: Hours in CVT courses per employee*; ***CvtHwork***: Hours in CVT courses per 1.000 hours worked*; ***CvtFirm***: training enterprises as percentage of all enterprises.*

APPENDIX

TFP growth, TFP levels and the distance to the frontier

The total factor productivity growth index is made available by the EUKLEMS database and measures the efficiency improvements in the use of inputs; in other words, it measures the reduction in input costs to produce a given amount of output. This measure reflects disembodied technical changes, i.e., those changes not embodied in the quality of inputs.

More precisely, the TFP growth ($\Delta \ln A$) used in this paper is calculated as the real growth of value added minus a weighted growth of inputs for a given industry:

$$\Delta \ln A_{ij} = \Delta \ln Y_{ijt} - \bar{v}_{ijt}^{K} \Delta \ln K_{ijt} - \bar{v}_{ijt}^{L} \Delta \ln L_{ijt} \quad (1)$$

where $\Delta \ln Y_{ijt}$, $\Delta \ln K_{ijt}$ and $\Delta \ln L_{ijt}$ denote, respectively, the growth of value added (Y), capital (K) and hours worked (L) in country *i* and sector *j,* between *t-1* and *t*, whereas $\bar{v}_{ijt}^{K}$ and $\bar{v}_{ijt}^{L}$ are the two period average shares of inputs, *K* and *L*, respectively, on value added.

It is worth noting that L and K take the heterogeneity of labour and capital assets, respectively, into account. Indeed, as shown by Timmer et al. 2007, p.24:

$$\Delta ln L_t = \sum_l \bar{v}_{l,t} \Delta ln H_{l,t}$$

where the weights $\bar{v}_{l,t}$ are given by the average shares of compensation for each type of labour in the value of labour compensation $\bar{v}_{l,t} = 1/2[v_{l,t} + v_{l,t-1}]$ and $v_{l,t} = \left(\sum_l P_{l,t}^L H_{l,t}\right)^{-1} P_{l,t}^L H_{l,t}$, with $P_{l,t}^L$ representing the price of one hour (*H)* of work of *l* type.

The different quality of labour *l* considers educational levels (low, medium and high-skilled workers), gender and three different age bands (15-19, 30-49, 50 and over). For the matching and harmonisation of educational levels and worker skills across countries, see Timmer et al. (2007).
The capital stock is constructed by the well-known perpetual inventory method, which is a weighted sum of past investments, with weights given by the relative efficiencies of capital goods at different ages. The heterogeneity of capital stock is defined as

$$\Delta lnK_t = \sum_k \bar{v}_{k,t}\Delta lnA_{k,t}$$

where A_k are different assets, whereas weights $\bar{v}_{k,t}$ are given by the average share of each component in the value of capital compensation $\bar{v}_{k,t} = 1/2[v_{k,t} + v_{k,t-1}]$ and $v_{k,t} = \left(\sum_l P_{k,t}^K A_{k,t}\right)^{-1} P_{k,t}^K A_{k,t}$, with $P_{k,t}^K$ being the price of capital services from assets of type *k*.

Nine different asset types are included in the total capital stock, including three ICT assets: Computing equipment, Communications equipment and Software (see Timmer et al., 2007 for further details).
Unfortunately, EUKLEMS makes TFP growth data available, but not information on TFP levels. Hence, to determine the distance to the frontier, we need to estimate time-varying TFP values across different sector-countries. More precisely, following Griffith et al. (2004), we estimated a value-added-based measure of TFP as follows:

$$\ln TFP_{ijt} = \ln Y_{ijt} - \alpha \ln K_{ijt} - (1-\alpha)\ln L_{ijt}$$

where Y is the real value added in Euro PPP and 1995 prices, K is the fixed real capital stock in Euro PPP and 1995 prices, L is the hours worked, α and $(1-\alpha)$ are the estimated parameters, that is, the output elasticity of Capital and Labour, respectively. We gathered data concerning these output and inputs from EUKLEMS database, with the exception of France and Belgium, for which the capital stock variables came from the OECD Stan database. We exclude Ireland and Hungary

because data on the capital stock of these countries were not available. Therefore, in regressions where we use the distance to the frontier, the sample is reduced to 12 countries.

