EUROPEAN CENTRAL BANK

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NO. 24 / FEBRUARY 2005

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AN OVERVIEW OF LABOUR COST DIFFERENTIALS ACROSS INDUSTRIES

by Véronique Genre, Daphne Momferatou and Gilles Mourre

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by Véronique Genre [2], Daphne Momferatou [3] and Gilles Mourre [4]

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CONTENTS

EXECUTIVE SUMMARY 5

1 INTRODUCTION 7

2 THEORETICAL BACKGROUND: WHY SHOULD WAGES BE DIFFERENT ACROSS INDUSTRIES? 9

2.1 Standard competitive theories: the role of worker characteristics 9

2.2 New theories of wage determination: efficiency wages and bargaining power of employees 9

3 EVIDENCE ON THE EURO AREA WAGE STRUCTURE 12

3.1 Patterns of wage differentials in the euro area 13

3.2 Is the euro area representative of individual countries? 16

3.3 Comparison with the United Kingdom and the United States 16

3.4 Determinants of wage differentials: the role of worker characteristics versus industry-specific factors 18

3.4.1 Compositional effects due to worker characteristics 18

3.4.2 Compositional effects due to industry-specific factors 21

4 DEVELOPMENTS IN THE EURO AREA WAGE STRUCTURE SINCE THE 1980s 27

4.1 A slight increase in wage differentiation across sectors since the early 1980s 27

4.2 Possible factors behind the increasing wage differentiation 32

5 CONCLUSION 34

ANNEXES

1 Data sources 35

2 Available industrial breakdown and relative weight of each sector 36

3 The Spearman rank order correlation coefficient 37

4 Measures of wage dispersion 38

5 A closer look at individual euro area countries 39

6 Wage structure comparisons between the euro area, the United States and the United Kingdom 40

7 Wage differentials and rankings 41

REFERENCES 43

EXECUTIVE SUMMARY

The ECB has a substantial interest in understanding labour market developments, and in particular, the way they interact with price determination. For instance, since labour costs are a large fraction of a firm's total production costs, rising compensation per employee may put pressure on firms to pass these higher costs on in the form of higher prices, possibly leading to inflation. As part of an overall labour cost analysis, studying inter-industry labour cost diversity in the euro area economy may thus provide insightful information. The existence of labour costs differentials across sectors of the economy is a widely observed phenomenon. It is also persistent and can be difficult to explain. Some indeed argue that inter-industry differentials stem from differences among workers affecting their labour market value, while others argue that it also reflects compensation policies specific to firms or industries.

This Occasional Paper takes a first step towards providing a descriptive overview of the magnitude of inter-industry wage differentials in the euro area as a whole (i.e. the average level of compensation per employee in each industry relative to that total economy). It also studies how the euro area wage structure compares with that of the United States and the United Kingdom. It discusses some possible determinants of inter-industry wage differentials in the euro area and their likely implications from a policy perspective. It also presents some basic stylised facts on how the euro area wage structure has evolved over the 1980s and the 1990s.

One of our key findings is that there are undoubtedly substantial differences in relative wage levels between agriculture, manufacturing, utilities, construction and services. In particular, wage dispersion turns out to be larger in manufacturing than in services, and wage levels in services as a whole appear to be about 16% lower than in manufacturing. These main findings are still valid when wages are considered in full-time equivalent terms or per hour worked, although the gap between the two sectors is reduced by half. Likewise, they broadly hold true when corrected for inter-industry differences in the skill composition of the labour force, and the gap between manufacturing and service wages even widens to 20%.

Regarding international comparisons, overall wage structures appear fairly similar across the three economic zones considered (i.e. the euro area, the United States and the United Kingdom). In particular, the similarity of wage structures is remarkably strong between the euro area and the United States. Wage dispersion in manufacturing is very close for all three economic areas, only slightly higher for the euro area than for the United States and the United Kingdom. In services, differences among the three economic areas appear to be larger, with a somewhat higher dispersion of wages in US services than in the euro area.

According to the theoretical literature, the standard "competitive theories", arguing that wage rates tend to be the same for equivalent workers in equivalent jobs, have failed to fully explain the existence of substantial wage differentials across industries, which persist even after correction for worker characteristics. New theories developed in a non-competitive framework, namely "efficiency wage" models and "employee bargaining power" models, may be of some help in explaining industry-specific wage differentials. According to these models, the link between wage and individual productivity is not as strict as competitive models would suggest, because wages can include a premium depending on specific firm or industry characteristics. These wage premia are likely to reflect both a strong market power of the industry or the firm in the product market, generating a rent, and a sharing of that rent between employees and employers.

To illustrate these theories, some empirical evidence is reported in this paper. It shows that a number of worker characteristics, in particular skills, the percentage of temporary

employment or self-employment and the share of youth, are indeed highly correlated with the structure of wage differentials in the euro area. However, the gap between labour productivity and wages in some industries may point to the existence of industry-specific wage premia. The average firm size and capital intensity emerge as the most significant industry-specific factors affecting the inter-industry wage structure. Although insufficient data is available for the euro area, other variables may play an important part in explaining wage differentials (e.g. union density differences between manufacturing and services, product market regulations restricting competition). These factors may be correlated with each other or may combine to explain high wage differentials. For instance, while the high positive wage differentials in utilities, financial intermediation and to a lesser extent in chemical and fuel products industries are likely to result partly from the composition of the workforce, they might also stem from a firm-size effect and/or the high labour productivity induced by the high capital intensity.

Looking at developments in wage differentials over time, we find that the overall wage structure has remained broadly unchanged since the early 1980s and has been remarkably unaffected by developments in the economic cycle. In other words, industries that paid more in the early 1980s continued to pay more at the end of the 1990s, and vice-versa. While the exact ranking of industries in terms of average wage level has remained stable, both the overall wage dispersion (measured by weighted standard deviation) and the gap between manufacturing and services have increased slightly, even after correction for the effect of developments in part-time employment or skill composition of the workforce. There is no general indication of convergence or a catch-up effect between industries. This seems to rule out the risk of wage-push coming from a limited number of sectors.

An initial investigation of the reasons behind the increasing wage differentiation across different industries showed that developments in part-time employment contributed to a widening of the gap between average wages in manufacturing and in services, while the change in the skill composition of the workforce across industries reduced the gap. These two compositional effects partly explain noticeable changes in wage differentials in a few sectors such as real estate and business services, the wholesale and retail trade, and construction. However, the rise in part-time employment and the changing skill composition of the workforce seem unable to fully account for the increasing wage differentiation across industries. In almost all sectors of the economy, these factors have just accentuated or mitigated wage differential developments without altering their direction. Another interesting finding is that the intense inter-industry reallocation recorded in the euro area in the last two decades does not emerge as a relevant explanatory factor for wage differentiation developments, with the causation likely to run the other way, from wages to employment. Noticeably, labour productivity developments appear to be a major driving force behind changes in inter-industry relative wages. The widening pay gap between manufacturing and services may be partly related to the fact that productivity growth was three times as high in manufacturing as in services during the 1990s.

I INTRODUCTION

Given the central importance of understanding inflationary pressures, the ECB has a strong interest in developing and maintaining a thorough understanding of labour market developments and in particular, of the nature and diversity of wage patterns in the euro area. Since labour costs are a large fraction of a firm's total production costs, rising wages and related social security contributions can put pressure on firms to pass these higher costs on in the form of higher prices, possibly leading to inflation. As part of an overall labour cost analysis, insight into inter-industry wage differentials may thus provide important additional information.

Together with data availability and quality factors, the focus on wages from the labour-cost and supply-side standpoint warrant the use of compensation per employee data (i.e. gross wages plus indirect labour costs), which will systematically be referred to as "wages" for the remainder of the paper. Yet this focus should not lead us to overlook the fact that, along with employment, wages are the main component of the household earnings and a crucial determinant of private consumption, effective demand and short-term developments in output.

