3. Determinants of competitiveness

Having proven that our measure of competitiveness is more effective in explaining the relative importance of the different sectors, we will now assess what factors are driving the evolution of equilibrium wages and competitiveness. The theoretical definition of equilibrium wages (equation 9) links competitiveness, as expressed by the ratio of actual to equilibrium wages, to capital intensity, capital productivity and the relative price effect.

In order to shed light on the determinants of equilibrium wages and competitiveness, we use a two-step methodology. In the first step, we focus on the capital–labour ratio and use a production function approach in order to derive an empirical specification relating capital accumulation to the dynamics of relative factor prices and to the bias in technical change. The latter is a measure of how capital intensity changed due to technological factors and to exogenous movements in factor prices. In the second step, we use the measure of bias in technical change as a determinant of equilibrium wages, together with the relative price effect. In both steps we introduce as additional explanatory variables two proxies for the globalisation process that characterised both advanced and developing countries since the start of the 1990s: import outsourcing and export intensity. We test whether these factors explain the specific changes that have occurred in the different countries under our analysis.

3.1 Theoretical model: a CES production function approach

The constant elasticity of substitution (CES) function is a general class of production functions that includes the well-known Cobb Douglas as a special case with elasticity of factor substitution equal to 1. The Cobb Douglas formulation is not useful for our purposes because, on one hand, most of the evidence points to an elasticity of substitution substantially below 1. On the other hand, as we mentioned in the introduction, the Cobb Douglas function does not allow changes in the factor shares, which are of the utmost importance in explaining competitiveness changes.

A general form of the CES production function includes both labour augmenting and capital augmenting parameters (a_L and a_K):

$$Y = A[(a_L L)^{\rho} + (a_K K)^{\rho}]^{1/\rho}$$

where ρ is the elasticity of substitution. The long-run profit maximisation implies that in equilibrium L and K are remunerated according to their marginal productivity:

$$(12) \qquad MPL = A\left[(a_L L)^{\rho} + (a_K K)^{\rho}\right]^{\frac{1-\rho}{\rho}} a_L^{\rho} L^{\rho-1} = \frac{W}{P}$$

$$(13) \qquad MPK = A\left[(a_L L)^{\rho} + (a_K K)^{\rho}\right]^{\frac{1-\rho}{\rho}} a_K^{\rho} K^{\rho-1} = \frac{r}{P}$$

Hence, in equilibrium the marginal rate of transformation between labour and capital equals the relative price of the two factors:

$$(14) \qquad MRT = \left(\frac{a_L}{a_K}\right)^{\rho} \left(\frac{K}{L}\right)^{1-\rho} = \frac{W}{r}$$

This is, of course, an indicator of the equilibrium distribution of value added. With higher wages or lower return on capital (which in equilibrium is equal to interest rates), the MRT becomes steeper. We assume that all variables are stochastic and can change over time; thus by transforming equation (12) into logs and adding a time subscript we get:

$$(15) \qquad \rho\,(log a_{Lt} - log a_{Kt}) + (1-\rho)\,(k_t - l_t) = w_t - r_t$$

which can be solved for the log of the capital–labour ratio:

$$(16) \qquad k_t - l_t = \frac{\rho}{1-\rho}\,(log a_{Kt} - log a_{Lt}) + \frac{1}{1-\rho}\,(w_t - r_t) = \frac{\rho}{1-\rho}\gamma_t + \frac{1}{1-\rho}\,(w_t - r_t)$$

where

$$(17) \qquad (log a_{Kt} - log a_{Lt}) = \gamma_t$$

Equation (16) states that in equilibrium the capital–labour ratio is a function of the relative factor price and of the difference between logs of capital augmenting and labour augmenting technical parameters. The parameter γ can then be considered a measure of biased technical change. Capital biased change, which implies a positive sign for γ_t, will save labour and *increase the capital share* (lower the labour share), while a negative value of γ_t implies that technical change has augmented the efficiency of labour inputs more than the efficiency of capital, *with a consequent rise in the labour share*. Hence, a positive γ_t indicates technologies that save more labour than capital (also called Harrod-neutral technological progress) and thereby increase the equilibrium wage.

