15 Technological choices under institutional constraints: measuring the impact on earnings dispersion

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15.1 Introduction

The performance of a country is more often evaluated in terms of too high an unemployment rate than too high earnings[1] inequality. The technological decisions of the firms in developed countries have been held responsible for the employment rate, but their impact on earnings dispersion is much less debated. By the same token, labour market regulation is alleged to move the economic system away from the macroeconomic equilibrium, as the minimum wage and the employment protection legislation (EPL) reduce labour demand and slow down the flow of the younger labour force towards employment; nevertheless, the focus is on the target for the employment rate more than on how wide earnings inequality should be tolerated. Recently, wages as well as earnings inequality has gained momentum – almost to the same extent of employment and unemployment rates – not only on equity but also on efficiency grounds, as the firms' production process is considered a co-determining factor in the evolution of pay disparities.[2]

It is apparent that wage dispersion is strictly interwoven with employment rates across skill levels, as they are jointly determined by the trajectories followed by firms in choosing their productive techniques, as well as by labour market institutions providing insurance to risk-averse workers against unemployment and low wages. In addition, the competitive pressure of imports from the developing countries is part of the explanation of the switch to labour-saving techniques.[3]

Very scant research work has been carried on so far to provide empirical evidence on the technological patterns determined by restrictions placed by labour market regulation on the employers' production decisions. We aim at contributing to fill this gap by studying the impact of technological choices on earnings dispersion when institutional constraints narrow the capacity of the firm to decide on the employment level and on the productive techniques combining high-skill and low-skill workers.

Our empirical investigation concerns the European economies after the recession of the early 1990s. In Section 15.2, we compare different

approaches to the analysis of the interaction between technology and institutions. In Section 15.3, for each country under scrutiny and for each sector the skill premium (SP) and the high-skill ratio (HR) are related to the index of earning dispersion (EDI) (Gini 1914) we use in order to disentangle the combined effect of earnings and employment percentages of high-, intermediate-, and low-skill workers. In Section 15.4, evidence is presented to account for the evolution of wages and employment at the sectoral level and a Theil decomposition (Theil 1972) is accomplished so to analyse the trends in earnings and wage dispersion between-sectors and within-sectors. Section 15.5 concludes.

15.2 The impact of technologies and institutions on employment and wage levels

The opinion about the trends of employment rates and earnings inequality in the European Union is sharply divided. The empirical investigation indicates that in the past decades bargaining institutions have been compressing the wage distribution, thus causing lower employment of the less educated male workers while female employment has been rising along with an increase in the participation rate (Blau and Kahn 2000). According to the view recently proposed by the OECD, by compressing wages, labour market regulation hampers labour demand. The clue is that those European countries where earnings inequality has risen more than average during the 1990s also appear to have experienced a relative increase in employment (and a relative decrease in unemployment).[4] Other studies contend this interpretation by showing that the sign of the correlation between the employment rate and the earnings inequality turns out to be negative when reference is made to the household level,[5] and for jobs in traditional sectors.[6]

The OECD view relies upon a well-known approach to wage inequality in Europe, which interprets the labour market performances of European countries as a result of the degree of labour market regulation (Krugman 1994). According to the Krugman hypothesis, a downward shift in the relative labour demand for low-skill workers is expected to result in a higher wage inequality in countries characterized by a flexible labour market and in a higher unemployment rate in countries characterized by a rigid labour market. In fact, the tenet is widely shared that starting from the end of the 1970s in many European countries labour market institutions have increasingly protected the wages of the *insiders*, at the cost of a lift in structural unemployment in the two subsequent decades. Under wage compression, employment and participation rates of the low-skill labour force were stuck, especially in those sectors more exposed to harsher international competition.

The Krugman hypothesis was anticipating that in Europe – differently from what was happening in the US where a flexible labour market exists – wage inequality would have decreased, as a consequence of persistent

unemployment causing a much lower proportion of low-pay workers at the bottom of the wage distribution.[7] Yet, data for the 1980s and the early 1990s seem to indicate a fall in labour demand not only for the low-skill but also for the high-skill workers; in addition, in the second half of the 1990s labour market deregulation is alleged to have improved the overall employment rate in most EU countries, due to an increasing number of low-skill workers in low-pay jobs, albeit at the cost of widening the wage inequality.[8] While the implementation of active labour market programmes (ALMP) was expected to raise workers' skills and capabilities, and cause an upgrading in wage levels, with possible reduction in wage and/or earnings disparities (Agell 1999 and 2002), other labour market reforms have favoured the expansion of jobs for low-skill workers with temporary labour contracts (Layard and Nickell 1999).

Empirical evidence also indicates that economic growth has remained sluggish in Europe, a possible reason being an interaction between institutions and technological choices which determines an inverse correlation between productivity and employment (van Ark *et al.* 2003). During the first half of the 1990s, productivity gains largely came from the expulsion of low-skill workers; later on, in the period 1996–2001, a rising labour input caused the slowdown in labour productivity and in wage levels at the bottom of the wage distribution (Blanchard 2004 and 2006). Wage levels for every skill level seems to be influenced in Europe by investment decisions made by firms driven by the need to cope with productivity of workers at a constant employment level (Pischke 2005).

These studies suggest that an alternative to the Krugman's view can be envisaged. The influence of institutions does not absolutely orient firms towards the choice of labour-saving techniques, thus compressing the wage distribution and enlarging the unemployment rate. Technological patterns differ, depending on sectoral characteristics, the skill distribution of the labour force, and a varying degree of labour market regulation.

The two main technological strategies conceived by Acemoglu (1999, 2002) respond to different combinations of these factors. The first strategy is the skill-biased technical change (SBTC) driven by the ICT-intensive producing and using sectors. The incentive of high profits stemming from investment in innovation determined in the United States a strong labour demand for highly educated workers, well above the rising supply of new entrants in the labour market with university degrees, thus widening the wage distance between high-skill and low-skill workers (the so-called skill premium). Empirical evidence confirms that wider wage dispersion across skill levels in the US manufacturing was a result of skill-biased organizational changes both within and across plants (Dunne *et al.* 2004).