Studying the magnitude and development of wage differentials across industries (i.e. the level of average compensation per employee relative to that of the total economy) explains the overall structure of wages in general and provides a context in which competing approaches to wage determination may be compared. Indeed, in homogenous and perfectly competitive labour and product markets, an individual's salary should be independent of the industry in which the person is employed. Furthermore, temporarily higher wages in one industry should attract a sufficient supply of labour to eventually bring wages in that particular industry back to the average for the economy as a whole. The empirical literature, however, has revealed the actual persistence of wage differentials across industries in many countries. This may be due to a wide range of factors: differences in worker characteristics, varying degrees of employment protection, constraints on labour mobility, efficiency wages, specific employees' bargaining power in some industries, other differences between sectors (such as profitability or relative growth in economic activity), and others.

This paper is aimed at deepening the ECB's understanding of wage formation in the euro area, by reviewing the available information on the wage structure at the industry level, assessing its possible determinants and studying its developments over time.

Our analysis will first draw a descriptive picture of the current wage structure by the main sectors of the economy in the euro area. We will use a 20-sector[1] breakdown (into agriculture, ten manufacturing industries, utilities, construction and seven services sectors), which represents a considerable improvement compared with the six-sector breakdown currently available in euro area quarterly national accounts. The paper will also provide a comparison with the United States and the United Kingdom and will discuss some possible determinants of wage differentials in the euro area, on the basis of both theoretical grounds and empirical evidence. These determinants may be differences in worker characteristics (e.g. skills) across sectors or sector-specific factors. In this way, we hope to capture various factors likely to play a role in labour cost determination and explain differences across sectors of the economy.

Second, our study will examine developments in wage differentials over time. This will determine whether specific wage developments since the early 1980s have had

1 The word "sector" is often used in general economic analysis to refer to branches of the economy or industries. It should not however be confused with the so-called "institutional sectors" (i.e. financial and non-financial corporations, government and households) defined in the European System of National Accounts.

some influence on overall wage developments in the euro area. Different wage developments across industries may lead to a catch-up effect in some sectors, possibly pushing up overall wages. This study will also investigate the extent to which developments in wage differentials mirror possible convergence in wage growth across sectors, the influence of part-time work and inter-industry skill composition differences, as well as the effect of inter-industry reallocation and productivity growth. Given differences in labour productivity developments, similar wage growth across sectors, in particular between industry and services, may contribute to changes in the internal terms of trade (the relative price of non-traded goods compared with traded goods). An understanding of such developments is in turn of relevance to assessing the broader interactions between the labour market and the price formation process.

The paper is organised as follows. Section 2 reviews why the wage level can indeed be expected to differ across sectors of the economy from a theoretical point of view. Section 3, after highlighting the data sources and methods used in our analysis, provides a descriptive analysis of the current structure of euro area wage differentials, compares it with that of the United States and the United Kingdom, and discusses some possible factors behind the existence of inter-industry wage differentials. Finally, Section 4 takes a close look at the development of wage differentials over time.

2 THEORETICAL BACKGROUND: WHY SHOULD WAGES BE DIFFERENT ACROSS INDUSTRIES?

The empirical literature has pointed to substantial and persistent differentiation of wages across industries in many countries. Standard competitive theories, arguing that wage rates tend to be the same for equivalent workers working in equivalent jobs, have failed to fully explain these differences, which persist after correction for worker characteristics. Thus, new theories, developed in a non-competitive framework, may be of some help in explaining wage differentials.

2.1 STANDARD COMPETITIVE THEORIES: THE ROLE OF WORKER CHARACTERISTICS

As explained by Dickens and Katz (1986), competitive theories argue that wage differentials are mainly the result of unmeasured differences in labour quality related to worker characteristics such as skills, professional experience, age, weekly working time, and others. Similarly, differences in wages might also compensate for differences in non-pecuniary aspects of work that directly affect a worker's utility (dangerous or particularly demanding type of work, atypical working hours, etc.). For example, strenuous jobs, particularly common in industry, may offer higher wages compared with occupations such as that of a clerk. In this framework, wage differentials stem from a competitive equilibrium reflecting differences in productivity between workers and/or the specific costs borne by employees as regards specific types of jobs.

Alternatively, wage differentials may reflect temporary differences owing to shifts in labour demand or supply across industries and imperfect mobility of labour in the short term. This effect is described as friction induced by inter-industry reallocations.

Competitive theories say that, by and large, wage differentials reflect differences in individual labour productivity[2] in the long run (see Table 1). Therefore, after correction for worker and job characteristics, no specific wage differentials should remain, on a permanent basis, across industries. Empirical research, however, has contradicted this prediction. In 1988, an influential paper by Krueger and Summers showed that, after controlling for personal characteristics, some US industries paid wages up to 20% above and below the average wage. This finding fostered a line of research which largely confirmed that wage differentials remain significant and quite stable over time.[3]

2.2 NEW THEORIES OF WAGE DETERMINATION: EFFICIENCY WAGES AND BARGAINING POWER OF EMPLOYEES

In the 1980s a number of new theories of wage determination focused on reasons why firms may find it profitable to pay higher wages than those suggested by the equilibrium level. They examined a series of variables which differ both within and across industries and therefore may provide explanations for industry wage differentials. The models make two assumptions. First, firms have the ability to pay higher wages, which means that they are able to extract a rent from their product market. In other words, the theoretical framework of all these models is imperfect product-market competition, which may be the result of barriers to international trade, national regulation, monopolistic competition stemming from innovations or specialisation in certain niches, or other factors. Second,

2 Taking into account the non-pecuniary costs associated with the jobs.

3 See, among others, Erica Groshen, "Sources of intra-industry wage dispersion: how much do employers matter?, in Quarterly Journal of Economics, vol. 106, No 3, 1991, pp. 869-84; or David Levine, "Can wage increases pay for themselves? Tests with a production function", Economic Journal, vol. 102, No 414, 1992, pp. 1102-15. Both studies found that controlling for differences in human capital variables could not explain the wage differences among employers (after controlling also for the type of occupation). See also Kouwenberg and Van Opstal, "Inter-industry wage differentials: evidence from micro data", in CPB Report 99/3, pp. 26-29, for a study applied to the Netherlands. The standard deviation of wage differentials (after controlling for individual characteristics) is found to be about 7% between 1985 and 1997.

employers distribute part of this rent to their employees in the form of a "wage premium". The sharing of the rent may be motivated by the need to pay efficiency wages or by a strong bargaining power of the wage earners.

Krueger and Summers (1988) surveyed the efficiency wage theories that attempt to explain the payment of non-competitive wages. Efficiency wage theories suggest that firms want to pay more than the reservation wage in order to select the most efficient workers, reduce a training-costly turnover of employees, or increase the motivation and the productivity of their staff. Regarding this latter reason, workers who are paid only the opportunity cost of work have little incentive to perform well since losing their jobs would not be costly. By raising wages, firms make the cost of quitting higher and thereby encourage effort among workers. If the firm shares its profit with its employees, workers' feelings of loyalty to their firm increase, with a positive effect on productivity. In this theoretical framework, if all firms were identical, they would all pay the same wage to equivalent workers. However, when firms differ in their ability to bear the costs of turnover, to supervise and monitor their employees, or to measure labour quality, either because of differences in management capacity or in production technology, the optimal wage can vary across firms and industries. For instance, in industry (excluding construction), the average size of firm is greater than in services, which may render the monitoring of employee productivity more difficult than in small-sized firms and require the payment of efficiency wages to raise workers' effort levels.