By first differentiating equation (16) we obtain a relation between (log) growth rates:

(18) $$\Delta\,(k_t - l_t) = \frac{\rho}{1-\rho}\,\Delta\gamma_t + \frac{1}{1-\rho}\,(\Delta w_t - \Delta r_t) = \frac{\rho}{1-\rho}\,\Delta\gamma_t + \frac{1}{1-\rho}\,\Delta rfp_t$$

which states that the growth rate of the capital–labour ratio is a linear combination of changes in the relative factor prices and changes in the ratio between the capital and labour augmenting parameters of the CES production function (the bias in technical change). Note that these are technological processes, although the adoption of such technology depends on microeconomic relative costs. For example, falling prices in IT technology will increase the incentive to adopt capital augmenting (labour saving) technology, while lower minimum wages may increase labour augmenting (capital saving) technology. While a lower minimum wage may be compensated in aggregate by higher wages elsewhere (especially for high skilled labour), a fall in interest rates relative to wages is likely to increase the K/L ratio and, ceteris paribus, the equilibrium wage.

This is an interesting result. It means that

- under certain conditions, the rise in equilibrium wages can be the consequence of actual wage increases, provided they are not inflationary and do not cause interest rate increases;
- a fall in the equilibrium wage may be caused by economic uncertainty and higher risk premia in the interest rate;
- a rise in the equilibrium wage may be the consequence of capital-biased technological change;
- to the degree that outsourcing of low-skill labour increases capital-biased technological change and the capital share (see below), outsourcing increases equilibrium wages and incentives for 'keeping jobs at home' may lower the equilibrium wage and competitiveness.

Interestingly, the developments after European monetary union started had very differentiated effects. In many southern crisis countries, but not in Germany, interest rates came down, thereby raising the capital–labour ratio and the equilibrium wage. But when the global financial crisis hit, this process was reversed. By contrast, in Germany, where interest rates were relatively stable, the change in equilibrium wages must be explained primarily by technological change.

3.2 Estimation of the bias in technical change

In order to obtain an empirical equivalent of equation (18) we would need data on the cost of capital for each manufacturing sector. The cost of capital is usually calculated as a weighted average of the cost of the different sources of firms' financing (also called the weighted average cost of capital [WACC]), where a main distinction is between debt financing and equity financing. In order to obtain estimates of the weighted average cost of capital representative firm-level data are required. Assuming efficient capital markets means that the weighted average cost of capital is the same across sectors and varies only over time. We can then estimate equation (18) by assuming that common variations in the weighted average cost of capital are captured by yearly dummies and the empirical specification becomes:

(19) $$\Delta(k_{i,t} - l_{i,t}) = \beta_1 + \beta_2 \Delta w_{i,t} + \theta_t + u_i + \varepsilon_{i,t}$$

Where $u_i + \varepsilon_{i,t}$ is the error component made up of sector-specific effects and the two-way error term, whereas θ_t is a set of time dummies that controls for common changes in the weighted average cost of capital and for any other shocks common to all sectors. In particular, both domestic and external demand can generate important common effects. The two factors are also influenced by the fiscal and monetary policy stances, which have played an important role since the global financial crisis. We estimate equation (19) on a panel of i sectors over time for each country and use the fixed effect estimator (FE).

A proxy of biased technical change could be obtained from the estimated residuals. In this way, it can be expressed as the sum of the constant term and the sector-specific effects multiplied by a function of the elasticity of substitution:

(20) $$\beta_1 + u_i + \varepsilon_{i,t} = \frac{\rho}{1-\rho} \Delta\gamma_i$$

Due to the lack of sector-specific data on the weighted average cost of capital, our final measure is multiplied by the ratio $\frac{\rho}{1-\rho}$ but since the use of a CES production function implies that capital and labour have a degree of complementarity, the elasticity of substitution ρ is below 1, which means that the sign of $\Delta(\log a_k - \log a_l)$ and that of equation (20) are the same. This means that the indices of bias in technical change built in this way are a monotonic transformation of the real indexes, providing by consequence the same information on the dynamics of capital intensity due to biases in technology.