Acemoglu presents a production function with constant elasticity of substitution (CES):

$$Y(t) = [(A_L(t)\,L(t))^{\rho} + (A_H(t)\,H(t))^{\rho}]^{1/\rho}$$

where $\rho \leq 1$, and its implicit relative labour demand function, expressing the skill premium, is:

$$\frac{W_{Hi}}{W_L} = \frac{A_H/A_L}{(H/L)^{-(1-\rho)}} = \frac{(A_H/A_L)^{(\sigma-1)}}{(H/L)^{-1/\sigma}}$$

The skill premium depends on A_H and A_L, the factor-augmenting technological terms, and on the elasticity of substitution – $\sigma \equiv 1/(1-\rho)$ – between the high-skill (H) and the low-skill (L) workers. The condition for the implementation of SBTC is labour market flexibility. The productivity gaps created by SBTC between the high-skill and the low-skill workers through A_H and A_L respectively should be reflected by the wage and employment gaps between these two groups of workers. Under the condition of $\sigma > 1$, a rising wage inequality is explained by an increase in the A_H/A_L ratio higher than the H/L ratio, which raises the relative wage rate for the more educated and more productive high-skill workers.

In many European countries the SBTC could not develop, as firms have been suffering from an opportunity set of production techniques restrained by labour market institutions, with job protection and minimum wage playing a very relevant role (Acemoglu 2003). To equalize the low-skill workers productivity to their wage above the equilibrium level, employers would have been compelled to resort to 'complementary technologies', whereby low-skill workers share functions and mansions with high-skill workers so raising their labour performances. Differently from the Krugman interpretation, the company facing a rigid labour market does not remain passive, but adjusts its productive technology in order to cope with possible inefficiencies connected to labour market regulation.

To understand why labour market regulation may have prevented Europe from following the skill-biased technological trajectories which characterized the US economy during the 1990s, we construct an example, inspired by Acemoglu (2003), to describe an institutionally-constrained technological decision. Suppose labour market regulation consists of a minimum wage equal to 6 and an EPL causing high firing costs. Assume that in a firm one high-skill worker and one low-skill worker are employed, and the bargaining makes the wage to be equal to ¾ and ½ of productivity for the high skills and the low skills respectively. The high-skill worker's productivity is equal to 24, so that her wage level is 18, while the low-skill worker productivity is equal to 8, but must be paid the minimum wage 6 instead of 4, thus exceeding the ½ of productivity. Total production is 32, total wages are 24, and profits are 8. Now suppose a switch to SBTC, through an innovative investment which costs 1 to the firm. As a second high-skill worker substitutes the low-skill worker, the two high-skill workers are paid, as before, ¾ of productivity. Total production rises to 48, so that the minimum wage would no longer be binding and profits increase to 11 (= 48 – 36 – 1). Alternatively, in order to avoid possibly prohibitive firing costs, but still escape the minimum-wage constraint,

the firm could lay out an investment in a 'complementary technology', whereby the low-skill worker shares mansions with the high-skill worker. The employer could consider an investment, assumed to cost 2 and allowing the low-skill worker's productivity to rise from 8 to 12, while the high-skill worker's productivity stays at 24. Since total production would be 36, the minimum wage would not be binding, and profits would increase to 10 (= 36 – 24 – 2).

While profits appear to be higher with the SBTC, we did not quantify yet the firing costs. Under the SBTC the low-skill worker could not be substituted, but must be paid even if he does not take part in production, until the legal dispute is settled. Hence, whether or not the SBTC dominates the 'complementary technology' depends on the effect of the second institutional factor – the EPL – combining with the minimum wage. If the job protection legislation is such to determine a firing cost higher than 1, the higher profitability warranted by the SBTC vanishes.

The rationale conveyed by the numerical example is that when the higher profits permitted by SBTC cannot be obtained, as litigation costs discourage firing the low-skill workers, a 'complementary technology' may be chosen, allowing the low-skill workers' productivity to match the minimum wage. By pointing to the adjustment of technology to institutions, this view may explain why SBTC has spread in Europe to a much lesser extent than in the US. Yet, a comprehensive analysis considering different labour market institutions across the European countries constraining the employers' technological decisions, and their fall-out on labour demand and the wage level for different skill groups, is still lacking.[9]

This interpretative impasse over interactions between technology and institutions as the determinant of earnings dispersion is confirmed by simple calculations. On the basis of the information provided by the ECHP dataset, covering the 15 EU countries (hereafter, EU-15) in the years 1994–2001, we have computed for each country a Gini index for wages net of taxes as well as the ratio of working (with an employer in paid job for at least 15 hours per week) to total population. Since the ECHP dataset only surveys the population aged at least 16, this 'working ratio' is meant to be more informative of both (1) the employment rate,[10] as it focuses on the self-declared employed, while keeping information about the population structure like the activity rate does; and (2) the activity rate,[11] as it provides information on the working population net of the unemployed and of children under 16. The picture is uplifted, but does not change substantially, when the working ratio is referred to all employed persons including the self-employed and those with unpaid work in family enterprise.

Figure 15.1 shows the scatter diagram of the Gini indices and the working ratio for the waves 1 (1994), 4 (1997) and 8 (2001). The Scandinavian countries (Denmark, Finland and Sweden) tend to show higher-than-average working ratios and lower-than-average net wage inequality, so are to be found in the upper left section of the diagram. The Anglo-Saxon countries (Ireland

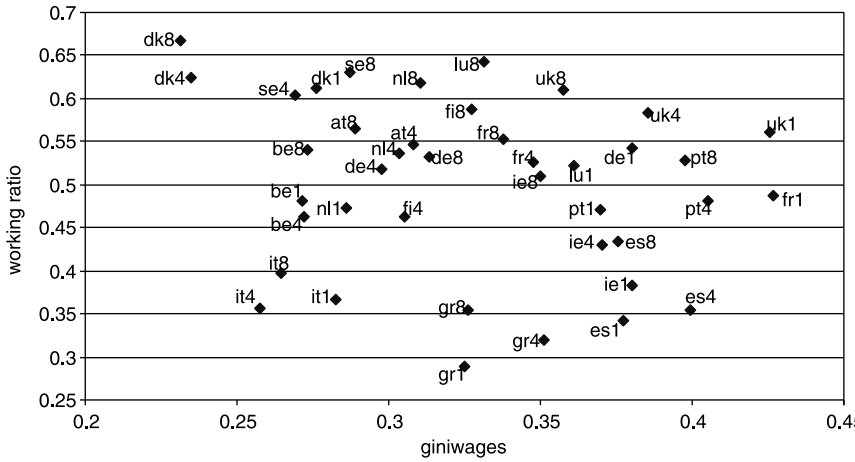


Figure 15.1 Working ratios and Gini net wages in the EU-15 (1994, 1997, 2001)

and the United Kingdom) tend to occupy the upper right section, presenting on the whole higher-than-average levels both for employment (Ireland moves from lower- to higher-than-average working ratios during the eight years of the survey) and for net wage inequality. The Continental countries (Austria, Belgium, France, Germany, Luxembourg and the Netherlands) are positioned in the middle of the picture and the Mediterranean countries (Italy, Greece, Portugal and Spain) in general show the lowest employment rates and, with the exception of Portugal, are found at the bottom of the diagram.