The bargaining power of wage earners depends positively on how difficult it would be for their employers to fire and replace them and on how easy it would be for them to find another job. There are two main types of model based on employee bargaining power, one including the influence of unions and another making a distinction between "insiders" (i.e. workers who are employed by firms) and "outsiders" (i.e. workers wishing to be employed by firms). First, the presence of strong or highly coordinated unions, particularly in some industries (e.g. utilities), may induce higher wages, while the lesser influence and presence of unions in some services may lead to lower wage premia. Second, in insider/outsider models (with non-unionised workers), firms may find it profitable to pay more than competitive wages to insiders to avoid strikes or an increase in unionisation and to maintain

Table 1 Summary of theoretical explanations for inter-industry wage differentiation

1. Standard competitive models

Wage differentials are explained by:

- Worker characteristics (e.g. skills, professional experience)
- Working conditions/job characteristics
- Temporary effect of shifts in labour demand/supply in the presence of labour market segmentation

Consequence: wages are in line with individual productivity.

2. Non-competitive models

Assuming the existence of a product market rent, wage differentials are explained by:

- Efficiency wages paid by firms:
  - to select the most efficient workers
  - to reduce turnover
  - to increase workers' loyalty to the firm
  - to raise the level of workers' effort.
- Employees' bargaining power, affected by:
  - influence of strong trade unions
  - role of non-unionised insiders

Consequences: besides working conditions and job characteristics, sector-specific characteristics play a role, resulting in a looser link between wages and individual productivity.

industrial peace. Moreover, insiders, who have gained firm-specific skills, are likely to be more productive than outsiders, who would need to "learn by doing". Their experience in the firm makes them less easy to replace, which puts them in a good position to ask for and obtain higher wages, i.e. to capture part of the product market rent. This bargaining power depends of course on numerous factors: the nature of the jobs (the proportion of skilled occupations in a sector), the size of the firms (which affects their ability to replace numerous wage claimers at the same time) and the firms' ability to pay (i.e. market power).

The non-competitive models (efficiency wages and bargaining power of the employees) have two implications. First, wages depend not only on worker and job characteristics, but also on the characteristics of the industry (and the firm). Second, and as a consequence, the link between wage and individual productivity is not as strict as in competitive frameworks, as wages may include a wage premium, depending on sector-specific characteristics. Of course, the link broadly remains, as wage premia are still intended to foster staff productivity and/or avoid costly turnover or industrial conflicts.

Table 1 sums up the theoretical discussion as to why wage levels may differ quite substantially across firms and sectors. In the rest of this Occasional Paper, we will take stock of wage differential patterns in the euro area and explore how the overall wage structure fits within this theoretical background.

3 EVIDENCE ON THE EURO AREA WAGE STRUCTURE

This study builds on previous work, including the comparative analysis of inter-industry wage differentials by Erdil and Yetkiner (2001), who compare the consistency and stability of wage differentials for about 20 industrialised and developing countries. Our study also draws on Jean and Nicoletti (2001), who identify the existence of wage premia and try to trace their determinants by constructing an econometric model.

Our main source of data is the Structural Analysis database (STAN) of the Organisation for Economic Co-operation and Development (OECD).[4] This database provides annual compensation payment and employment data disaggregated by sector of activity, as well as other relevant series related to output and capital stock on a national basis. Data are available from 1970 until 2001 and consistent with national accounts (see Annex 1 for more details).

For the purpose of this paper, it was necessary to aggregate national data to form the relevant series for the euro area as a whole.[5] The main variable of interest was nominal compensation per employee, calculated on the basis of national data disaggregated by sector of economic activity. Nominal compensation per employee is the ratio of total compensation of employees (which normally includes the total wage bill and social security contributions) to the number of employees. Data between 1970 and 2001 were not fully available for all 12 euro area countries. In an effort to maximise the coverage of the countries in the euro area and to achieve an optimal time frame and level of disaggregation, we used relevant time series for nine euro area countries[6] between 1980 and 1999 and for 20 sectors of economic activity. Annex 2 provides the available detailed breakdown by sector, together with the relative weight of each sector in total employment. Overall, our sample covers more than 95% of the euro area. To compare the wage structure in the euro area with that in other economic areas, the same set of variables were also calculated for the United States and the United Kingdom.

Wage differentials were then computed as the percentage difference between the average level of compensation per employee in a given sector and the average level of compensation per employee in the economy as a whole. Intra-manufacturing and intra-services wage differentials were also computed.

To investigate inter-industry wage differentials, we used a variety of different statistical tools i.e. graphical analysis, variance and standard deviation estimates, and correlations and rank correlations across time (see Annex 3), as well as across the three economic areas considered in this paper, i.e. the euro area, the United States and the United Kingdom.

Potential weaknesses of the STAN database should be borne in mind, as these data have been assembled with a varying degree of accuracy for different countries and sectors of the economy (see Annex 1). In particular, caution should be exercised when comparing results for European countries with those for the United States (whose data relies on a slightly different industrial classification). Also, the reliability of disaggregated data in STAN is lower than that of aggregate data. For the euro area countries, some consistency checks were run against available national accounts data, and a fair degree of consistency was found between the two sources. Similarly, at a more disaggregated level, which appears more problematic as regards the accuracy of the data, we ran consistency checks with the 1995 Eurostat Survey of Earnings Statistics. The correlation between the two was 0.9. STAN should thus be suitable for the broad economic analysis carried out in this paper.

4 Erdil and Yetkiner (2001) used an earlier version of the STAN database, which covered only the manufacturing sector.

5 While the focus of this Occasional Paper is on the euro area as a whole, it is worth mentioning at this point that there is a high degree of similarity among individual euro area countries in terms of wage differentials, both in current levels and over time since the 1980s (see Section 3.2 and Tables in Annex 5).

6 Namely, Belgium, Germany, Spain, France, Italy, the Netherlands, Austria, Portugal and Finland. In some cases, values had to be backcast to complete gaps in the available series.

3.1 PATTERNS OF WAGE DIFFERENTIALS IN THE EURO AREA

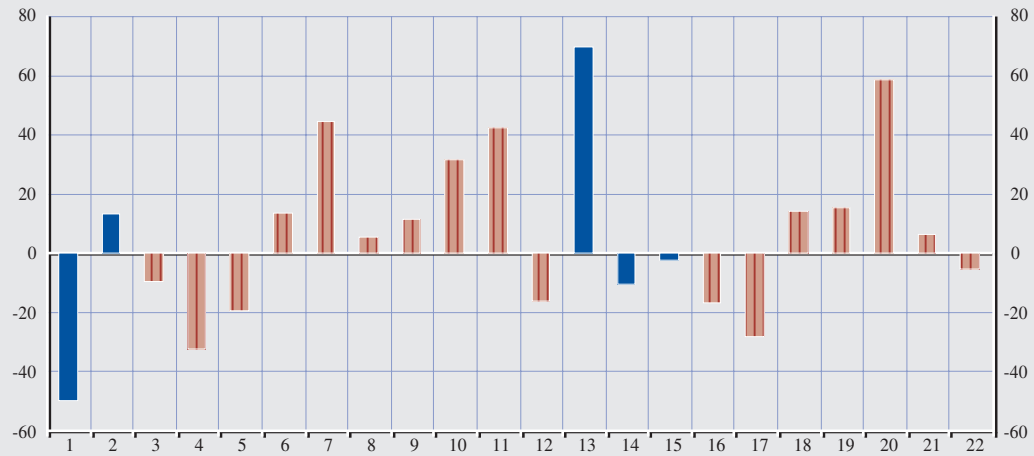
Chart 1 shows average percentage differentials for 1997-99 with respect to the average level of compensation per employee for the economy as a whole. The focus is put on these three years to avoid any year-specific effect and maximise the coverage of the euro area countries. At first glance, there is a great degree of wage dispersion across sectors of the euro area economy, with strongly negative wage differentials (50% in agriculture) and strongly positive ones (up to 70% in utilities, i.e. electricity, gas and water supply). Average wages in manufacturing are 13% higher than the average euro area wage, while construction has a negative wage differential (-10%). Finally, average wages in services are 2% lower than the overall economy average. On average, this overview of the euro area wage structure indicates that wage levels in services are nearly 16% lower than in manufacturing.