We then defined the frontier as the country with the highest value of *lnTFP* in each industry (j) at time (t) (denoted ln*TFPFjt*). Subtracting *TFPFjt* from *TFPijt*, we obtain a measure of relative TFP, which is the distance to the frontier indicator.

$$\text{Re} \, lTFP_{ijt} = \ln TFP_{ijt} - \ln TFP_{Fit}$$

TABLE A1: DESCRIPTION OF VARIABLES

TFP (annual growth rate)	Growth rate of total factor productivity (sector-country level and time varying data). *Source: EU KLEMS*
EPLT	Employment protection of temporary contracts (country level and time varying data). It ranges from 0 to 6. *Source: OECD*
EPLR	Employment protection of regular workers against individual dismissal (country level and time varying data). It ranges from 0 to 6. *Source: OECD*
EPLR (refined)	Index of employment protection for regular contracts against individual dismissals (EPLR) and collective dismissals (EPLC): with weights 5/7 and 2/7, respectively (country level and time varying data). It ranges from 0 to 6. *Source: OECD.*
RI	The Regulatory Impact Index for product market regulation measures the knock on effects of anticompetitive regulation in energy, transport and communication (plus the finance sector) on sectors that use the outputs of these sectors as intermediate inputs. (sector-country level and time varying data). *Source: OECD (Conway and Nicoletti, 2006)*
Union Density	Net union membership as share of wage and salary earners on total employment (country level and time varying data). *Source: ICTWSS database (Visser, version 3.0, May2011)*
Coverage Bargaining	Employees covered by wage bargaining agreements: share of wage and salary earners on total employment with the right to bargaining (country level and time varying data). *Source: ICTWSS database (Visser, version 3.0, May2011)*
TWSBench (UK)	Share of workers with temporary contracts on total employees in UK (sector level and time invariant data: average 1995-2007). Temporary workers are those who declare themselves as having a fixed term employment contract or a job which will terminate if certain objective criteria are met *Source: EUROSTAT*
Lay-off (UK)	Lay-off rates in UK (sector level and time invariant data: average 1995-2007). *Source: Quarterly Labour Force surveys, UK*
R&D	Sectoral R&D expenses standardised to value added (sector-country level and time varying data). *Source: EUROSTAT*
Rel TFP	Difference between log of TFP in industry j, country i, time t, and log of the European productivity frontier for that industry. (sector-country level and time varying data). *Source: our elaborations of EUKLEMS and OECD data*

TABLE A1: DESCRIPTION OF VARIABLES (*continued*)

Trained employees (%)	Percentage of employees participating in CVT courses (sector-country level data for 1999 and 2005). *Source: EUROSTAT*
Training per employee (hours)	Hours in CVT courses per employee (sector-country level data for 1999 and 2005) *Source: EUROSTAT*
Share of training hours (%)	Hours in CVT courses per 1.000 hours worked (sector-country level data for 1999 and 2005) *Source: EUROSTAT*
Share of firms with training (%)	Training enterprises as percentage of all enterprises (sector-country level data for 1999 and 2005). *Source: EUROSTAT*
Schmidt-Index	Cabinet composition: (1) hegemony of right-wing (and centre) parties (gov_left=0), (2) dominance of right-wing (and centre) parties (gov_left<33.3), (3) balance of power between left and right/centre (33.3<gov_left<66.6), (4) dominance of social-democratic and other left parties (gov_left>66.6), (5) hegemony of social-democratic and other left parties(gov_left=100). Country level and time varying data. *Source: Comparative Political Dataset III*
Parliament Composition	Social democratic and other left-wing parties as a percentage of parliamentary seats of all governmental parties, weighted by the number of days the government was in office in a given year. Country level and time varying data. *Source: Comparative Political Dataset III*

