Online Complement C1 – The Model

The estimated specifications of the Employment Protection Legislation (EPL) impact on production factor combination are derived from firm profit maximization, assuming perfect markets for products and capital but search frictions on the labour market. We distinguish seven different production factors: ICT capital, R&D capital, non-ICT capital equipment (i.e. non-ICT and non-R&D equipment), non-residential capital construction, high, medium and low -skilled employment. We assume a Constant Elasticity of Substitution (CES) production function mobilizing these seven factors (individual and time indices are omitted in order to lighten the equations):

$$Q = A. \left[\sum_f \left(\theta_f^{1/s} . X_f^{\frac{s-1}{s}} \right) \right]^{\frac{s}{s-1}}$$

where Q is the value added, A the disembodied technical change, s the elasticity of substitution, X_f and θ_f the quantity and factor share coefficient (or factor efficiency) of production factor f.
Our profit function introduces the labour adjustment cost:

$$\pi = P.Q - \sum_f \left(C_f X_f + \mu_f \right)$$

where π is the firm profit, P the value added price, C_f the (observed) unit user cost of production factor f and μ_f its adjustment cost. We assume search frictions on the labour markets such that the adjustment cost $\mu_f \neq 0$ is growing with the level of employment.[1]

Assuming perfect product markets, the first order conditions of profit maximization lead to:

$$\frac{C_f^*.X_f}{P.Q} = \theta_f . A^{s-1} . \left(\frac{C_f^*}{P} \right)^{-(s-1)} \forall f \quad \Rightarrow \quad \frac{X_f}{X_{f'}} = \frac{\theta_f}{\theta_{f'}} . \left(\frac{C_f^*}{C_{f'}^*} \right)^{-s} \forall f, f'$$

where C_f^* is the marginal unit cost of factor f, therefore $C_f^* = C_f + \frac{\partial \mu_f}{\partial X_f}$.

The intensity of use of a production factor f relatively to another factor f' depends on their relative efficiency $(\theta_f/\theta_{f'})$ and marginal costs $(C_f^*/C_{f'}^*)$. Our main estimated specifications focus on the intensity of use of the production factors relatively to total employment, i.e. the capital intensity (or capital-labour ratio) of each capital factor and employment share by skill level. Thus, our relations of interest are (with small letters for logarithms):

$$\left(x_f - l \right) = \ln\left(\theta_f/\theta_L \right) - s. \left(c_f - w \right) - s. \ln\left(\frac{\partial \mu_f}{\partial X_f} \middle/ \frac{\partial \mu_L}{\partial L} \right) \forall f$$

with L total employment, W the average labour compensation and θ_L the average labour efficiency.

Production factor efficiency θ_f and adjustment cost μ_f are unobserved, but Employment Protection Legislation (EPL) may influence these factors as well as observed labour costs C_f, thus impacting capital intensity and employment share. An increase of EPL, i.e. an increase of the constraints on hiring and firing, may influence differently the seven production factors through these three channels.

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[1] We also assume the concavity of the CES production function and the convexity of the adjustment cost function in order to verify second order conditions of firm profit maximization.

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In order to estimate these effects of EPL on capital intensity and employment share, we assume linear relationships of EPL with the logarithm of marginal labour adjustment cost $(\partial\mu_f/\partial X_f)$ and factor efficiency (θ_f). Then, we substitute EPL for these unobserved factors into our relations of interest:

$$\begin{cases} \ln(\theta_f) = \varphi_f + \rho_f . \text{EPL} + u_f \\ \ln(\partial\mu_f/\partial X_f) = \phi_f + \zeta_f . \text{EPL} + v_f \end{cases} \Rightarrow (x_f - l) = \alpha_f - s.(c_f - w) + \beta. \text{EPL} + \delta_f$$

with φ_f, ϕ_f and α_f constant terms, u_f, v_f and δ_f residual terms. We assume $\zeta_f = 0$ for the capital stocks.