The euro area wage structure remains broadly unchanged if one considers compensation per employee in terms of full-time equivalents or compensation per hour rather than compensation per employee (see Chart 2). The main difference is that the gap between average wage levels in services and in manufacturing is reduced from 16% to 8%.[7] Similarly, the euro area wage structure holds true after correction for the inter-industry differences in the educational level of the workforce. The education-adjusted gap between manufacturing and service wages (not adjusted for part-time work) even widens to 20%, reflecting the larger proportion of highly

7 The higher proportion of part-time work in services (around 20% of employment) compared with manufacturing (around 7%) explains this reduction in the wage differential, as part-time workers tend to have a lower monthly wage than full-timers. This is due to the fact that they work fewer hours than full-timers but also to the fact that they earn lower hourly wages (OECD, 1999).

Chart 1 Wage differentials in the euro area economy

(percentage differences from the total economy average wage; 1997-1999)

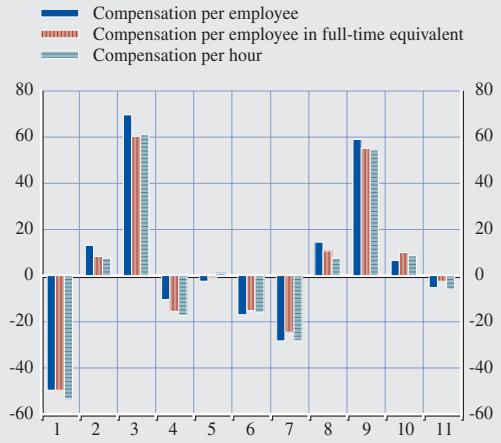


1 Agriculture, hunting, forestry and fishing
2 Total manufacturing
3 Food products, beverages and tobacco
4 Textiles, textile products, leather and footwear
5 Wood and products of wood and cork
6 Pulp, paper, paper products, printing and publishing
7 Chemical, rubber, plastics and fuel products
8 Other non-metallic mineral products
9 Basic metals and fabricated metal products
10 Machinery and equipment
11 Transport equipment
12 Other manufacturing; recycling
13 Electricity, gas and water supply
14 Construction
15 Total services
16 Wholesale and retail trade; repairs
17 Hotels and restaurants
18 Transport and storage
19 Post and telecommunications
20 Financial intermediation
21 Real estate, renting and business activities
22 Community, social and personal services

Source: OECD.

Chart 2 Euro area wage differentials in full-time equivalent terms and corrected for usual hours worked

(percentage differences from the total economy average; 1997-1999)

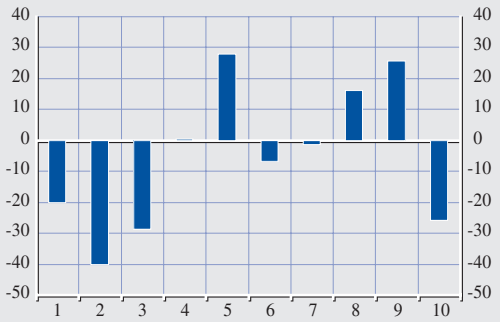


1 agriculture, hunting, forestry and fishing
2 total manufacturing
3 electricity, gas and water supply
4 construction
5 total services
6 wholesale and retail trade; repairs
7 hotels and restaurants
8 transport and storage and communication
9 financial intermediation
10 real estate, renting and business activities
11 community social and personal services

Source: OECD, Eurostat (European Labour Force Survey) and ECB calculations.

Chart 3 Euro area wage differentials in manufacturing

(percentage differences from the average wage in manufacturing; 1997-1999)



1 Food products, beverages and tobacco
2 Textiles, textile products, leather and footwear
3 Wood and products of wood and cork
4 Pulp, paper, paper products, printing and publishing
5 Chemical, rubber, plastics and fuel products
6 Other non-metallic mineral products
7 Basic metals and fabricated metal products
8 Machinery and equipment
9 Transport equipment
10 Other manufacturing; recycling

Source: OECD

educated workers in services.[8] Moreover, if wage differentials derived from the 1995 Eurostat Survey of Earnings Statistics are compared with those from STAN, the euro area wage structure is also broadly unchanged, especially in terms of rankings per industry. It is possible that the wage differential figures are partly affected by statistical problems concerning the measurement of employment or the wage bill in some sectors. For instance, sectors with very high positive wage differentials in the STAN database (e.g. utilities, financial intermediation) also display high differentials according to the 1995 Eurostat Survey of Earnings Statistics, but of a lower magnitude. Some caution should therefore be exercised when interpreting the magnitude of sector-specific differentials, but the picture of the euro area wage structure presented in this paper appears fairly robust.

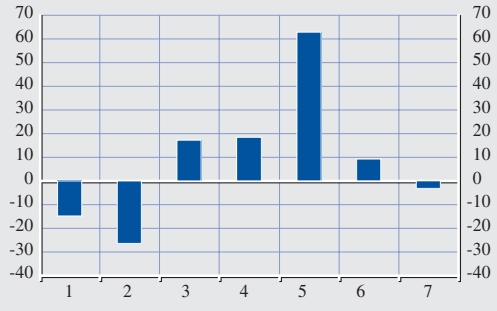
This overall picture needs to be refined, since a great deal of wage dispersion is also visible within the two main branches of economic activity, i.e. manufacturing and services.

Chart 3 focuses on the wage dispersion among different industries of total manufacturing. In this chart, differentials are expressed as a percentage difference from the average wage level in manufacturing. The general picture of considerable dispersion is confirmed. Employees in transport equipment and chemical, rubber, plastics and fuel products are paid respectively 26% and 28% more than the average for manufacturing. Conversely,

8 Nearly 30% of employees working in services in 1999 had tertiary education, compared with about 16% in manufacturing. Workers with tertiary education are paid on average 30% more than those with higher secondary education, and more than 90% more than those with lower secondary education (see Box C in section 4 for more details).

Chart 4 Euro area wage differentials in services

(percentage differences from the average wage in services; 1997-99)



1 Wholesale and retaitrade; repairs
2 Hotels and restaurants
3 Transport and storage
4 Post and telecommunications
5 Financial intermediation
6 Real estate, renting and business activities
7 Community, social and personal services

Source: OECD.

employees in the textiles and wood products industries receive compensation 40% and 29% short of the total manufacturing average.

Turning to dispersion in services (see Chart 4), wage differentials appear to lie within a narrower range (±20%), with the notable exception of wages in financial intermediation (+63% compared with the average wage in services[9]) and hotels and restaurants (-26%).

9 This large positive differential may result from specific type of compensation that does not enter the definition of compensation per employee. Indeed, financial but non-wage benefits (e.g. stock options) are not always included in national accounts definitions of compensation per employee. Taking into account this important part of remuneration in some service sectors (e.g. financial intermediation, business activities) might increase the differential with the average wage paid in services. Unfortunately, there is insufficient data to provide sound evidence and enable firm conclusions to be drawn.