Among the determinants of factor intensities, the delocalisation of production, which can be classified as a form of technical change, plays an important role. Recent works on the subject (Timmer *et al.* 2014; Amador *et al.* 2015) indicate a transformation of the labour market. The increased fragmentation of production processes across different countries is usually associated with an increase in the relative use of capital and skilled labour. This is explained by the increased importance of new technologies embedded in capital equipment, especially ICT and financial capital in favouring the delocalisation of some stages of production. These types of capital are a complement to skilled labour (Autor *et al.* 2003; Acemoglu 1999; Acemoglu 2002; Esposito and Stehrer 2012), and a substitute for medium and low skilled jobs. Finally, the effect on the capital–labour ratio depends on the recomposition of employment among skill groups. (Timmer *et al.* 2014) show that among the main euro area countries, the effect is positive – that is, it increases the capital share – for Germany, the Netherlands and Spain, null for France and negative for Italy. The effect for the latter is due to a small reduction in the capital share caused by the strong increase in the share of medium-skilled workers. This literature emphasises changes in factor shares and their dynamics. It is broadly consistent, on a descriptive level, with our sectoral measure of the profit shares which report a reduction in the wage share for most of the countries.

In order to control for the effect of outsourcing on factor intensities we augment equation (19) by introducing the share of imported intermediates in total intermediate inputs ($ImpII$), which represent the inward outsourcing process, and the share of exports in total value added ($ExpVA$) representing a general measure of export intensity. The two measures are taken from the OECD World Input Output Database (Timmer *et al.* 2015) and represent better proxies of outsourcing and export intensity than the standard national accounts and custom data. The estimated specification is as follows:

$$(21) \qquad \Delta(k_{i,t} - l_{i,t}) = \beta_1 + \beta_2 \Delta\log(w_{i,t}) + \beta_3 \Delta ImpII_{i,t} + \beta_4 \Delta ExpVA_{i,t} + \theta_t + u_i + \varepsilon_{i,t}$$

The difference in btc estimates between equations (19) and (21) is an indirect measure of how much of the change in factor intensities is due to the globalisation of production processes.

Equations (19) and (21) are estimated using the fixed effects (FE) estimator. In addition, separate specifications are estimated for the manufacturing sector and for services, given their different behaviour in terms of international competitiveness and outsourcing relations. Before discussing the estimation results, we must clarify that our approach is different from the studies mentioned above (Timmer *et al.* 2014) as we are interested in the determinants of the capital–labour ratio, which is on the LHS of equation (18), while they assessed the change in relative factor prices due to the outsourcing process.

The estimation results are shown in Tables 8 and and 10, while in Table 11 we show the distribution of biased technical change (see equation 20) in manufacturing and services for the different countries. In Table 10 we also show the same estimates for capital per hours worked rather than capital per worker; the results are fairly similar, which is why we stick to average wages in the other tables.

In manufacturing (Table 8), we find that the impact of the average wage on the capital–labour ratio has a significant coefficient close to unit in Spain and France, while in Finland its impact is around 0.3. In the other countries (Italy, Germany, Netherlands, Austria, Belgium), wage movements alone are not significant in explaining the change in the capital–labour ratio, because the coefficients are not significant and this is not an estimation of the elasticity of substitution.

Timmer *et al.* (2014) have found evidence for the thesis that firms in mature economies relocate their unskilled labour-intensive production activities to lower-wage countries, while keeping strategic and high-value-added functions concentrated at home where the skilled workers and intangible capital they need are available.

Our results tend to confirm the findings of Timmer *et al.* (2014). The impact of inward outsourcing – that is, of buying intermediary inputs abroad rather than producing them locally – is negative and significant in Germany and the Netherlands. This result is in line with the assumption **that capital intensive stages of production are more likely to be delocalised, reducing by consequence the ratio within each manufacturing industry**. It must be noted that while this effect implies a reduction in equilibrium wages (see formula 9), the total effect of outsourcing on equilibrium wages depends nevertheless also on its impact on capital productivity (see section 3.3 below). Finally, export intensity is positive and significant in Italy, Spain and, to a lower extent, in the Netherlands, whereas it is negative and significant in Germany. The positive impact implies that, having controlled for the outsourcing process, an increase in the export intensity of the first three countries is associated with higher capital intensity. This result can be intuitively explained by two factors: first, in order to compete in international markets firms must invest more in new technologies and in product quality; second, the role of firm size is important as larger firms are more likely to be stay competitive in international markets and larger firms are usually more capital intensive. The German case, instead, can be explained by the higher role played by inward outsourcing and by the labour market reforms that helped to maintain high levels of employment despite the overall technological progress taking place in the global economy. This is also coherent with Sinn's (2006) hypothesis that during the previous decade Germany had become a bazaar economy specialised in low value added exports.