We use a difference-in-difference approach to estimate the effects of EPL. We introduce country*industry and country*year fixed effects to prevent from various sources of endogeneity, such as reverse causality and omission bias which could stem from governments modifying their EPL depending on the economic situation. To identify the effects of EPL, which is collinear to country*year fixed effects, we allows EPL effects to depend on the intensity of use of labour. This approach allows investigating whether the impact of EPL increases with the intensity of use of labour. This estimation strategy leads to the estimated specifications:

$$(x_f - l)_{cit} = \alpha_f - s.(c_f - w)_{cit} + \beta_f . \lambda_i . \text{EPL}_{ct} + \eta_{f,ci} + \eta_{f,ct} + \epsilon_{f,cit} \quad \forall f$$

where *c*, *i*, *t* are the country, industry and time indices, λ_i the "natural" industry *i* labour share, EPL the OECD indicator of Employment Protection Legislation (see next section for more information), $\eta_{f,ci}$ and $\eta_{f,ci}$ the fixed effects, and $\epsilon_{f,cit}$ the residual terms. The variable $\lambda_i . \text{EPL}_{ct}$ is called further EPL impact.

Contrary to the CES production function presented in this simple model, the estimated specification assume that the elasticity of substitution may differ between factors, which is consistent with various degrees of complementarity/substitutability between factors, notably a possible complementarity between high-skilled workers and capital (see Appendix B for robustness to this assumption).

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Online Complement C2 – Descriptive Analysis

Table C2-1 and C2-2 present means, standard-errors and the main quantiles of the distribution of our principal variables in level and in growth respectively, while Figure C2-1 to C2-4 present country sample averages of our main variables, showing large country differences.[2]

Table C2-1
Summary of the Main Variables – Level

	Statistics	Mean	Std. err.	D1	Q1	Median	Q3	D9	Obs
Capital intensity	Total capital	13.658	19.848	3.010	4.650	7.740	13.137	22.760	3625
	Non-ICT eq.	5.558	6.382	1.463	2.229	3.832	6.043	9.844	3625
	Cons.	6.653	14.422	0.869	1.541	2.560	4.756	9.607	3625
	ICT	0.605	0.810	0.072	0.139	0.299	0.698	1.598	3625
	R&D	1.152	1.987	0.046	0.109	0.341	1.196	3.599	2537
Empl. Share	High-skilled	0.110	0.093	0.021	0.044	0.077	0.151	0.247	3200
	Med.-skilled	0.625	0.185	0.353	0.517	0.642	0.723	0.856	3200
	Low-skilled	0.265	0.183	0.047	0.134	0.239	0.351	0.517	3200
Relative cost	Total capital	0.057	0.023	0.033	0.041	0.053	0.068	0.088	3625
	Non-ICT eq.	0.059	0.029	0.032	0.041	0.053	0.069	0.092	3625
	Cons.	0.035	0.017	0.019	0.024	0.032	0.043	0.056	3625
	ICT	0.199	0.157	0.068	0.093	0.149	0.254	0.392	3625
	R&D	0.110	0.040	0.069	0.083	0.103	0.127	0.162	2537
	High-skilled	1.608	0.340	1.246	1.385	1.569	1.799	2.039	3200
	Med.-skilled	0.991	0.084	0.901	0.946	0.997	1.039	1.089	3200
	Low-skilled	0.769	0.145	0.606	0.702	0.779	0.873	0.923	3200
EPL impact		0.589	0.346	0.110	0.344	0.563	0.794	1.039	3625

Note: The total capital mean differs from the sum of the different asset means because the R&D mean is calculated on the subsample of industries investing significantly in R&D.