Box 1

COMMUNITY, SOCIAL AND PERSONAL SERVICES

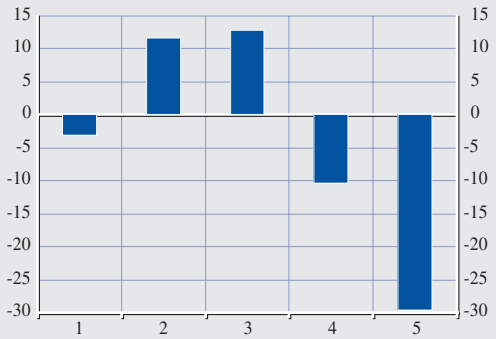
Wages within community, social and personal services are characterised by a significant heterogeneity. Considering that this sector accounts for nearly half of total employment in services and nearly a third of total economy employment, it is worth providing a more detailed picture.

As shown in Chart A, public administration and defence, social security and education display positive wage differentials, whereas health and social work as well as other community, social and personal services show negative differentials. Sectors such as education and public administration can be expected to have a large proportion of higher-skilled employees, who contribute to the positive wage differential. In sectors with lower-than-average wages, part of the explanation may lie in the higher proportion of part-timers, who tend to have a lower hourly wage than their full-time counterparts (OECD, 1999). Indeed, in 2000, the proportion of part-time workers in sectors such as health and social work (29.7%) and private households with employed workers (59%)[1] was very high, compared with 16.2% for the economy as a whole and 12.8% for the public administration sector.

1 Workers employed in private households are part of the total community and social services branch, but no separate data on their wages are available.

Chart A Euro area wage differentials in community, social and personal services

(percentage differences from the average wage in services; 1997-1999)



1 Community, social and personal services
2 Public admin. and defence; compulsory social security
3 Education
4 Health and social work
5 Other community, social and personal services

Source: OECD.

The figure for community, social and personal services is close to the average but could be broken down further. This category of services groups together very heterogeneous activities and accounts for nearly half of total services. Our data show that there are positive wage differentials in public administration and defence, as well as education, and below-average wages in health and social services. More details are provided in Box 1.

Overall, wage dispersion, measured by a weighted standard deviation, is found to be somewhat lower in services (17.8 percentage points on average) than in manufacturing (24.7 percentage points) (see Table 2, Annex 4).

3.2 IS THE EURO AREA REPRESENTATIVE OF INDIVIDUAL COUNTRIES?

One should proceed with caution when interpreting results related to the euro area as a whole. Indeed, apparent wage differentiation could reflect the aggregation of different countries with different bargaining systems and economic developments rather than the existence of a common wage structure. It is therefore useful to check whether any country-specific pattern may have influenced the overall euro area structure.

Table 2 shows correlations between individual countries' inter-industry wage structures. Overall, correlation coefficients are generally high (ranging from 0.6 to 0.9), indicating that wage structures are broadly similar across the five biggest euro area countries (Germany, Spain, France, Italy and the Netherlands). This similarity of inter-industry wage structures is confirmed by a comparison of detailed wage rankings across the five countries (see Annex 5). Moreover, the correlation increased between the 1980s and the 1990s. After 1990, Euro area results thus seem to reflect broadly similar structures across countries.

3.3 COMPARISON WITH THE UNITED KINGDOM AND THE UNITED STATES

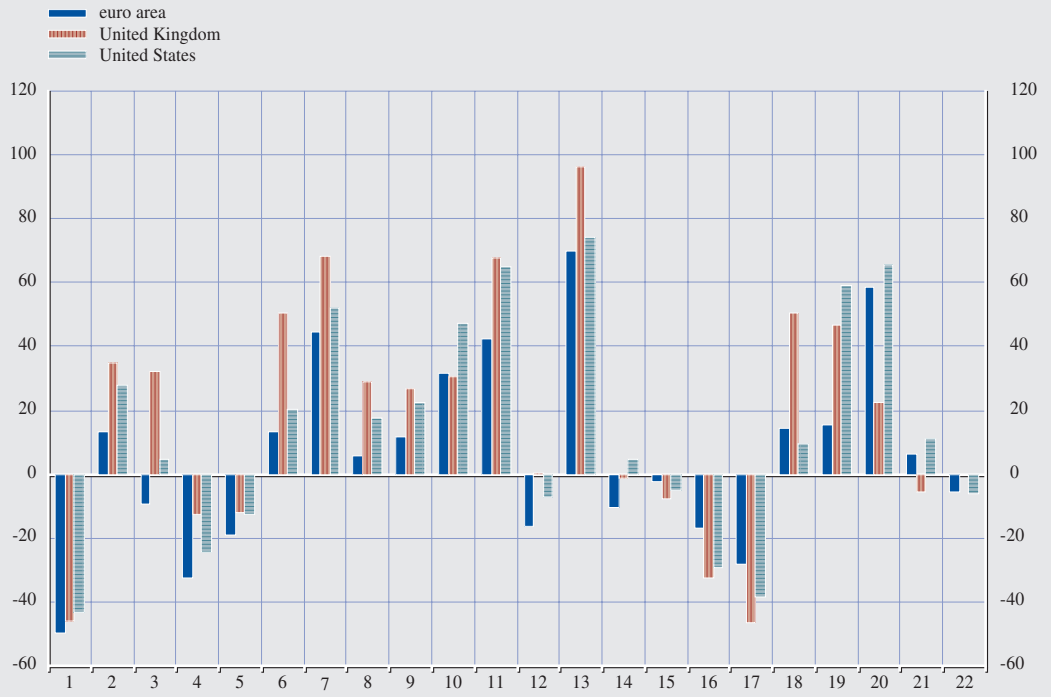
In order to see whether the observed wage structure is specific to the euro area, we compare it with that of the United Kingdom and the United States. Chart 5 suggests that overall wage structures are very close between the euro area and the United States and broadly comparable between the euro area and the United Kingdom. In particular, the substantial spread between the highest average wage (paid in utilities in all three economic areas) and the lowest (paid in agriculture, also in all three cases) is roughly the same in the United Kingdom, the United States and the euro area. The degree of similarity in wage structures among the three economic areas is confirmed by the correlation coefficients of wage differentials for each economic area with respect to the other two. All three correlation coefficients are very high, the highest being that of the euro area with the United States (0.948), followed by that of the United Kingdom with the United States (0.902) and finally that of the euro area with the United Kingdom (0.850) (see Table 1, Annex 6). Wage structures appear even more similar across the

Table 2 Rank order correlation coefficients of euro area

	Average 1980s					Average 1990s				
	DE	ES	FR	IT	NL	DE	ES	FR	IT	NL
Germany	1.0	-	-	-	-	1.0	-	-	-	-
Spain	0.9	1.0	-	-	-	0.8	1.0	-	-	-
France	0.8	0.9	1.0	-	-	0.8	0.9	1.0	-	-
Italy	0.7	0.9	0.6	1.0	-	0.7	0.9	0.8	1.0	-
Netherlands	0.8	0.8	0.7	0.6	1.0	0.8	0.8	0.8	0.7	1.0

Chart 5 Comparison of the euro area wage structure with those of the United States and the United Kingdom

(percentage differences from the total economy average wage; 1997-1999)



1 Agriculture, hunting, forestry and fishing
2 Total manufacturing
3 Food products, beverages and tobacco
4 Textiles, textile products, leather and footwear
5 Wood and products of wood and cork
6 Pulp, paper, paper products, printing and publishing
7 Chemical, rubber, plastics and fuel products
8 Other non-metallic mineral products
9 Basic metals and fabricated metal products
10 Machinery and equipment
11 Transport equipment
12 Other manufacturing; recycling
13 Electricity, gas and water supply
14 Construction
15 Total services
16 Wholesale and retail trade; repairs
17 Hotels and restaurants
18 Transport and storage
19 Post and telecommunications
20 Financial intermediation
21 Real estate, renting and business activities
22 Community, social and personal services

Source: OECD.

three areas when the average-wage rankings of different sectors are compared, as shown by rank correlation coefficients all close to one (see Table 2, Annex 6).