Turning to the service sector (Table 10), we find wages to have a positive and significant impact on the capital–labour ratio in Italy, Spain and France, with coefficients ranging from 0.36 to 0.58. Outsourcing seems to play a role only in Finland, where the share of imported intermediate input increases the capital to labour ratio. The export intensity is, instead, never significant. These results are not unexpected as the bulk of outsourcing covers manufactured goods, benefitting the service sector through the use of globally built equipment goods. The heterogeneity in the sectoral requirements in terms of imported capital goods and the distinction between tradable and non-tradable services add to the difficulty of identifying significant correlations.

To sum up, the estimates indicate that the manufacturing and service sectors behave differently in all countries. In manufacturing, international outsourcing is particularly important in explaining the German dynamics of capital intensity, whereas export intensity seems to have a more generalised effect.

Table 8 Dependent variable log of the capital–labour ratio for manufacturing

	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
Basic specification (equation 19)								
Δw	0.148	0.183	0.908***	0.928**	−0.156	0.181	0.229	0.322**
	[0.152]	[0.168]	[0.170]	[0.273]	[0.665]	[0.590]	[0.227]	[0.097]
R^2w	0.162	0.119	0.317	0.249	0.131	0.076	0.227	0.201
N	192	208	121	132	192	208	192	192
Outsourcing augmented specification (equation 21)								
	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
Δw	0.052	0.169	1.015**	1.001**	0.018	0.200	0.228	0.282**
	[0.144]	[0.140]	[0.319]	[0.339]	[0.592]	[0.641]	[0.229]	[0.113]
ΔImpII	−0.304	−0.146**	−1.453	−0.38	−0.576*	0.402	−0.082	0.038
	[0.234]	[0.066]	[0.861]	[0.260]	[0.273]	[0.297]	[0.138]	[0.215]
ΔExpVA	0.026**	−0.034***	0.023*	−0.006	0.014***	0.000	0.007	0.019
	[0.010]	[0.003]	[0.011]	[0.010]	[0.002]	[0.024]	[0.006]	[0.018]
R^2w	0.179	0.238	0.388	0.257	0.194	0.088	0.234	0.228
N	191	208	121	132	192	208	192	192

Notes: * Significant at 10% level; ** significant at 5% level; *** significant at 1% level. RoC=adjusted return on capital; Wage=average compensation per employee. Imp/II=Imports on intermediate inputs (from input output tables). Exp/VA=Exports on value added (from input output tables). R2w=within groups R squared.

Table 9 Dependent variable log of the capital–labour (in hours) ratio for manufacturing; hourly wages

	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
Basic specification (equation 19)								
Δw	0.662**	0.305	1.024***	0.685**	−0.195	0.049	−0.078	0.641***
	[0.181]	[0.188]	[0.189]	[0.192]	[0.405]	[0.388]	[0.106]	[0.111]
R^2w	0.403	0.357	0.361	0.236	0.107	0.09	0.369	0.405
N	160	176	121	128	192	208	120	192
Outsourcing augmented specification (equation 21)								
	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
Δw	0.664**	0.251	1.042**	0.772**	−0.102	0.091	−0.072	0.587**
	[0.195]	[0.149]	[0.236]	[0.292]	[0.364]	[0.388]	[0.107]	[0.138]
ΔImpII	−0.360**	−0.168***	−1.46	−0.272	−0.549*	0.321	0.015	−0.066
	[0.098]	[0.034]	[0.813]	[0.265]	[0.253]	[0.349]	[0.257]	[0.244]
ΔExpVA	0.01	−0.034***	0.023	−0.005	0.014***	−0.005	0.002	0.023
	[0.006]	[0.003]	[0.013]	[0.008]	[0.002]	[0.017]	[0.002]	[0.017]
R^2w	0.415	0.453	0.43	0.24	0.176	0.098	0.37	0.428
N	159	176	121	128	192	208	120	192

Notes: * Significant at 10% level; ** significant at 5% level; *** significant at 1% level. RoC=adjusted return on capital; Wage=average compensation per employee. Imp/II=Imports on intermediate inputs (from input output tables). Exp/VA=Exports on value added (from input output tables). R2w=within groups R squared.