Table C2-2
Summary of the Main Variables – Growth

	Statistics	Mean	Std. err.	D1	Q1	Median	Q3	D9	Obs
Capital intensity	Total capital	3.32%	4.36%	-1.43%	0.56%	2.84%	5.59%	8.57%	3625
	Non-ICT eq.	3.03%	4.69%	-2.28%	0.03%	2.64%	5.57%	8.78%	3625
	Cons.	2.26%	4.86%	-3.10%	-0.72%	1.75%	4.73%	8.06%	3625
	ICT	11.10%	8.54%	1.62%	5.70%	10.21%	15.34%	21.61%	3625
	R&D	7.78%	9.83%	-2.04%	2.23%	6.51%	12.03%	19.14%	2537
Empl. share	High-skilled	3.82%	9.35%	-3.62%	0.24%	3.17%	6.97%	13.06%	3200
	Med.-skilled	1.07%	3.00%	-1.19%	-0.15%	0.65%	1.84%	3.59%	3200
	Low-skilled	-3.60%	6.73%	-9.26%	-6.09%	-3.27%	-1.02%	1.62%	3200
Relative cost	Total capital	-3.86%	4.30%	-9.13%	-6.34%	-3.65%	-1.30%	1.02%	3625
	Non-ICT eq.	-3.92%	4.32%	-9.38%	-6.51%	-3.78%	-1.24%	1.31%	3625
	Cons.	-4.58%	9.59%	-12.19%	-8.11%	-4.33%	-0.99%	2.93%	3625
	ICT	-10.05%	9.50%	-19.65%	-14.26%	-9.58%	-5.84%	-1.75%	3625
	R&D	-3.29%	3.82%	-8.03%	-5.53%	-3.01%	-1.07%	0.90%	2537
	High-skilled	-0.45%	3.72%	-4.07%	-1.90%	-0.46%	0.95%	2.96%	3200
	Med.-skilled	-0.33%	1.40%	-1.62%	-0.79%	-0.20%	0.17%	0.92%	3200
	Low-skilled	-0.85%	3.94%	-4.14%	-1.66%	-0.45%	0.41%	1.93%	3200
EPL impact		-0.81%	4.01%	0.00%	0.00%	0.00%	0.00%	0.00%	3625

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[2] As first years and the last year observations are not always available, these charts present the values from 1994 to 2006 to ensure country comparability.

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Figure C2-1
Non-ICT and Non-R&D Capital Intensity – Country Sample Average
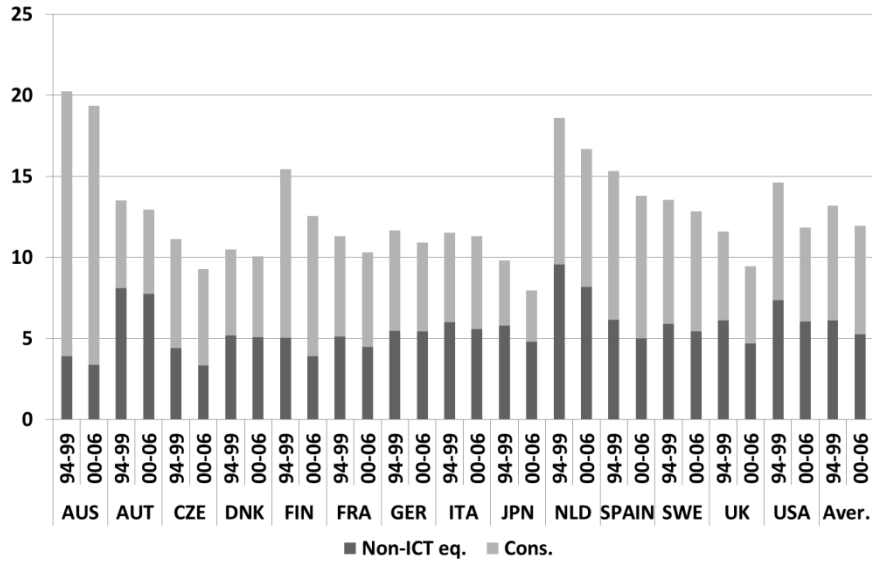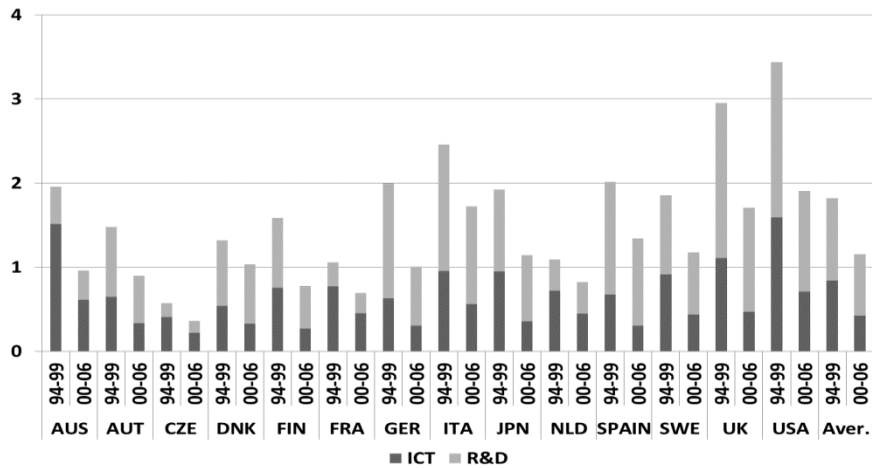
(In thousands of constant 2000 US $ per worker)