Therefore, no evidence of a unified pattern for employment and wage dispersion emerges in the eight-year period throughout the EU-15, let alone when focusing on the evolution across countries, as the role institutions play in each country is unclear. On the one hand, the wage distribution of European economies was certainly affected by the large movements in employment rates of the 1990s. After the sharp fall in unemployment had caused the 1990–93 recession in the whole EU except Germany (whose cycle was overheated by the inflationary consequences of reunification), the recovery in growth rates in the second half of the decade boosted an Europe-wide increase in the employment rates, also signalled by a structural break in econometric estimates (Mourre 2004; Arpaia and Mourre 2005). On the other hand, in many econometric estimates '(c)ountry dummies explain a larger proportion of the relation between wage inequality and unemployment' (Bertola, Blau and Kahn 2002: 18). Hence, differing 'initial conditions' across countries – such as technological gaps in the productive structure and the impact of the educational system on the skill distribution of the labour force[12] – could have differently impinged both on the employment performance and earnings disparities. The EU-15 widespread heterogeneity in the relationship between employment and earnings dispersion may conceal the presence of more profound regularities beneath under aggregate data. In

the following, we exploit the availability of microdata directly observing the human capital of the employed workers through matching between skills and working positions.

15.3 The evolution of employment rates and earnings inequality in Europe

Research and empirical evidence about employment growth and wage dispersion across skill levels is very scant. A recent IMF investigation far from conveys the real picture, as 'due to available data, (. . .) results relate to income shares of workers in skilled and un-skilled sectors, rather than to income shares of skilled and un-skilled workers themselves' (IMF 2007: 168). To find out how interactions between institutions and technology impact on earnings distribution, we enquire how the rise in ICT investment relates both to the skill premium and the larger utilization of low-skill and low-pay workers permitted by the relaxation of employment and wage rigidities. In fact, a measure of earnings inequality is needed whereby in measuring earnings dispersion changes in employment across skill levels are taken into account. For instance, in the event of recourse to the strategy of SBTC, due to the decrease induced by labour-saving techniques in the number of low-skill workers, the widening of wage disparities could have been underestimated by the computation of earnings dispersion.

The ECHP dataset permits the breakdown of earnings distribution across 18 economic sectors and 20 working positions, shown in Appendix 15.1 and 15.2, respectively. All information was re-aggregated in three macro-sectors according to their link with information and communication technologies (ICT)[13]: ICT producing (A), intensively ICT users (B), and less intensive utilizing sectors (C), both for manufacturing (1) and Services (2), while working positions were aggregated into three skill levels: high (H), intermediate (I) and low (L). Our investigation covers seven European countries – Belgium, Denmark, France, Italy, Germany, the Netherlands, United Kingdom – whose sectoral structure in terms of employment is shown in Appendix 15.3 for wave 1 (1994) and wave 8 (2001). The reason behind this selection is to refer our analysis to clusters of countries characterized by similar labour markets institutions, so as to compare the cluster of the so-called Continental countries to a representative country from each cluster, namely the United Kingdom for the Anglo-Saxon, Denmark for the Scandinavian and Italy for the Mediterranean cluster.

Variations in the skill premium (SP) – the wedge across wages: $SP = w_H / w_L$ – are contrasted with variations in the 'high-skill ratio' (HR), the fraction of high-to-lower skill workers, where $HR = H / (I + L)$. While the SP signals how the employees' bargaining power interacts with the firm's choice of techniques, the HR signals how the relative proportions of workers across skill categories evolve over time by following this choice.

To better characterize this empirical background, we devise four patterns

of technological choices, depending on a varying combination of technological choices and institutions: (1) SBTC; (2) Complementary Technology; (3) Restructuring; (4) Downsizing.

(1) In case regulation does not constrain the substitution of capital and high-skill workers to low-skill workers, firms may find it profitable to introduce labour-saving techniques. The presence of SBTC manifests in an increase of both SP and HR, as the high skill-intensive techniques implying the expulsion of low-skill workers push up the share of high-skill workers *vis-à-vis* the low-skill and low-pay workers; (2) In case regulation constrains, firms realize complementary technologies by investing in low-skill workers when EPL inhibits their dismissal due to high firing costs (i.e. too high litigation costs in the courts) and their productivity has to be raised to the level of the minimum wage (legally imposed or defended by unions). The choice of a 'complementary technology' entails a decrease both in the SP and in the HR, through the reduction of minimum wage and/or the relaxation of EPL enlarging the relative number of intermediate and low-skill workers. Firms might also choose intermediate strategies resulting from the influence of additional variables, such as the country's productive structure and the peculiar skill characteristics of the labour force; (3) the restructuring strategy, whereby the retrenchment of the low-skill traditional productions under the competitiveness pressure of developing economies causes the loss (or the outsourcing) of low-pay jobs, so that in spite of deregulation wage compression remains (or SP even falls) and the high-skill to low-skill workers ratio (HR) increases; (4) the downsizing strategy, whereby labour market deregulation prompts the structural change towards small-size firms, with a higher percentage of low-skill workers in the presence of lowering wage rates, so causing an increase in SP and a fall in HR.

The four patterns of technological choices, reflecting different decisions about product and process innovation taken by firms under institutional constraints, are reflected by the measure of earnings dispersion. Figure 15.2 shows the construction of the earnings dispersion index (EDI) where workers are ranked on the basis of their average wages (and corresponding skill level).

Unlike the more usual Gini index, where percentiles are equally numerous, the population on the X axis has been partitioned into three groups ($k = 3$) denoted by α, β and γ, where $\alpha + \beta + \gamma = 1$, corresponding to the three skill levels, from lowest to highest; while on the Y axis s_α, s_β and s_γ, where, again, $s_\alpha + s_\beta + s_\gamma = 1$, indicate their respective earnings shares. The EDI are calculated as the ratio between the area (λ) limited by the diagonal and the Lorenz curve, and the whole triangle area. Were we unable to measure the separate influence of skill premium and wage distance between high-skill and low-skill workers, it would have been difficult to go back to the cause of variation of the EDI. However, by construction, it is apparent that EDI varies depending on the relative strength of the variation in SP and HR. As we will now see, the computation of the EDI reveals that earnings dispersion augments in many macro-sectors. No clear evidence results for 13 cases only (over the 42 cases