Table A.2 Descriptive statistics of the variables used in the empirical analysis at the beginning and end of the period

1995

	Mean	St.Dev	Median	Min	Max	Obs
TFP (annual growth rate, %)	0.97	5.64	0.41	-16.42	16.74	140
EPLT	2.23	1.59	1.98	0.25	5.38	140
EPLR	2.27	0.67	2.33	0.95	3.31	140
EPLR (refined)	-	-	-	-	-	-
RI	0.19	0.16	0.11	0.01	0.70	140
Union Density (%)	44.32	22.58	39.82	8.35	85.06	140
Coverage Bargaining (%)	78.80	18.28	85.50	42.50	98.50	140
TWS_Bench (%) (UK)	6.84	2.56	6.64	3.67	11.96	140
Lay Off rate (%) (UK)	3.59	1.55	3.93	0.38	6.42	140
R&D (%)	0.87	1.88	0.22	0.00	11.86	113
RelTFP	-0.53	0.54	-0.38	-2.74	0.00	119
Trained employees (%)	40.83	17.99	40.75	7.00	91.00	121
Training per employee (hours)	13.66	7.96	12.00	2.00	41.00	121
Share of training hours (%)	8.38	5.23	7.50	1.00	27.00	126
Share of firms with training (%)	72.21	23.17	77.25	14.00	100.00	121
Schmidt Index	2.71	1.22	3.00	1.00	5.00	140
Parliament Composition	42.16	31.84	42.78	0.00	100.00	140

2007

	Mean	St.Dev	Median	Min	Max	Obs
TFP (annual growth rate, %)	-0.11	6.10	0.13	-21.17	34.63	130
EPLT	1.70	0.94	1.44	0.38	3.63	140
EPLR	2.22	0.59	2.27	1.12	3.05	140
EPLR (refined)	2.52	0.46	2.52	1.50	3.21	126
RI	0.13	0.10	0.08	0.01	0.41	140
Union Density (%)	35.14	22.33	29.10	7.62	77.80	140
Coverage Bargaining (%)	73.51	21.62	82.50	34.40	99.00	140
TWS_Bench (%) (UK)	6.84	2.56	6.64	3.67	11.96	140
Lay Off rate (%) (UK)	3.59	1.55	3.93	0.38	6.42	140
R&D (%)	1.07	2.07	0.26	0.00	12.62	114
RelTFP	-0.58	0.60	-0.45	-3.06	0.00	119
Trained employees (%)	39.34	16.97	37.00	9.00	104.00	121
Training per employee (hours)	10.80	6.59	9.00	2.00	40.00	121
Share of training hours (%)	6.50	2.98	6.00	2.00	18.50	126
Share of firms with training (%)	70.26	18.88	73.00	14.00	100.00	121
Schmidt Index	2.71	1.34	2.50	1.00	5.00	140
Parliament Composition	42.97	38.61	41.98	0.00	100.00	140

Table A.3 Proportion of temporary workers at sector and country level (at the beginning and the end of the period)