Figure C2-2
ICT and R&D Capital Intensity – Country Sample Average

(In thousands of constant 2000 US $ per worker)

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Figure C2-3
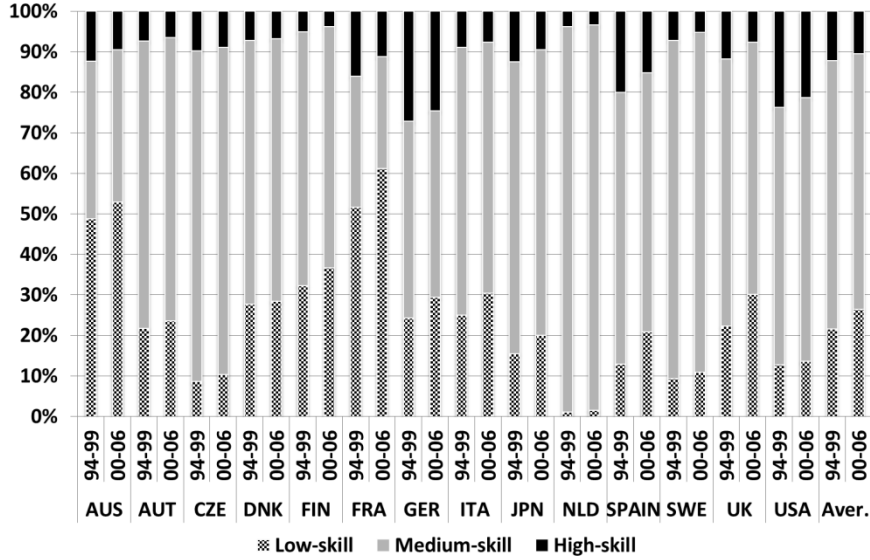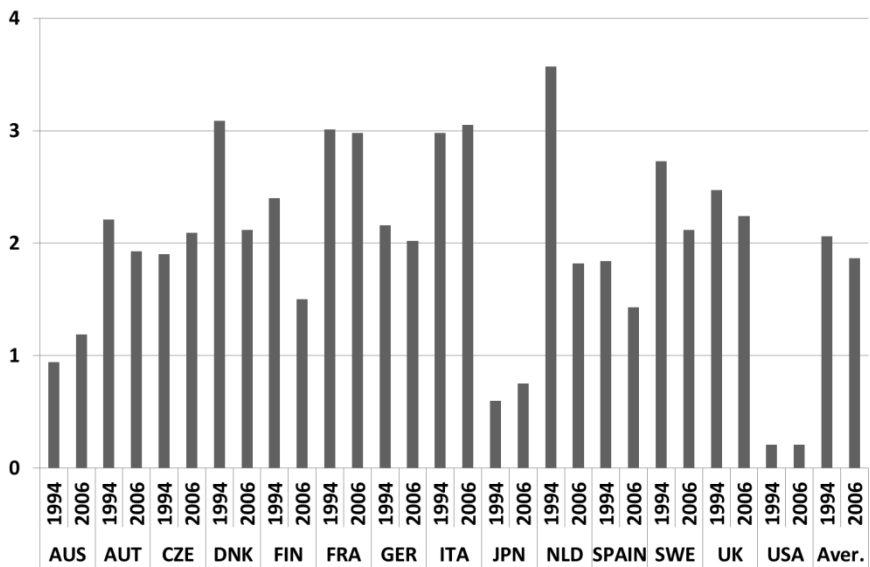**Employment Share by Skill Level – Country Sample Average**