Table 10 **Dependent variable log of the capital-labour ratio for services**

Basic specification (equation 19)								
	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
Δw	0.301**	0.092	0.401***	0.485*	0.533*	0.409	0.203	0.208
	[0.104]	[0.097]	[0.079]	[0.223]	[0.274]	[0.249]	[0.127]	[0.248]
R²w	0.32	0.1	0.427	0.328	0.106	0.117	0.124	0.105
N	192	192	119	192	192	192	192	192
Outsourcing augmented specification (equation 21)								
	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
Δw	0.367**	0.022	0.395***	0.585**	0.542	0.618	0.107	0.196
	[0.082]	[0.113]	[0.080]	[0.199]	[0.368]	[0.363]	[0.075]	[0.242]
ΔImpII	0.149	0.577	−1.126*	−0.667	−0.178	0.198	0.012	0.465**
	[0.375]	[0.389]	[0.599]	[0.487]	[0.413]	[0.497]	[0.170]	[0.149]
ΔExpVA	0.384	−0.102	−0.114	0.372	0.123	−0.07	−0.051	0.057
	[0.401]	[0.109]	[0.214]	[0.273]	[0.147]	[0.083]	[0.041]	[0.090]
R²w	0.377	0.122	0.444	0.347	0.11	0.143	0.118	0.163
N	176	176	108	176	176	176	176	176

Notes: * Significant at 10% level; ** significant at 5% level; *** significant at 1% level. RoC=adjusted return on capital; Wage=average compensation per employee. Imp/II=Imports on intermediate inputs (from input output tables). Exp/VA=Exports on value added (from input output tables). R2w=within groups R squared.

The distributions of the capital biased (that is, labour saving) technical change in the two main macro-sectors $-\frac{\rho}{1-\rho}\Delta\gamma_i$ as calculated in equation (20) and derived from Tables 8 and 10 – are shown in Table 11. The numbers indicate the final value of the factor changes in the log of the ratio a_k/a_l, that is, $(loga_{Kt} - loga_{Lt}) = \gamma_t$ (multiplied by the term $\rho/1-\rho$) and its probability distribution in terms of percentiles. A positive value indicates a bias in favour of capital, while a negative value indicates a bias in favour of labour. Values on the 50 per cent column indicate the median change of the ratio, and a similar logic applies to the other percentiles. Thus, for example in Germany 75 per cent of all manufacturing sectors use labour-saving technology, but in France it is only 25 per cent and in Spain even less. By contrast, in the service sector, the distribution is close to 50:50 in all countries.

The estimates reveal useful information, which integrates the evidence collected so far. In aggregate, all euro area member states reveal capital-augmenting biased technological change, although the estimates confirm the difference between manufacturing and services, the former having experienced a higher tendency to a capital bias in technical change, as shown by the median values (50 per cent). In all countries and in both macro-sectors the results come from strong changes between individual sectors, with particularly large tails in Finland, Austria, and the Netherlands in manufacturing. The latter two show similar dynamics also in services, and Spain shows sectors with particularly low levels. The Spanish case can be explained by the large immigration from Latin America, which is concentrated in labour intensive sectors, whereas the peaks in capital biases might be due to the role of multinational investment and the high increase in the share of college graduates during the past 20 years.