A striking, and maybe surprising, result of these comparisons is the larger degree of similarity between the euro area and the United States than between the euro area and the United Kingdom. This might be partly due to problems of data comparability across countries. However, the fact that the United Kingdom is a net oil exporter might also explain why wage differentials are higher in some industries (e.g. chemicals, rubber, plastics and fuel products, and utilities).

Lastly, correlations between the three economic areas have been increasing over time, with those between the United Kingdom and the other two respectively exhibiting the sharpest developments of continuous convergence towards the trends of the euro area and the United States (see Table 3, Annex 6).

Turning to the dispersion of wages across all sectors of economic activity, (see Table 1, Annex 4), the euro area has the lowest overall

standard deviation (23.1 percentage points), followed by the United States (28.9) and the United Kingdom (30.5). Although these values appear to be fairly close, an interesting pattern emerges when differentials in manufacturing are compared with those in services (see Table 2, Annex 4). Wage dispersion in manufacturing is very similar for all three economic areas, but there are greater differences in services. The lowest standard deviation in services is found in the euro area (17.8), followed by the United Kingdom (23.8) and finally the United States with the highest figure (25.4). These results are in conformity with the common idea of a more flexible labour market in services in the United States, characterised by a greater availability of low-paid jobs, thus resulting in wider wage dispersion in services. In particular, the literature (see, for example, Piketty, 1998, and Garibaldi and Mauro, 2002) points to the role of retail trade as a driving force behind higher low-wage employment in the United States compared with continental Europe.

3.4 DETERMINANTS OF WAGE DIFFERENTIALS: THE ROLE OF WORKER CHARACTERISTICS VERSUS INDUSTRY-SPECIFIC FACTORS

Sections 3.1 and 3.2 revealed significant wage differentials across sectors of economic activity in the euro area. Wage differentials may reflect both the characteristics of the workers in each sector (e.g. skills) and sector or firm-specific conditions. In this section we provide a snapshot picture of the current situation in the euro area with respect to general worker characteristics as well as some sector-specific variables that could be expected to be relevant determinants of wage differentials. However, the purpose of this section is restricted to accounting for wage differentials by relating them to various economic factors. We will refrain from in-depth interpretation of the statistical correlation displayed and will base our conclusions, to the extent possible, on the existing literature on wage determination.

3.4.1 COMPOSITIONAL EFFECTS DUE TO WORKER CHARACTERISTICS

Worker characteristics for which we have data comparable to wage differential data in terms of period and breakdown by sector include educational level, part-time working, temporary jobs, self-employment and the share of women and young people in total employment. All data are provided by Eurostat's New Cronos database.

We expect educational attainment to be a rough proxy of skills and to be positively related to inter-industry wage differentials; in other words, the more educated/skilled the worker, the higher his or her relative wage. The data available show three levels of education: low (i.e. up to lower secondary education), medium (i.e. upper secondary education) and high (i.e. tertiary education). We can easily point to a high degree of correlation between the relative wage differential of a sector and the average level of education for workers employed in that sector (see Chart 6).

Each point on the charts represents a sector of the economy. Sectors where the proportion of low-skilled workers is large (such as textiles, with 69%, or agriculture, with 63%) are generally those with the lowest average wages, while sector with a high proportion of highly educated workers (such as financial intermediation, with 28%, and utilities, with 23%) also have the highest average wages.[10] Overall, the correlation coefficients for the relationship between education and wages are very high (close to 0.8).

It may be argued that educational level is a poor proxy of workers' skills as it does not take into account on-the-job training and experience. In 2000, a survey of continuing vocational

10 Community, social and personal services together with real estate and business services stand as exceptions. Both are among the sectors with the highest shares of highly educated workers, but their wage differentials are close to zero, suggesting that the relationship between skills/education and relative wages is less strong in these sectors or blurred by other factors.

Chart 6 Nominal wage differentials versus proportion of low-skilled/high-skilled workers per sector

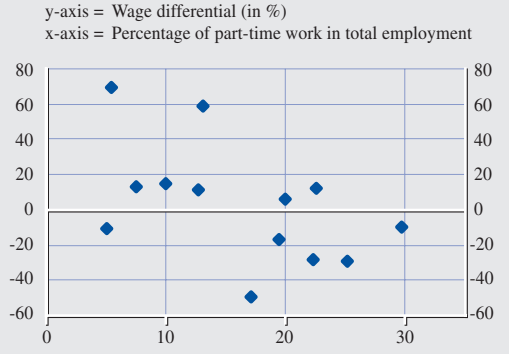
(average 1997-1999)

Sources: Eurostat, OECD and ECB calculations.

training in firms was conducted in all Member States of the European Union (EU). This survey provided data on the percentage of employees following vocational training courses in various sectors of the economy (both in manufacturing and in services). Comparing these data with the euro area wage structure confirms the results obtained with educational level data. There is a very high positive correlation between the wage differential structure and the number of employees participating in vocational training courses (the correlation coefficient is 0.9).

Chart 7 Wage differentials versus part-time employment per sector

(average 1997-1999)



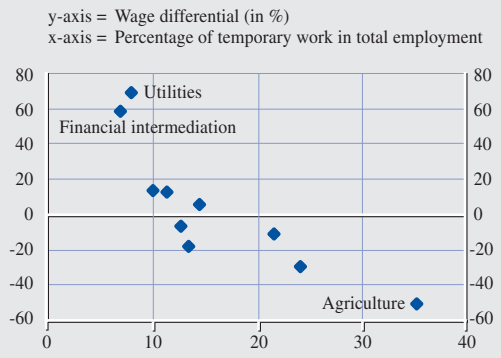
Sources: OECD, Eurostat and ECB calculations.

Another factor likely to (negatively) influence the structure of wages across sectors of the economy is the relative share of part-time in total employment (see, for instance, Buddelmeyer, Mourre and Ward, 2004). First, the euro area has witnessed a significant increase in part-time work, in particular in the 1990s, which has mechanically decreased the average hours worked per person and reduced compensation per employee, all else being equal. Second, the hourly wage rate received by a part-time worker is consistently lower than that of full-timers.[11] Chart 7 conveys a picture of a negative, albeit relatively weak, relationship between the incidence of part-time work and the average relative wage. The Spearman rank correlation coefficient is actually close to -0.5, but not significant. Another illustration of the only modest impact of part-time employment on wage differences is the fact that nominal wage differentials

11 See, for example, OECD Employment Outlook, June 1999. This remains true even after correction for occupational characteristics of part-time and full-time jobs. One reason may be that part-timers tend to receive less vocational training than full-timers.

Chart 8 Wage differentials versus temporary employment per sector

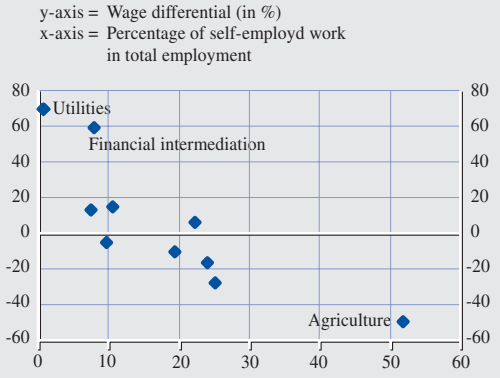
(average 1997-1999)



Sources: OECD, Eurostat and ECB calculations.

Chart 9 Wage differentials versus self-employment per sector

(average 1997-1999)



Sources: OECD, Eurostat and ECB calculations

remain broadly unchanged when compensation is considered in terms of full-time equivalent positions rather than compensation per employee (see Section 3.1).