Figure C2-4
OECD Employment Protection Legislation Indicator (EPL)

(Scale 0-6, 0 for the most flexible country labour market)

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As regards hours worked, the share of medium-skilled employment is on average the largest, i.e. more than 60%, whereas the average share of high-skilled employment is only 11% (Table C2-1). But these shares differ significantly across countries: the higher proportions are observed (on average over the 2000-2006 period) in the US (21%) and in Germany (25%) (Figure C2-3). It is also interesting to note the large decreases in the OECD EPL indicator from 1994 to 2006 in some previously highly-regulated countries, such as Denmark, Finland and Netherlands (Figure C2-4). In 2006, the level of labor market regulations (EPL) is the lowest in the US and the highest in France and Italy.

Table C2-3 presents the variance analysis of equation (1) variables. It shows that for most of our variables a large part of their variances is accounted for by the fixed effects. Apart from the EPL, the three single fixed effects (country, industry and years) together explain at least 64% of the variability of each variable, and even more than 90% for the capital intensity indicators (column (1)). And the three potential crossed fixed effects (country*industry, country*year, industry*year) explain at least 76% of the residual variability, and even often more than 90%. Therefore, our main specification does not introduce the industry*year fixed effects, but includes the country*industry, country*year fixed effects in order to prevent various sources of endogeneity.

Table C2-3
Variance Analysis of the Estimate Variables

		First step R²	Second step R²			
Fixed effects:		(1) country, industry, year	(2) country*indus.	(3) country*indus., country*year	(4) country*indus., country*year, industry*year	Obs.
Capital intensity	Total capital	0.9743	0.8510	0.8935	0.9295	3625
	Non-ICT eq.	0.9635	0.8766	0.9132	0.9350	3625
	Cons.	0.9596	0.8818	0.9205	0.9470	3625
	ICT	0.9550	0.7865	0.8692	0.8933	3625
	R&D	0.9225	0.9210	0.9300	0.9517	2537
Empl. share	High-skilled	0.8602	0.8518	0.9081	0.9299	3200
	Med.-skilled	0.8853	0.6961	0.8994	0.9397	3200
	Low-skilled	0.9363	0.8472	0.9453	0.9563	3200
Relative cost	Total capital	0.8508	0.7280	0.8842	0.9064	3625
	Non-ICT eq.	0.8683	0.6916	0.9194	0.9359	3625
	Cons.	0.8112	0.4199	0.9522	0.9620	3625
	ICT	0.9030	0.5087	0.6912	0.7686	3625
	R&D	0.8716	0.9098	0.9709	0.9768	2537
	High-skilled	0.7824	0.7208	0.8534	0.8714	3200
	Med.-skilled	0.7875	0.7929	0.8541	0.8723	3200
	Low-skilled	0.6478	0.7864	0.9350	0.9426	3200
EPL impact		0.0207	0.8870	0.8895	0.9324	3625

Note: This table summarizes the results of an analysis of variance for all the variables in our analysis in terms of separate country, industry and year effects as well as a sequence of two-way interacted effects. Column (1) documents the variability of the variables lost in terms of "first step" R² when we include in the regressions of our model the three one-way fixed effects separately, as a basic control for the usual sources of specification errors. The three following columns (2), (3) and (4) document what is the additional variability lost (within the first step residual variability) in terms of "second step" R² when we also include interacted two-way effects, in order to control for other potential sources of specification errors.