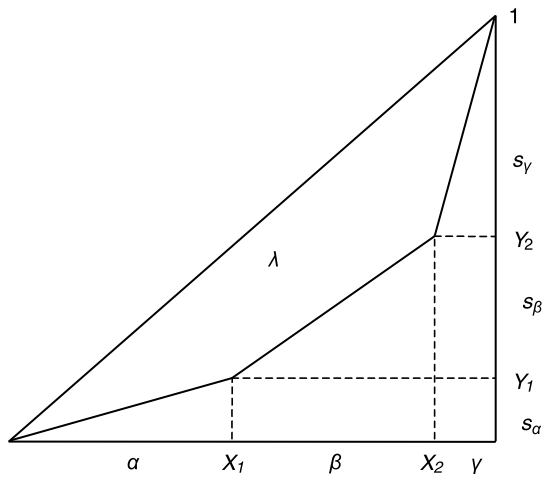


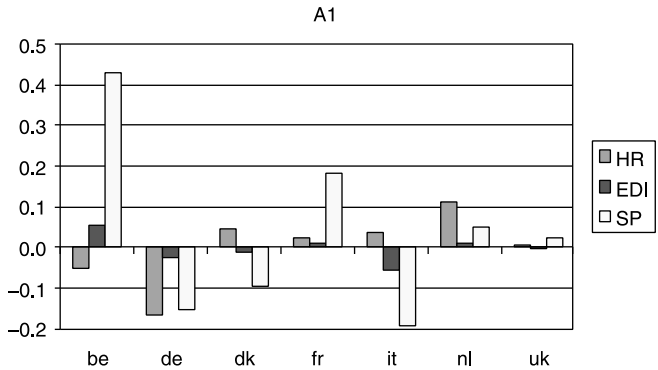
Figure 15.2 Earnings dispersion index (EDI)

examined), since the lines for the initial (1994) and the final (2001) year cross each other.

In Figure 15.3, manufacturing and services have been re-aggregated into six macro-sectors (ICT producing, ICT intensive using, and ICT less intensive using, both for manufacturing and services) as described above. Wage disparities are computed by using average wage levels for each sector and category of high-intermediate- and low-skill workers, and allowing for a varying number of workers in each category.

Table 15.1 classifies the variations of SP and HR between 1994 and 2001 by attributing – for each country – the macro-sectors to one of the four strategies on the basis of the sign of their variation and also specifying whether the EDI would increase or decrease. Upward movements of both SP and HR hint to SBTC and result in a rising EDI, because the enlarging wage distance between skill levels happens to be more relevant than the expulsion of low-skill workers. Complementary technology, which corresponds to both SP and HR moving downwards, is found in a minority of cases and mainly in Continental countries. An SP increase (probably due to a lowering of low-skill wages) larger than the HR reduction (a clue to a modest improvement in job creation) suggests the evolution towards a downsizing strategy, which is mainly chosen by firms not involved in the ICT revolution with an high percentage of low-skill workers.

The most frequent strategy in Europe seems to be the restructuring strategy, as a decreasing SP and an increasing HR point to the prevalence of reduction of low-skill jobs in the presence of wage compression, both in manufacturing and in service sectors. All Denmark macro-sectors manifest SP and HR variations indicating restructuring; the Netherlands and Germany follow, with three macro-sectors each. However, due to the crossing of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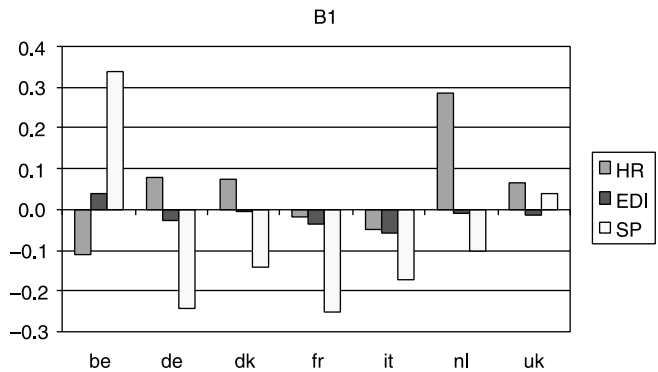
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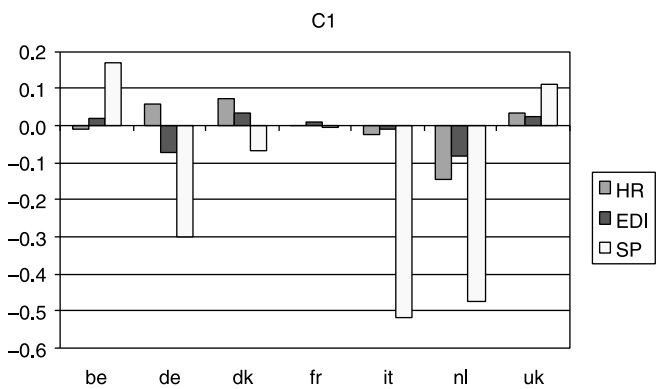
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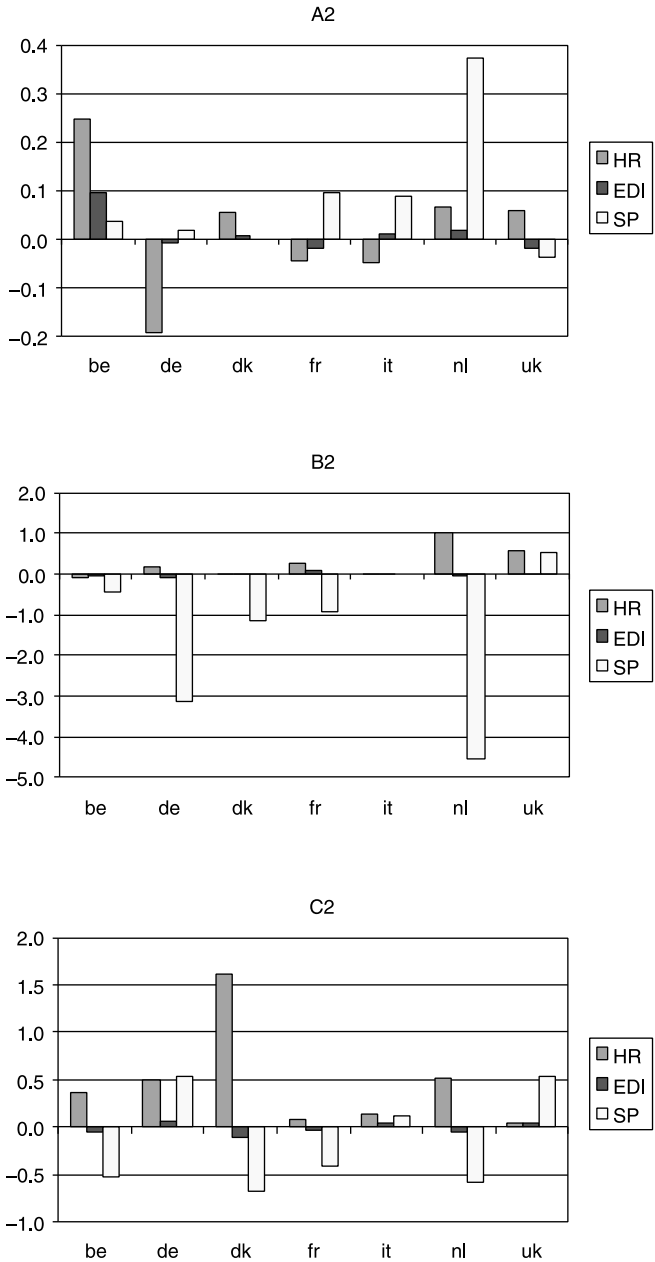