Table 11 **Distribution of the log growth rate of biased technical change in manufacturing (percentiles)**

Manufacturing									
	0.01	0.05	0.10	0.25	0.50	0.75	0.90	0.95	0.99
Austria	–0.31	–0.11	–0.04	0.01	0.04	0.07	0.11	0.17	0.28
Belgium	–0.29	–0.07	–0.01	0.03	0.06	0.09	0.11	0.12	0.22
Germany	–0.08	–0.01	0.00	0.02	0.05	0.07	0.10	0.11	0.23
Spain	–0.22	–0.15	–0.11	–0.06	–0.04	0.00	0.05	0.10	0.26
Finland	–0.37	–0.08	–0.03	0.03	0.07	0.10	0.14	0.18	0.29
France	–0.19	–0.14	–0.09	–0.05	–0.02	0.01	0.04	0.06	0.28
Italy	–0.13	–0.05	–0.03	0.00	0.02	0.05	0.07	0.08	0.13
Netherlands	–0.21	–0.11	–0.06	–0.03	–0.01	0.01	0.07	0.10	0.34
Services									
	0.01	0.05	0.10	0.25	0.50	0.75	0.90	0.95	0.99
Austria	–0.37	–0.13	–0.08	–0.04	–0.01	0.02	0.05	0.08	0.17
Belgium	–0.11	–0.06	–0.04	–0.02	0.00	0.03	0.05	0.08	0.17
Germany	–0.09	–0.04	–0.03	–0.01	0.01	0.03	0.04	0.05	0.15
Spain	–0.26	–0.15	–0.09	–0.04	–0.01	0.02	0.06	0.09	0.15
Finland	–0.11	–0.06	–0.04	–0.02	0.00	0.02	0.05	0.07	0.13
France	–0.19	–0.07	–0.05	–0.01	0.03	0.05	0.09	0.12	0.21
Italy	–0.15	–0.09	–0.05	–0.01	0.02	0.05	0.10	0.12	0.21
Netherlands	–0.40	–0.17	–0.09	–0.02	0.02	0.06	0.12	0.17	0.34

Source: Authors' estimation.

3.3 Biased technical change, outsourcing and competitiveness

From equation (9) we know that equilibrium wages depend crucially on the relative price effect, on the capital–labour ratio and on capital productivity. In the previous section we extracted the part of the changes in the capital–labour ratio due to factor price movements and assumed that the residual is a measure of the bias in technological change (*btc*), including the effects of outsourcing and export intensity. In this section, we seek to understand what forces are driving changes in wage competitiveness as described by the gap between equilibrium and actual wages.

The bias in technical change remains the main explanatory variable, but we also add the price effect (the relative GDP deflator) and the two measures of inward outsourcing and export intensity used in the previous analysis. The latter are included because they can affect competitiveness through other channels than the relative change in factor use. For example, by simply increasing the amount of trade they can foster the diffusion of international knowledge spillovers (Coe and Helpmann 1995) or the exploitation of economies of scale, or increase productivity due to efficient production delocalisation and to a market size effect (Rodrik 1988) (Yeaple 2005). All these factors imply an increase in capital productivity and therefore affect equilibrium wages as we have defined them.

The estimated specification is as follows:

(22) $$\Delta Comp_{i,t} = \alpha + \beta_1 btc_t + \beta_2 \Delta ImpII_{i,t} + \beta_3 \Delta ExpVA_{i,t} + \beta_4 \Delta PYeff_{i,t} + \theta_t + u_i + \varepsilon_{i,t}$$

where *PYeff* is the GDP price effects, defined as the log difference between European and national prices, and *Comp* is the measure of wage competitiveness given by the ratio of actual to equilibrium wages. Hence, **an increase in $\Delta Comp_{i,t}$ reflects a deterioration of competitiveness**. The coefficients θ and u represent, as before, time and sector-specific dummies. We do not include the relative capital deflator as it turned out to be never significant. The equation is estimated, as before, with the fixed effect estimator.

The results are shown in Table 12 for manufacturing and in Table 13 for services. Each panel presents specifications adding one by one the variables of equation 22, starting with *btc* only. In manufacturing, the common result is the positive and significant impact of the relative price effect, the only exception being Austria. The inward outsourcing variable is negative and significant in Germany, France and Austria, leading to higher competitiveness, whereas it is positive, although only weakly significant, in Spain. Finally, the export intensity is positive and significant in all countries except Spain (where it is negative), while it is insignificant in Belgium and Finland.