1995														
Sectors	AUT	BEL	CZE	DNK	ESP	FIN	FRA	GER	HUN	IRL	ITA	NLD	SWE	UK
Agriculture	9.22	-	5.66	21.03	60.59	22.86	19.91	21.00	6.58	9.51	36.28	21.22	22.17	7.70
Constructions	6.94	2.68	6.14	13.44	64.44	16.89	12.64	11.01	10.16	12.91	10.68	4.94	12.52	6.83
Electricity&Gas	-	-	4.84	-	11.08	-	4.77	6.92	-	-	1.97	-	-	6.27
Finance&RealEstate	3.23	5.46	6.51	6.69	31.41	15.02	9.54	9.11	5.59	9.56	5.73	10.73	11.69	7.07
Hotels&Restaurants	11.59	6.60	11.47	16.29	53.97	24.88	19.05	14.20	11.23	17.66	18.00	26.44	31.68	9.32
Manufacturing	5.31	3.96	5.40	5.83	30.63	8.52	10.35	7.49	6.25	4.97	4.46	7.95	7.01	4.27
Mining	-	-	2.87	-	23.97	-	-	9.09	-	-	-	-	-	11.96
PublicAdmin&OtherServices	6.94	7.71	10.11	16.12	24.23	24.68	15.02	13.87	7.37	15.41	6.42	10.13	16.65	9.60
Transports&Communications	3.02	2.40	3.98	7.76	21.24	9.13	7.76	6.38	3.55	7.22	3.21	7.55	7.62	4.92
Wholesale&RetailTrade	-	4.00	6.74	14.75	39.99	10.81	10.02	8.75	5.28	9.04	6.96	9.42	10.68	3.79
Median	*6.94*	*4.00*	*5.90*	*14.09*	*31.02*	*15.95*	*10.35*	*9.10*	*6.41*	*9.53*	*6.42*	*9.78*	*12.11*	*6.95*

2007														
Sectors	AUT	BEL	CZE	DNK	ESP	FIN	FRA	GER	HUN	IRL	ITA	NLD	SWE	UK
Agriculture	15.18	11.21	7.36	16.11	59.02	19.38	24.95	22.83	10.65	-	51.64	28.62	26.33	6.17
Constructions	11.16	4.97	7.00	11.25	54.74	13.34	17.47	14.46	10.82	5.10	12.04	12.84	11.78	3.78
Electricity&Gas	-	-	3.53	-	15.45	-	12.61	10.35	-	-	5.65	14.39	-	7.80
Finance&RealEstate	5.89	6.40	10.05	5.38	22.87	13.02	10.80	12.84	5.38	5.22	11.21	18.53	14.98	5.03
Hotels&Restaurants	16.80	14.00	11.18	10.13	38.60	15.01	19.30	20.24	8.54	13.08	26.18	38.83	42.91	8.75
Manufacturing	7.25	6.96	7.40	4.98	23.01	9.82	12.46	11.77	7.83	3.41	9.26	15.00	9.79	4.14
Mining	-	-	4.92	-	24.23	-	-	-	-	-	-	-	-	-
PublicAdmin&OtherServices	10.20	11.12	9.06	11.58	30.78	23.77	16.90	17.52	7.97	8.55	13.52	13.44	19.59	7.52
Transports&Communications	4.69	5.46	4.31	4.49	23.16	8.91	8.33	10.70	3.31	3.91	9.14	18.65	14.38	4.08
Wholesale&RetailTrade	-	8.28	7.65	7.82	25.34	11.70	11.47	14.38	5.65	9.85	12.78	21.78	18.57	4.22
Median	*10.20*	*7.62*	*7.38*	*8.98*	*24.78*	*13.18*	*12.61*	*14.38*	*7.90*	*5.22*	*12.04*	*18.53*	*16.78*	*5.03*

Note: all values are in percentage points

Table A.4 Annual Average TFP growth rates at sector and country level (two sub-periods)