Figure 15.3 EDI, SP and HR. First differences for 7 EU countries (1994–2001)

Table 15.1 Summary results for the 4 strategies in the 6 macro-sectors and frequencies of strategies for the 7 EU countries

	SBTC			*Complementary technology*			*Restructuring*			*Downsizing*		
	EDI up	*EDI down*	*crossing*	*EDI up*	*EDI down*	*crossing*	*EDI up*	*EDI down*	*crossing*	*EDI up*	*EDI down*	*crossing*
A1	F, NL	–	UK	–	–	D	–	I, DK	–	B	–	–
B1	–	–	UK	–	F, I	–	–	–	D, DK, NL	B	–	–
C1	UK	–	–	F	–	I, NL	DK	D	–	B	–	–
A2	B, NL	–	–	–	–	–	DK	UK	–	I	F	D
B2	I, UK	–	–	–	–	B	F	D	DK, NL	–	–	–
C2	D, I, UK	–	–	–	–	–	B, DK, F	–	NL	–	–	–

the initial and final lines, the computation of EDI does not offer a clear interpretation for the complementary technology and the restructuring strategy.

The United Kingdom is the only country where all macro-sectors (except the producing ICT service sectors[14]) present the sign of variations of SP and HR corresponding to the choice of SBTC. Only a few countries – in particular France and Italy, both in intensive and less intensive ICT using manufacturing – present SP and HR variations corresponding to complementary technologies. Finally, the downsizing strategy is confirmed by the EDI increasing in four over six cases. This technological choice, which is shown by earnings dispersion varying as an effect of rising low-skill employment levels more than of the wage wedge, seems to be followed essentially by Belgium (where low-skill employment increases concern in two out of six macro-sectors), and by the ICT-producing service sectors of Germany, France and Italy.

15.4 Theil decomposition of earnings dispersion between and within sectors

Whatever the direction of the SP and HR values, the above picture could be distorted by movements in the earnings inequality indicators occurring between sectors rather than within sectors. The values of the earnings inequality computed by the EDI could therefore conceal a compositional effect.

The strong increase in the EU-15 employment during the second half of the 1990s stems mostly from the creation of new jobs in market-related services, which experienced a very strong value-added growth (Marimon and Zilibotti 1998). In fact, labour market flexibility fuelled the process of job shifting from the more capital-intensive manufacturing sectors to low-productivity and low-pay service sectors. In the period 1997–2001, job intensity of growth (the ratio of employment growth to value-added growth) reached very high values in financial, real estate renting and business services. Also in sectors like trade, repairs, hotels and restaurant, transport and communication, characterized by a large percentage of self-employment and temporary positions, employment has grown at a faster pace than in manufacturing and the relative price of labour has fallen accordingly.

The employment expansion in the EU-15 services sector has concerned both high-skill researchers, engineers and managers in the ICT-producing and -using sectors, and low-skill workers in technology extension and provision of software service either to firms or directly to consumers. In the labour-intensive service sectors the employment increases has instead involved the utilisation of intermediate-skill workers, in operations which cannot be informatized by firms in manufacturing (for instance, the outsourcing of non-routine occupations by computer-using companies). Finally, in more recent years the production and use of ICT has started increasing

also in the EU-15, with investment in ICT reaching 18 per cent over total investment and contributing 42 per cent of labour productivity growth; in the US these percentages were 29 per cent and 80 per cent, respectively (Denis *et al*. 2005).

These structural changes legitimate the suspicion that a compositional effect might play a part in explaining developments in employment growth. The 'Baumol disease' hypothesis predicts that productivity growth rates are lower in the service sectors characterized by routine occupations than in manufacturing. Since labour market deregulation should translate differential productivity growth into wider wage differentials, low-skill workers are expected to move from manufacturing to service occupations. In increasing the employment levels, the expansion of the service sectors could have been a more important factor than the interaction between technology and institutions.

Consequenly, the variation in wage inequality in the period 1994–2001 could have been different from the variation in earnings inequality. Due to a varying speed of relaxation of constraints posed by labour market institutions on employment growth in services across European countries, the measurement of within-sectors earnings inequality could have been affected by a shift of workers towards self-employment and/or by a rising share of temporary contracts in services' jobs. These two phenomena artificially reduce the breadth of earnings inequality, thus underestimating the gap between earnings inequality and wage inequality.

To get an idea of this possible bias, we computed the Theil decomposition, both for the earnings and the wage distributions. By separating out the between-sectors *vis-à-vis* the within-sectors inequality, we aim to assess the relative expansion of the service sector. It is also worth noticing that the between-sector component refers to reallocation of resources across industries due to market share reshuffling among sectors, as well as entry and exit. A rising market contestability encourages firms to invest in innovation mainly when the sector and/or the country is close to the technological frontier, and the incumbents are under the threat of a Schumpeterian process of imitation (Aghion *et al*. 2005). Hence, a stimulus to technical change as an effect of deregulation also depends on how far from the technological frontier in the middle of the 1990s the manufacturing and service sectors of the EU-15 economies were.