The bias in technical change has a differentiated effect. In Italy it is negative but it turns insignificant when controlling for the price effect; in Germany it is positive but it becomes insignificant when export intensity is added; in France it is robustly negative and significant in all specifications, implying that having controlled for all other factors the capital bias in technical change has increased the competitiveness of the country; a similar result holds weakly for Finland. In Spain, Austria and the Netherlands it is instead positive and significant, implying that a bias in favour of capital and labour saving actually causes a reduction in competitiveness. The results for these countries can be explained by the negative dynamics of capital productivity caused by changes in the capital–labour ratio, not due to the effects of outsourcing and export intensity. This assumption seems to be in line with the reduced dynamics of manufacturing capital productivity, as shown in Figures A2.1, A2.6 and A2.10.

Turning to the service sector (Table 13) the evidence is much weaker. The price effect tends to be positive and significant, whereas neither inward outsourcing not export intensity play a role in explaining wage competitiveness. This result is in line with the previous finding. Finally, the bias in technical change is significant only in Germany and with a positive sign, which indicates deterioration in competitiveness in services. This suggests that in this country services absorbed most of the low wage-low value added jobs created as a consequence of the labour market reforms (Hartz IV and so on) and by the recomposition of employment in manufacturing.

Table 12 **Estimates of competitiveness for manufacturing industries**

	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
btc	−0.468***	0.293**	0.092*	−0.088***	−0.565	0.677***	0.389	−0.355
	[0.084]	[0.070]	[0.045]	[0.012]	[0.678]	[0.100]	[0.242]	[0.207]
R2w	0.14	0.172	0.218	0.367	0.156	0.357	0.174	0.153
N	189	208	119	128	187	208	192	192
	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
btc	−0.01	0.295**	0.054**	−0.013***	0.818**	0.634***	0.491	−0.416
	[0.092]	[0.073]	[0.023]	[0.001]	[0.217]	[0.081]	[0.275]	[0.254]
ΔPYeff	1.314***	0.251***	3.026***	0.996***	1.921***	−0.211***	0.956***	0.933***
	[0.045]	[0.007]	[0.145]	[0.033]	[0.064]	[0.013]	[0.177]	[0.127]
R^2w	0.617	0.243	0.829	0.789	0.673	0.46	0.365	0.415
N	189	208	119	128	187	208	192	192
	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
btc_	−0.04	0.517***	0.050**	−0.013***	0.767**	0.615***	0.49	−0.38
	[0.054]	[0.066]	[0.022]	[0.001]	[0.232]	[0.075]	[0.274]	[0.242]
ΔPYeff	1.322***	0.336***	3.036***	0.998***	1.951***	−0.209***	0.946***	0.873***
	[0.036]	[0.020]	[0.144]	[0.034]	[0.069]	[0.012]	[0.182]	[0.089]
ΔImpII	1.109	−1.783***	0.618	0.228	0.832*	−0.745**	−0.18	1.257
	[0.946]	[0.255]	[0.594]	[0.302]	[0.446]	[0.174]	[0.376]	[0.865]
R^2w	0.632	0.336	0.83	0.789	0.68	0.477	0.365	0.444
N	188	208	119	128	187	208	192	192
	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
btc_	−0.015	0.109	0.048**	−0.024***	0.805**	0.617***	0.488*	−0.194*
	[0.081]	[0.099]	[0.020]	[0.004]	[0.202]	[0.070]	[0.270]	[0.101]
ΔPYeff	1.317***	0.335***	3.192***	0.871***	1.784***	−0.200***	0.957**	0.811***
	[0.037]	[0.032]	[0.203]	[0.029]	[0.081]	[0.014]	[0.236]	[0.101]
ΔImpII	0.855	−3.302***	1.131*	−0.724**	0.112	−1.045***	−0.145	0.224
	[0.781]	[0.611]	[0.622]	[0.265]	[0.627]	[0.170]	[0.454]	[0.379]
ΔExpVA	0.073	0.217***	−0.133**	0.210***	0.020***	0.164***	−0.003	0.176***
	[0.086]	[0.025]	[0.038]	[0.013]	[0.004]	[0.019]	[0.017]	[0.018]
R^2w	0.635	0.595	0.857	0.876	0.708	0.626	0.365	0.633
N	188	208	119	128	187	208	192	192

Notes: * Significant at 10% level; ** significant at 5% level; *** significant at 1% level. btc=bias in technological change. r2w=within groups R squared.