Years 1995-2001 (annual average)														
Sectors	AUT	BEL	CZE	DNK	ESP	FIN	FRA	GER	HUN	IRL	ITA	NLD	SWE	UK
Agriculture	4.13	2.56	2.71	2.93	2.81	4.59	1.72	7.15	6.7	4.56	2.18	-1.78	2.17	1.12
Mining	6.31	-2.32	-1.37	7.36	0.57	-0.69	-3.97	1.58	5.39	-3.04	-0.42	-1.01	-1.94	0.38
Manufacturing	4.17	0.66	1.38	-1.00	-0.62	4.09	2.4	1.83	3.48	4.01	-0.64	1.58	2.06	-0.10
Electricity&Gas	5.32	4.24	-4.95	0.38	3.88	3.63	4.27	3.14	1.22	4.01	-0.24	-0.38	-0.34	2.47
Constructions	2.07	0.08	-3.7	-1.52	-2.91	0.41	-0.16	-0.24	4.19	-2.94	-1.47	-1.63	-1.65	0.45
Wholesale&RetailTrade	1.5	-2.18	5.12	0.24	-0.9	2.67	0.62	2.14	2.38	2.63	-0.64	2.83	2.04	0.31
Hotels&Restaurants	0.53	-0.99	-9.59	-5.28	-2.54	-0.76	0.82	-0.17	1.15	2.13	0.22	1.89	2.33	-1.14
Transports&Communications	0.01	-1.72	-4.37	1.26	-1.34	4.32	3.45	3.77	5.89	2.57	2.12	2.96	-0.04	3.93
Finance&RealEstate	-2.55	-1.03	-1.79	-1.05	-0.52	0.26	-0.23	-1.64	2.04	2.53	-0.13	-0.58	-1.26	0.26
PublicAdmin&OtherServices	-1.28	-0.46	-1.09	-0.75	-0.67	-0.86	-0.28	0.57	4.16	-2.38	0.03	-0.71	0.06	-0.64
Median	1.79	-0.73	-1.58	-0.26	-0.65	1.54	0.72	1.71	3.82	2.55	-0.19	-0.48	0.01	0.35

Years 2002-2007 (annual average)														
Sectors	AUT	BEL	CZE	DNK	ESP	FIN	FRA	GER	HUN	IRL	ITA	NLD	SWE	UK
Agriculture	2.54	-3.08	1.13	-4.75	-0.42	3.9	1.69	3.24	5.45	2.13	0.31	1.39	5.45	3.26
Mining	3.39	3.23	0.32	-5.34	0.3	-0.62	3.32	0.70	4.05	-0.34	-2.89	-3.20	-5.27	-4.77
Manufacturing	3.59	1.41	5.56	1.80	-0.21	5.66	1.51	2.71	3.57	-0.73	-0.22	2.46	5.57	3.83
Electricity&Gas	3.98	0.54	2.97	-4.68	-1.13	2.02	3.25	0.62	-2.46	1.36	0.44	5.12	-3.72	-0.81
Constructions	2.45	1.91	-0.23	1.85	-1.40	0.45	-1.35	-0.54	-2.12	-1.19	-1.64	-0.09	0.35	0.18
Wholesale&RetailTrade	0.39	-0.89	5.05	1.53	-0.60	4.00	0.20	0.76	3.00	-1.02	-1.11	3.60	2.57	1.95
Hotels&Restaurants	-0.13	-1.56	-6.49	-2.44	-2.2	-0.95	-1.00	0.51	-4.22	1.32	-2.84	-1.24	-1.90	0.36
Transports&Communications	3.06	0.69	3.00	1.00	-1.42	1.61	3.16	2.44	3.86	-0.23	0.33	3.51	1.04	1.85
Finance&RealEstate	-0.37	0.4	0.14	-0.41	0.37	-1.73	0.76	-0.49	0.69	0.82	-0.29	-0.23	0.36	0.54
PublicAdmin&OtherServices	-0.11	-0.79	-0.73	-0.52	-0.55	-1.57	-0.15	0.09	0.24	-1.89	-0.06	-0.6	-0.71	-1.57
Median	2.50	0.47	0.73	-0.47	-0.58	1.03	1.14	0.66	1.85	-0.29	-0.26	0.65	0.36	0.45