The Theil decomposition in the within-sectors and the between-sectors variation of the earnings and the wage inequality described in Figure 15.4 was conducted on the ECHP dataset over the whole 18 sectors of the seven EU countries for the period 1994–2001. Self-employed workers and temporary contracts are the main source of divergence between the earnings and wage measures of dispersion, as well as across employment rates. Hence, evidence showing that the same variations happen within and between sectors for both measures (wages of employees as well as total remunerations) will be taken as an indicator that the expansion of service sectors is not significantly

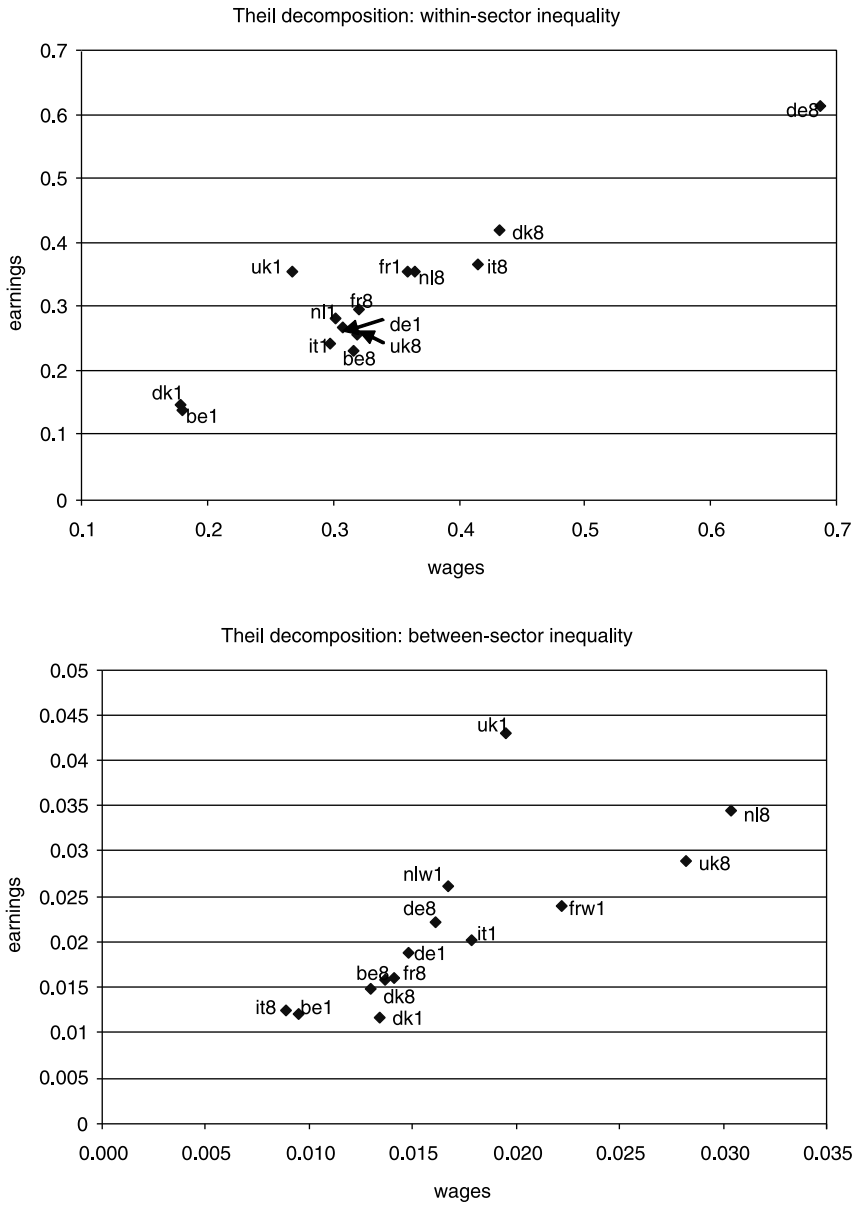

Figure 15.4 Sectoral earnings dispersion within and between sectors: 1994 (1) and 2001 (8)

affecting the wage and earnings trends, so that the measurement of the EDI should not be biased by a composition effect. On the contrary, where the evolution of earnings inequality between sectors does not find confirmation for wages – or the change in between-sectors inequality indices significantly

differs from the change for the within-sectors indices – the composition effect consisting of a disproportionate rise in self-employment and/or temporary positions in the expanding service sectors is likely to be at work.

Since in most countries the sign of variation of the inequality indices replicates both for wages and earnings as well as for the within- and the between-sectors components, the Theil decomposition seems to signal that the evidence of a composition effect is not impressive. The earnings and wage inequality appear to increase in most Continental countries (Belgium, Germany, the Netherlands), while is decreasing in France both for the within and between indices.

However, the United Kingdom presents a higher inequality for earnings and a lower inequality for wages, both within and between sectors (see Table 15.2). This is a clear indicator of an upward trend of the earnings of self-employed workers, to a larger extent in the technology-based services, whereas the wage wedge among the dependent workers is shrinking in both the Theil components. In other words, the contemporaneous increase of the two indices of earnings dispersion signals that the income gap of self-employed workers (and, possibly, also some mistaken reporting of the pay of temporary contracts) widens both in terms of average wage across sectors and in terms of within-sectors dispersion, possibly increasing the gap of the upper portion of the earnings distribution due to the relative expansion of the ICT service companies.

Two countries show uneven results across Theil decomposition. Italy shows a tendency towards shrinking disparities across sectors both for wage and total remunerations. Since sectors characterized by a lower-than-average wage level appear to be approaching the high-average wage sectors, the expansion of the services does not seem to concern the technology-based sectors. Contrary to the overall trend, a composition effect – wherever present – is perhaps driving the earnings distribution towards compression. Denmark appears to join the Continental countries as for the within-sector inequality indices, while the between-sectors earnings dispersion decreases. The broad message is that a divide has probably opened between those European economies where investments in the ICT sectors have increased the salaries of highly-educated self-employed workers and the European laggards both in product and process innovation and in the formation of human capital.

Table 15.2 First differences in wages and earnings inequality within and between sectors (1994–2001)

within inequality				*between inequality*			
		earnings				earnings	
		+	–			+	–
wages	+	B, D, DK, I, NL		wages	+	B, D, NL	DK
	–	UK	F		–	UK	F, I

15.5 Concluding remarks

Our aim in this chapter was to show that European firms, in contrast to the hypothesis put forward by Krugman, do not stay passive in the face of institutional constraints but their technological choices are meant to combine productive strategies with labour-market conditions.

During the 1990s, a wide range of productive strategies were implemented in European countries, as witnessed by the variety of variations experienced by the skill premium and by the high-skill ratio. The earnings dispersion index suggests that the most frequent technological decisions taken by European firms in the second half of the 1990s can be regarded as a restructuring strategy. The recourse to complementary technology has not been practised much by firms. The likely explanation is that institutional reforms implemented during the 1990s in the EU-15 labour markets have introduced wage flexibility – and also the abatement of job protection, though to a lesser extent – which enlarged the opportunity set of technological choices with respect to the previous period (to which the Acemoglu hypothesis refers).