The inter-industry differences in the proportion of temporary workers might also influence wage differentials. Studies have shown that temporary job holders are generally younger, less well educated and receive less training than workers with permanent contracts (see Paoli and Merllié, 2001, and Storrie, 2002). They are also very unlikely to be unionised given their relatively weak attachment to the firm (Houseman, 2001). As a result, they tend to receive lower average wages. Chart 8 shows a relatively strong correlation between the proportion of temporary workers in a sector and the relative average wage of that sector. For example, agriculture (where temporary work accounts for 35% of employment) is among the sectors with the lowest average wages. On the other hand, utilities and financial intermediation, both with a temporary work share of less than 10%, are among the sectors with the highest average wages. The overall Spearman rank correlation coefficient is high, at 0.9, and significant.

It is also worth noting that a strong negative correlation appears to exist between the degree of wage differential and the proportion of self-employed workers per sector (-0.9). It seems that sectors characterised by a low average wage are also those with the highest proportion of self-employment (see Chart 9). Several studies have reported that self-employed workers tend to earn less than other workers with similar characteristics.[12] One possible explanation, therefore, could be that, to the extent that self-employed workers are in direct competition with wage-earners and impede their achievement of higher wages, the presence of self-employed lowers the bargaining power of employees. Also, economic sectors where there are many self-employed are typically labour-intensive and organised in small firms. Both factors may contribute to a lower relative average wage.

The proportion of female workers, which is very uneven across sectors,[13] may also influence the overall wage structure, as women are generally less paid than their male

12 This would be mainly due to lower growth in earnings among self-employed workers over time (linked to the higher labour income risk associated with self-employment). According to Hamilton (2000), self-employed workers with ten years of business tenure would earn 19% less than a wage-earner with the same amount of experience.

13 In the euro area, women tend to work in services, where they account for nearly 50% of total employment, compared with around 30% in manufacturing.

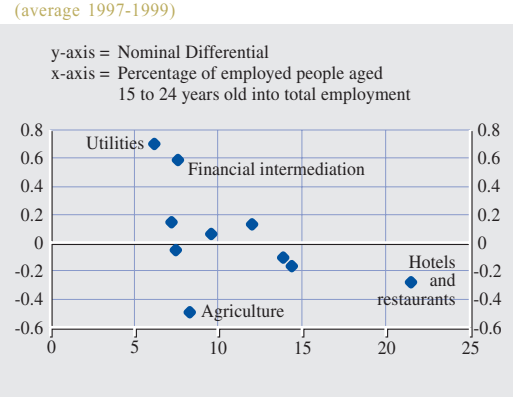
Chart 10 Wage differentials versus women in employment per sector

(average 1997-1999)

Source: OECD, Eurostat and ECB calculations.

Chart 11 Wage differentials versus youth employment per sector

(average 1997-1999)



Sources: OECD, Eurostat and ECB calculations.

counterparts. Eurostat recently reported that, on average in the EU, a woman was paid 84% of the average male wage, and this figure had remained stable between 1994 and 1999 (Eurostat, 2003). However, the scattered points shown in Chart 10 do not point to a strong relationship between the proportion of female workers in a specific sector and the corresponding wage differential. This is confirmed by the relatively low rank correlation coefficient, close to -0.3.

Finally, the proportion of workers aged between 15 and 24 years old might also have some bearing on the overall inter-industry wage structure. Young people are likely to earn less than older, more experienced workers. Moreover, young workers are not homogeneously distributed across sectors of the economy. They are overproportionately represented in hotels and restaurants for example, where they account for around 21% of total employment, while they account for no more than 6% of employment in utilities. Chart 11, plotting wage differentials against the proportion of young workers in each sector, shows a fairly significant negative relationship between the two variables, with a rank correlation coefficient of around 0.7.

In sum, this quick review of worker characteristics likely to influence relative wages confirms our suspicion that inter-industry wage differentials are, to a large extent, due to the heterogeneity of workers in the labour market. This has also been widely researched and commented upon in the empirical literature (see, for example, Dickens and Katz, 1986, Gibbons and Katz, 1992, or Abowd et al., 1999). Some sectors, such as agriculture, appear to have an accumulation of worker characteristics that typically coincide with lower average wages (e.g. a high proportion of low-skilled positions, temporary employment and self-employment). Interestingly, some other sectors, such as utilities and financial intermediation, frequently appear as outliers in our charts, pointing to sector or firm-specific features that may not be related to worker characteristics.

3.4.2 COMPOSITIONAL EFFECTS DUE TO INDUSTRY-SPECIFIC FACTORS

It has also been widely suggested in the literature that inter-industry wage differences persist even after controlling for a wide range of worker characteristics. In particular, Krueger and Summers (1988) have shown for the United States that significant wage differentials between equally skilled workers exist across sectors of the economy and appear to be "a pervasive empirical regularity". We therefore proceed by taking a look at some

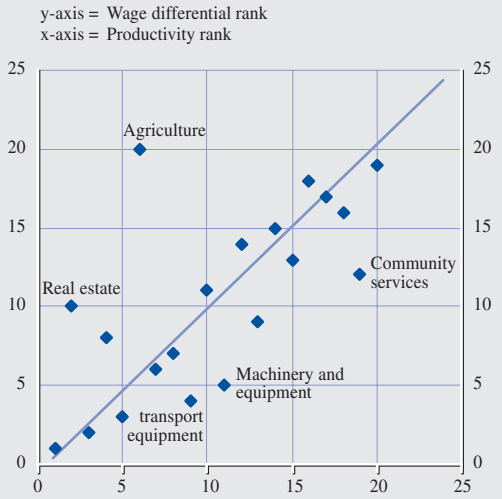
sector-specific characteristics, which have been identified in earlier studies as possible determinants of wage differentials. Sector-specific features for which data are available include labour productivity, capital intensity, profitability, import penetration ratios and average firm size. All data are drawn from the STAN database.

A comparison of wage differentials with labour productivity turns out to be very insightful. Inter-industry differentials in average productivity (measured in terms of real value added per employee) are expected to be positively correlated with wage differentials, since it is assumed that higher productivity brings about higher wages. Using US and French microeconomic data, Abowd et al. (2001) show that higher-paid workers are employed in firms that are more productive. Ideally, a measure of multi-factor productivity should be used to assess inter-industry productivity differentials, i.e. a measure relating output to a bundle of inputs rather than only to labour. Unfortunately, the set of available data limits the measurement of total productivity. Nevertheless, while labour productivity is mainly influenced by the individual characteristics of workers, it may also reflect specific conditions in a sector, such as production technology and the intensity of competitive pressures. Chart 12 confirms that, in general, sectors with higher labour productivity pay higher wages. It graphs the ranking of the different sectors with respect to wage differentials against their ranking with respect to labour productivity. Observations lie very close to the 45° diagonal, suggesting that wage differentials in most sectors mirror labour productivity differentials. This is confirmed by the value of the rank correlation coefficient (close to 0.7).[14]

In some sectors (in particular, agriculture and real estate, renting and business activities), wages are lower than the average labour productivity rank would appear to allow. Agriculture is a highly competitive sector, which experienced marked restructuring throughout the 1990s, partly due to reforms in the EU's Common Agricultural Policy. Real estate, renting and business activities are generally capital-intensive sectors in which employees have relatively low bargaining power due to lower trade union density and in which a proportion of employees is also commonly remunerated with stock options and

Chart 12 Nominal wages versus labour productivity

(average 1991-99; rankings)



	Wage differential rank	Productivity rank
Agriculture, hunting, forestry and fishing	20	6
Food products, beverages and tobacco	14	12
Textiles, textile products, leather and footwear	19	20
Wood and products of wood and cork	17	17
Pulp, paper, paper products, printing and publishing	7	8
Chemical, rubber, plastics and fuel products	3	5
Other non-metallic mineral products	11	10
Basic metals and fabricated metal products	9	13
Machinery and equipment	5	11
Transport equipment	4	9
Other manufacturing; recycling	16	18
Electricity, gas and water supply	1	1
Construction	13	15
Wholesale and retail trade; repairs	15	14
Hotels and restaurants	18	16
Transport and storage	6	7
Post and telecommunications	8	4
Financial intermediation	2	3
Real estate, renting and business activities	10	2
Community, social and personal services	12	19

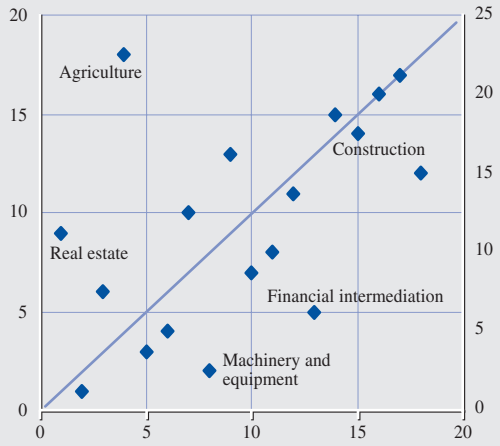
Sources: OECD and ECB calculations.
Note: Rank 1 indicates the sector with the highest positive differential.