Note: all values are in percentage points

Table A.5: TFP estimates for different period 1997-2006

	Dependent variable TFP (annual growth rate)								
Explanatory variables	1	2	3	4	5	6	7	8	9
EPLT *TWSBench	0.128**	0.138**	0.148**	0.151**	0.153**	0.142**	0.183**	0.080	0.118*
	(0.061)	(0.060)	(0.062)	(0.063)	(0.062)	(0.063)	(0.071)	(0.054)	(0.062)
ΔEPLT * TWSBench	0.005	0.006	0.006	0.006	0.006	0.005	0.007	-0.006	-0.006
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
RI	-0.031					-0.025			
	(0.034)					(0.033)			
ΔRI	-0.127***					-0.125***			
	(0.041)					(0.041)			
Union Density *Lay-Off		0.000		-0.003	-0.043	-0.039			
		(0.003)		(0.003)	(0.032)	(0.030)			
Coverage *Lay-Off			0.006*	0.007*	-0.005	-0.005			
			(0.004)	(0.004)	(0.009)	(0.009)			
Union Density *Coverage*Lay-Off					0.000	0.000			
					(0.000)	(0.000)			
EPLR *Lay-Off	-0.085	-0.087	-0.125	-0.155	-0.22	-0.202	-0.091	-0.111	-0.123
	(0.099)	(0.106)	(0.106)	(0.109)	(0.134)	(0.127)	(0.102)	(0.109)	(0.108)
ΔEPLR Lay-Off	0.011	0.012	0.018	0.017	0.015	0.013	0.009	0.011	0.01
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
R&D							0.239**		0.174
							(0.106)		(0.158)
Rel TFP								-0.0130**	-0.010*
								(0.005)	(0.006)
Country *Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R_Squared	0.182	0.177	0.178	0.178	0.179	0.183	0.207	0.311	0.332
Wooldridge test for autocorrelation (p_value)	0.466	0.448	0.422	0.425	0.430	0.449	0.694	0.798	0.813
Obs	1400	1400	1400	1400	1400	1400	1250	1190	1066

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: *OLS estimates. Robust standard errors in parentheses are clustered at sector-country level. All regressors reported in levels are taken at time t-1. The null hypothesis in the Wooldridge test is the absence of serial correlation.*

Table A.6: TFP estimates for different period 1998-2007

Explanatory variables	Dependent variable TFP (annual growth rate)								
	1	2	3	4	5	6	7	8	9
EPLT*TWSBench	0.171***	0.168***	0.176***	0.181***	0.182***	0.188***	0.199**	0.093*	0.110*
	(0.062)	(0.060)	(0.061)	(0.062)	(0.062)	(0.064)	(0.080)	(0.054)	(0.059)
ΔEPLT*TWSBench	0.007	0.008	0.008	0.008	0.008	0.007	0.008	-0.004	-0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)
RI	0.01					0.015			
	(0.030)					(0.029)			
ΔRI	-0.100**					-0.097**			
	(0.044)					(0.044)			
Union Density*Lay-Off		-0.001		-0.003	-0.04	-0.039			
		(0.003)		(0.003)	(0.031)	(0.031)			
Coverage *Lay-Off			0.005	0.007*	-0.004	-0.004			
			(0.003)	(0.004)	(0.009)	(0.009)			
Union Density*Coverage *Lay-Off					0.000	0.000			
					(0.000)	(0.000)			
EPLR *Lay-Off	-0.049	-0.047	-0.075	-0.111	-0.177	-0.183	-0.03	-0.06	-0.058
	(0.096)	(0.094)	(0.095)	(0.093)	(0.114)	(0.119)	(0.092)	(0.097)	(0.096)
ΔEPLR*Lay-Off	0.016	0.016	0.02	0.019	0.018	0.017	0.015	0.013	0.012
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.019)	(0.019)
R&D							0.263***		0.19
							(0.094)		(0.143)
Rel TFP								-0.011**	-0.009**
								(0.004)	(0.005)
Country *Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R_Squared	0.171	0.168	0.169	0.169	0.17	0.172	0.19	0.303	0.316
Wooldridge test for autocorrelation (p_value)	0.781	0.787	0.785	0.785	0.786	0.778	0.978	0.954	0.743
Obs	1390	1390	1390	1390	1390	1390	1249	1180	1071