To the question whether rising earnings dispersion in European countries during the 1990s stemmed from SBTC, the computation of the EDI analysis provides a negative answer, except in the case of the United Kingdom.[15] Hence, our computation confirms that the United Kingdom largely differentiates from the other EU countries as the only productive structure where the presence of skill-biased techniques is pervasive. The UK is also the only country for which the computation of the Theil decomposition clearly shows that a composition effect, due to the expansion of the technology-based service sectors, drifts the evolution of the earnings dispersion away from the wage dispersion, due to the increasing number of high-income high-skill workers disproportionately widening the earnings distribution.

Notes

1 In the following, earnings disparities (i.e. all workers: employees and self-employed) are analysed; when labour is limited to the sub-set of employees only, reference will be made to wage disparities (which include wages and salaries).

2 Huge difficulties both on theoretical and on empirical grounds arise when labour needs be precisely separated from capital (for the self-employed) and in particular from human capital (for the skilled labour). Although some corrections have been proposed and extensively relied upon (Guscina 2006), so far they have been mainly regarded as rules of thumb. The empirical flair of this chapter, based on microdata supplied by ECHP, makes the debate about the definition of labour somewhat unnecessary: 'total net personal income' (PI100) is broken down into 'total net income from work' (PI110), 'non-work private income' (PI120) and 'total social insurance receipts' (PI130); in turn, code PI110 is broken down into 'wage and salary earnings' (PI111) and 'self-employment income' (PI112), while 'capital income' is coded PI121. Data availability has induced the choice of the variable PI110, and the inclusion of the warning.

3 Globalization and trade openness also propose an explanation for recent developments, such as a rising ratio of temporary over long-term labour contracts and

a rising earnings inequality (Feenstra 2007). We do not directly deal with international trade, but its impact on earnings dispersion is at least partially embodied in the way in which technological and institutional factors interact in the determination of jobs and pays.

4 'Employment and unemployment developments – in particular, the relative employment of youths and older persons of working age – tended to be less favourable in countries in which earnings inequality rose more slowly since 1970 (or fell), than in countries where the earnings inequality rose more rapidly. Furthermore, the apparent trade-off between a strong employment performance and a more equal distribution of earnings appears to have worsened, consistent with relative labour demand having shifted towards high-skill workers' (OECD 2004: 129).

5 'Unlike for earnings inequality among full-time employed individuals, for pretax-pretransfer income among households we observe sizeable increases over time in most countries. This development appears to have been driven to an important extent by changes in employment. In countries with better employment performance, low-earning households benefited relative to high-earning ones; in nations with poor employment performance, low-earning households fared worse.' (Kenworthy and Pontusson 2005: 21–2).

6 'In sum, our examination of the wage compression hypothesis (like that of the other empirical researchers) finds little support for the belief that lack of jobs in the EU is due to the effect of the compression of wages on employment in low skill industries' (Freeman and Schettkat 2001: 25).

7 Atkinson and Brandolini (2006) have drawn attention to the unemployment rate as a major cause of variation of wage and salaries inequality by taking into account the differences between skilled and unskilled workers.

8 In the year 2000 temporary contracts were 13.4 per cent in the EU-15, ranging from over 33 per cent in the 'outlier' Spain, to 6.7 per cent in the United Kingdom and below 5 per cent in Ireland and Luxembourg.

9 Additional factors are likely to be involved in the evolution of technological choices, first of all the conditions of competitiveness of the market structure, as studied by the rapidly developing literature on the negative impact on growth and employment of rigid goods and labour markets (Bassanini, Hemmings and Scarpetta 2001; Blanchard and Giavazzi 2003).

10 While the employment rate refers to the percentage of workers who actually have jobs, different definitions co-exist: Eurostat refers to the employed persons aged 15–64 as a percentage of the same age population; the UK Office for National Statistics (ONS) refers to the proportion of the working age population who are in employment: aged 16–64 if men, 16–59 if women. In addition the definitions of both workers and jobs may differ, for example, as to whether the job is paid and the weekly hours are at least 15.

11 Similarly, the activity rate refers to the percentage of working population; however, Eurostat defines activity rate of the labour force as a percentage of the population of working age (15–64), the Italian ISTAT refers to the ratio between labour force and the population over 15, while the UK ONS refers to the population over 16. Since these definitions differ, a cross-country comparison is more easily referred to the first differences than in terms of absolute values.

12 However, the measurement of the technological level of workers through the general educational attainment of the population leads to inconsistency problems (Croci Angelini and Farina 2007).

13 The six macro-sectors are formed by re-aggregating the 18 ECHP manufacturing and service sectors according to the classification used by the European Commission services (see Denis *et al*. 2005).

14 Among the most important sub-sectors of the producing ICT service sectors,

computer services are lacking, as the ECHP does not classify them in a separate category. Hence, the measurement of the EDI for this sub-sector is likely to be biased.

15 These findings are confirmed by recent studies comparing the growth performances of the EU and the US economies. During the 1990s, for the first time in the last two decades, both the capital deepening and the TFP presented growth rates lower in the EU than in the US. While the declining capital investment in Europe might be partially explained by the end of the capital-for-labour substitution which followed the rise in the wage/profit rate, the second indicator definitely points to lower rate of innovation and ICT investment in the EU *vis-à-vis* the US (O'Mahony and van Ark 2003). Moreover, in the EU a productivity growth in the ICT-producing manufacturing industries much lower than the US one was only partially counteracted by the relatively better productivity performance in ICT-using manufacturing and ICT-producing services in the first half of the 1990s (van Ark *et al*. 2003).

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Appendix 15.1

Table 15.A.1 Sectoral breakdown

Codes	*Labels*	*Sectors*
A + B	Agriculture, hunting and forestry + Fishing	Other
C	Mining and quarrying	C1
DA	Manufacture of food products, beverages and tobacco	C1
DB + DC	Manufacture of textiles, clothing and leather products	C1
DD + DE	Manufacture off wood and paper products; publishing and printing	B1
DF – DI	Manufacture of coke, refined petroleum/chemicals/rubber and plastic/products etc.	B1
DJ + DK	Manufacture of metal products, machinery and equipment n.e.c.	A1
DL – DN	Other manufacturing	A1
E	Electricity, gas and water supply	C2
F	Construction	Other
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal/household goods	Other
H	Hotels and restaurants	Other
I	Transport, storage and communication	A2
J	Financial intermediation	B2
K	Real estate, renting and business activities	C2
L	Public administration and defense; compulsory social security	Other
M	Education	Other
N	Health and social work	Other
O – Q	Other community, social and personal service activities; private households with employed persons; extra-territorial organizations and bodies	Other
–8	not applicable	
–9	missing	