To sum up, our results indicate that the bias in technical change, outsourcing and export intensity exert a strong impact on wage competitiveness and that these effects are concentrated in the manufacturing sector. The results, combined with those in section 3.2 provide an interesting explanation for the German case:

— the outsourcing process has improved the country's competitiveness because the negative effect on capital intensity is more than compensated by the positive effect on capital productivity;

— on the other hand, the increased export intensity has lowered competitiveness as it reduced both capital intensity and capital productivity.

Table 13 **Estimates of competitiveness for manufacturing industries**

	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
btc	−1.257	0.153	0.574*	−0.582	−0.006	−0.122	0.153	0.184
	[1.054]	[0.206]	[0.280]	[0.393]	[0.050]	[0.163]	[0.160]	[0.170]
R2w	0.222	0.087	0.372	0.24	0.058	0.145	0.058	0.085
N	191	176	87	174	176	176	186	176
	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
btc	−1.222	0.202	0.508*	−0.524	0.098	−0.01	0.229	0.152
	[1.109]	[0.248]	[0.230]	[0.454]	[0.102]	[0.132]	[0.162]	[0.164]
ΔPYeff	0.159	0.252	1.182***	0.35	1.289***	0.853**	0.875*	1.065**
	[0.594]	[0.186]	[0.200]	[0.394]	[0.243]	[0.334]	[0.403]	[0.239]
R^2w	0.222	0.096	0.396	0.244	0.312	0.196	0.101	0.35
N	191	176	87	174	176	176	186	176
	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
btc_	−1.688	0.454**	0.504	−0.596	0.092	−0.029	0.137	0.138
	[1.459]	[0.144]	[0.285]	[0.490]	[0.108]	[0.133]	[0.233]	[0.188]
ΔPYeff	0.866	0.383**	1.309***	0.283	1.261***	0.798**	0.925**	1.075**
	[0.577]	[0.138]	[0.206]	[0.487]	[0.245]	[0.352]	[0.415]	[0.236]
ΔImpII	3.834	0.614	−0.273	−2.523	0.656	0.347	0.924	−0.620**
	[2.655]	[0.533]	[1.644]	[2.476]	[0.547]	[0.904]	[0.743]	[0.264]
R^2w	0.262	0.142	0.4	0.276	0.311	0.199	0.115	0.37
N	175	160	76	158	160	160	170	160
	ITA	DE	ESP	FR	NL	AUT	BEL	FIN
btc_	−1.665	0.456**	0.498	−0.596	0.087	−0.044	0.094	0.144
	[1.449]	[0.142]	[0.290]	[0.491]	[0.101]	[0.135]	[0.237]	[0.190]
ΔPYeff	0.723	0.381**	1.374**	0.28	1.154***	0.708*	0.913*	1.068**
	[0.590]	[0.138]	[0.287]	[0.509]	[0.221]	[0.346]	[0.430]	[0.233]
ΔImpII	2.735	0.658	−0.25	−2.522	−0.175	0.351	0.435	−0.602**
	[2.399]	[0.513]	[1.669]	[2.481]	[0.618]	[0.972]	[0.641]	[0.263]
ΔExpVA	2.268	−0.249	−0.253	0.054	0.390	0.381*	0.436	0.12
	[3.047]	[0.263]	[1.002]	[0.833]	[0.341]	[0.180]	[0.247]	[0.132]
R^2w	0.267	0.143	0.4	0.276	0.326	0.214	0.134	0.372
N	175	160	76	158	160	160	170	160

Notes: * Significant at 10% level; ** significant at 5% level; *** significant at 1% level. btc: bias in technological change. r2w=within groups R squared.

— the actual changes in these two variables suggest that the effect of inward outsourcing prevails, meaning that competitiveness has actually improved due to globalisation.

The effect of export intensity is common to most of the countries, suggesting that it is the result of a general tendency affecting the whole European economy, while *btc* appears to be particularly important in the other northern countries, as well as in Spain. Among core countries, France and, to a lesser extent, Finland, seem to be the only gainers from this process.