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: *OLS estimates. Robust standard errors in parentheses are clustered at sector-country level. All regressors reported in levels are taken at time t-1. The null hypothesis in the Wooldridge test is the absence of serial correlation.*

Table A.7: TFP estimates for different period 1995-2004

Explanatory variables	Dependent variable TFP (annual growth rate)								
	1	2	3	4	5	6	7	8	9
EPLT *TWSBench	0.081	0.101	0.105	0.108	0.109	0.088	0.185**	0.083	0.126**
	(0.072)	(0.072)	(0.074)	(0.075)	(0.075)	(0.076)	(0.072)	(0.056)	(0.050)
ΔEPLT * TWSBench	0.009*	0.010**	0.010*	0.010**	0.010**	0.010*	0.012**	0.002	0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
RI	-0.066**					-0.062**			-0.267
	(0.027)					(0.027)			(0.193)
ΔRI	-0.119**					-0.119**			0.011
	(0.050)					(0.049)			(0.030)
Union Density *Lay-Off		-0.001		-0.003	-0.043	-0.031			
		(0.003)		(0.004)	(0.030)	(0.030)			
Coverage *Lay-Off			0.004	0.005	-0.009	-0.007			
			(0.004)	(0.005)	(0.010)	(0.009)			
Union Density *Coverage *Lay-Off					0.000	0.000			-0.020
					(0.000)	(0.000)			(0.027)
EPLR *Lay-Off	-0.08	-0.098	-0.116	-0.144	-0.199	-0.158	-0.102	-0.084	-0.110**
	(0.104)	(0.117)	(0.122)	(0.125)	(0.139)	(0.120)	(0.118)	(0.121)	(0.042)
ΔEPLR*Lay-Off	0.007	0.007	0.012	0.011	0.009	0.006	0.005	0.008	-0.033
	(0.020)	(0.021)	(0.020)	(0.020)	(0.020)	(0.019)	(0.020)	(0.020)	(0.033)
R&D							0.209*		-0.003
							(0.109)		(0.010)
Rel TFP								-0.007	0.000
								(0.005)	(0.000)
Country *Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R_Squared	0.208	0.201	0.201	0.201	0.202	0.209	0.234	0.299	0.328
Wooldridge test for autocorrelation (p_value)	0.420	0.708	0.670	0.697	0.705	0.769	0.935	0.770	0.997
Obs	1260	1260	1260	1260	1260	1260	1100	1071	936

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: *OLS estimates. Robust standard errors in parentheses are clustered at sector-country level. All regressors reported in levels are taken at time t-1. The null hypothesis in the Wooldrige test is the absence of serial correlation.*

Table A.8: IV estimates of TFP and endogeneity tests (first-stage estimates)

Dependent variable	EPLT *TWSBench	EPLT *TWSBench	DEPLT * TWSBench	DEPLT * TWSBench
Explanatory variables	1	2	3	4
UD *LO_Bench	-0.007***		-0.043**	
	(0.001)		(0.018)	
GovCab* LO_Bench	0.106		-0.715	
	(0.130)		(1.419)	
GovPart* LO_Bench	-0.005		0.030	
	(0.005)		(0.051)	
EPLT *TWSBench_1		0.892***		
		(0.039)		
EPLT *TWSBench_2		0.005		
		(0.003)		
ΔEPLT * TWSBench_1				0.010
				(0.008)
ΔEPLT * TWSBench_2				0.022*
				(0.011)
Country x Time Dummies	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes
R_squared	0.96	0.97	0.88	0.88
Obs	1670	1390	1670	1390

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. *Note: All IV estimations are provided with the two-step GMM estimator that is robust to heteroskedasticity. Robust standard errors in parentheses.*