Appendix 15.2

Table 15.A.2 Occupational breakdown

Codes	*Labels*	*Class*
1112	Legislators, senior officials + Corporate managers	H
1300	Managers of small enterprises	H
2122	Physical, mathematical and engineering science professionals + Life science and health professionals	H
2300	Teaching professionals	H
2400	Other professionals	H
3132	Physical and engineering science professionals + Life science and health associate professionals	H
3334	Teaching associate professionals + Other associate professionals	H
4142	Office clerks + Customer services clerks	I
5100	Personal and protective services workers	I
5200	Models, salespersons and demonstrators	I
6100	Skilled agricultural and fishery workers	L
7174	Extraction and building trades workers + Other craft and related trades workers	L
7273	Metal, machinery and related trades workers + Precision, handicraft, printing and related trades workers	L
8183	Stationary-plant and related operators + Drivers and mobile-plant operators	L
8200	Machine operators and assemblers	L
8400	8 – Miscellaneous (ECHP-specific code)	L
9100	Sales and services elementary occupations	L
9200	Agricultural, fishery and related laborers	L
9300	Laborers in mining, construction, manufacturing and transport	L
9400	9 – Miscellaneous (ECHP-specific code)	L
–8	not applicable	–8
–9	missing, armed forces, 5 – Miscellaneous (ECHP-specific code)	–9

Appendix 15.3

Table 15.A.3 Employment structure by country

	wave 1	*wave 1*	*wave 1*	*wave 1*	*wave 8*	*wave 8*	*wave 8*	*wave 8*
Belgium	H	I	L	total	H	I	L	total
A1	0,02	0,02	0,06	0,10	0,02	0,01	0,06	0,09
B1	0,02	0,01	0,03	0,07	0,02	0,02	0,03	0,06
C1	0,01	0,02	0,03	0,06	0,01	0,01	0,02	0,04
A2	0,01	0,02	0,02	0,05	0,02	0,02	0,02	0,07
B2	0,02	0,02	0,00	0,05	0,03	0,03	0,00	0,06
C2	0,04	0,03	0,02	0,10	0,04	0,02	0,01	0,07
other	0,26	0,17	0,14	0,57	0,29	0,20	0,13	0,62
total	0,40	0,30	0,31	1,00	0,42	0,32	0,26	1,00
Germany	H	I	L	total	H	I	L	total
A1	0,05	0,02	0,08	0,15	0,05	0,01	0,11	0,18
B1	0,02	0,01	0,04	0,07	0,03	0,01	0,04	0,07
C1	0,01	0,02	0,02	0,05	0,01	0,00	0,02	0,03
A2	0,01	0,01	0,02	0,04	0,01	0,01	0,03	0,05
B2	0,02	0,03	0,00	0,05	0,02	0,02	0,00	0,04
C2	0,03	0,01	0,02	0,06	0,05	0,02	0,02	0,09
other	0,28	0,14	0,16	0,57	0,27	0,14	0,14	0,54
total	0,43	0,24	0,34	1,00	0,43	0,22	0,35	1,00
Denmark	H	I	L	total	H	I	L	total
A1	0,02	0,01	0,07	0,10	0,03	0,01	0,09	0,13
B1	0,02	0,00	0,02	0,04	0,01	0,00	0,01	0,02
C1	0,01	0,01	0,03	0,05	0,00	0,00	0,02	0,03
A2	0,02	0,02	0,03	0,07	0,01	0,02	0,02	0,05
B2	0,02	0,02	0,00	0,03	0,01	0,01	0,00	0,02
C2	0,05	0,01	0,02	0,08	0,06	0,01	0,01	0,08
other	0,25	0,20	0,18	0,63	0,31	0,21	0,15	0,67
total	0,38	0,27	0,36	1,00	0,44	0,27	0,29	1,00
France	H	I	L	total	H	I	L	total
A1	0,03	0,01	0,06	0,10	0,03	0,01	0,05	0,09
B1	0,02	0,01	0,03	0,06	0,02	0,00	0,03	0,05
C1	0,01	0,01	0,03	0,05	0,01	0,01	0,03	0,04
A2	0,02	0,02	0,02	0,06	0,02	0,02	0,03	0,06
B2	0,02	0,02	0,00	0,04	0,02	0,01	0,00	0,03
C2	0,05	0,02	0,03	0,10	0,06	0,03	0,03	0,11
other	0,23	0,19	0,19	0,61	0,23	0,20	0,17	6,00
total	0,37	0,27	0,37	1,00	0,38	0,28	0,34	1,00
Italy	H	I	L	total	H	I	L	total
A1	0,01	0,02	0,08	0,12	0,02	0,01	0,07	0,10
B1	0,01	0,01	0,03	0,05	0,01	0,01	0,03	0,05
C1	0,01	0,01	0,05	0,07	0,01	0,01	0,04	0,06
A2	0,01	0,02	0,03	0,05	0,01	0,02	0,03	0,06
B2	0,01	0,02	0,00	0,03	0,01	0,02	0,00	0,03
C2	0,03	0,02	0,02	0,06	0,04	0,03	0,02	0,09
other	0,16	0,20	0,26	0,62	0,17	0,24	0,21	0,62
total	0,24	0,30	0,46	1,00	0,26	0,34	0,40	1,00

Table 15.A.3 continued

	wave 1	*wave 1*	*wave 1*	*wave 1*	*wave 8*	*wave 8*	*wave 8*	*wave 8*
Netherlands	H	I	L	total	H	I	L	total
A1	0,02	0,00	0,03	0,05	0,02	0,00	0,02	0,05
B1	0,02	0,01	0,03	0,06	0,02	0,00	0,02	0,04
C1	0,01	0,00	0,02	0,04	0,01	0,00	0,02	0,03
A2	0,01	0,03	0,03	0,07	0,01	0,02	0,02	0,06
B2	0,03	0,01	0,00	0,04	0,03	0,01	0,00	0,04
C2	0,07	0,02	0,03	0,11	0,08	0,02	0,02	0,12
other	0,32	0,19	0,13	0,64	0,35	0,20	0,11	0,66
total	0,47	0,26	0,26	1,00	0,52	0,27	0,21	1,00
UK	H	I	L	total	H	I	L	total
A1	0,03	0,02	0,05	0,10	0,02	0,01	0,02	0,05
B1	0,02	0,01	0,03	0,06	0,01	0,00	0,01	0,03
C1	0,01	0,01	0,04	0,06	0,00	0,00	0,01	0,01
A2	0,01	0,02	0,03	0,06	0,01	0,01	0,02	0,04
B2	0,03	0,02	0,00	0,05	0,01	0,01	0,00	0,02
C2	0,06	0,02	0,02	0,10	0,04	0,02	0,01	0,06
other	0,24	0,21	0,12	0,57	0,33	0,27	0,19	0,79
total	0,41	0,31	0,29	1,00	0,42	0,32	0,26	1,00