14 This result should not be over-interpreted. When wage levels in different sectors are compared with labour productivity levels, the relationship becomes weaker, although it still exists. This might, however, reflect measurement difficulties in some sectors, which are likely to affect the productivity ranks to a lesser extent.

Chart 13 Wage differential rank versus capital intensity rank

(average 1991-1999; rankings)

y-axis = Wage differential rank
x-axis = Capital intensity rank



	Wage differential rank	Capital intensity rank
Agriculture, hunting, forestry and fishing	18	4
Food products, beverages and tobacco	13	9
Textiles, textile products, leather and footwear	17	17
Pulp, paper, paper products, printing and publishing	7	10
Chemical, rubber, plastics and fuel products	3	5
Other non-metallic mineral products	10	7
Basic metals and fabricated metal products	8	11
Machinery and equipment	5	13
Transport equipment	4	6
Other manufacturing; recycling	15	14
Electricity, gas and water supply	1	2
Construction	12	18
Wholesale and retail trade; repairs	14	15
Hotels and restaurants	16	16
Transport, storage and communication	6	3
Financial intermediation	2	8
Real estate, renting and business activities	9	1
Community, social and personal services	11	12

Sources: OECD and ECB calculations.

profit-sharing schemes. Conversely, a few sectors (machinery and equipment, transport equipment, and community, social and personal services) rank higher with respect to wages than their labour productivity ranking would suggest. This may point to the existence of wage premia. As mentioned in Section 2.2, these wage premia are likely to reflect both a strong market power in the product market, generating a rent, and a sharing of the rent between employees (wage premia) and employers (mark-up).[15] The sharing of the rent may be motivated by a desire to pay efficiency wages or by strong bargaining power of the wage earners, due, for instance, to the existence of powerful trade unions.

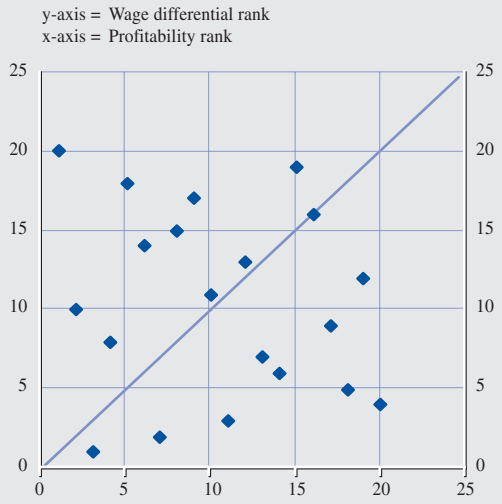
Among the sector-specific factors, capital intensity, measured as the capital/labour ratio, has been found in some studies to be positively related to wage differentials. Capital-intensive industries are likely to be characterised by a higher degree of firm concentration and are thus more likely to extract monopoly rents. Moreover, a high level of capital-intensity suggests workers in the sector may be using expensive machinery and equipment which requires specific skills, often learnt in the workplace. According to efficiency wage or insider bargaining power models, these skills may lead to higher wages. Chart 13 plots the rankings of the different sectors with respect to wage differentials against their ranking with respect to capital intensity. Most sectors are located around the diagonal, confirming a positive relationship between capital-intensity and wage differentials. The rank correlation coefficient is fairly high and positive (0.65).

Rent-sharing is another possible explanation that is put forward in the literature for inter-industry wage differentials: as far as workers are able to capture some share of the firms' profits, industries with higher profits should pay higher wages. To proxy a measure of profit given the set of available data, we calculated a rough profit share, i.e. the share of value added net of labour compensation in gross output. This can also be thought of as a measure of the product-market power of the industry. Indeed, according to the rent-sharing theory, firms that have a high

15 Keuning (1995) suggests that the relationship between wage and productivity can be negative under some circumstances. In the case of a strong terms-of-trade shock (such as an oil shock in an oil-producing developing country with some benefiting and some suffering industries), a negative correlation may be observed between productivity change and wage change. This situation would arise when the rise in profit mark-up is shared with some groups of wage earners in benefiting industries, while productivity is hit by overinvestment and less rigorous management. Conversely, the suffering industries have to make an additional effort to raise productivity and reduce wage increases. This pattern is of course not sustainable in the long-run and appears as an exception.

Chart 14 Wage differential rank versus profit share rank

(average 1991-1999; rankings)



	Wage differential rank	Profitability rank
Agriculture, hunting, forestry and fishing	20	1
Food products, beverages and tobacco	14	6
Textiles, textile products, leather and footwear	19	15
Wood and products of wood and cork	17	9
Pulp, paper, paper products, printing and publishing	7	13
Chemical, rubber, plastics and fuel products	3	11
Other non-metallic mineral products	11	10
Basic metals and fabricated metal products	9	17
Machinery and equipment	5	18
Transport equipment	4	20
Other manufacturing; recycling	16	16
Electricity, gas and water supply	1	3
Construction	13	12
Wholesale and retail trade; repairs	15	8
Hotels and restaurants	18	5
Transport and storage	6	14
Post and telecommunications	8	4
Financial intermediation	2	7
Real estate, renting and business activities	10	2
Community, social and personal services	12	19

Sources: OECD and ECB calculations.

product-market power (because they are in a monopoly or oligopoly situation) are more likely to make high profits and, possibly, to share them with workers. In Chart 14 we compare wage differential rankings for the different industries of the economy with their respective profit share rankings The results do not suggest the existence of any significant relationship between the two variables, as the correlation coefficient is extremely low. Yet, the empirical literature generally finds evidence of a relationship in some countries. For example, Blanchflower et al. (1996) showed, using US data, that increases in wages followed earlier movements in profits. Similarly, Kouwenberg et al. (1999) found, using Dutch data, that industries with high profits per employee paid wages above the average wage. Data shortcomings, in particular the level of aggregation, may prevent us from finding any correlation for the euro area. Alternatively, it is possible that although high profits mean a firm has a greater ability to pay higher wages, firms manage to retain most of the product-market rent for themselves. In other words, the bargaining power of the employees is not strong enough to secure any significant share in the firm's economic rent.

Import penetration may also have some relationship with wage differentials. Industries that are highly exposed to foreign competition might be expected to find it difficult to pay higher wages. An import penetration measure was derived, as the ratio of total import value to gross output for each manufacturing industry. According to Chart 15, it is true that textiles, which has the highest import penetration ratio in manufacturing, displays a strongly negative wage differential. However, this may also be attributable to other factors such as the average level of skills among the workforce. In general, the scattered points do not indicate a strong systematic relationship (the correlation coefficient barely reaches 0.2), even though the rank correlation coefficient is positive, as we might expect. This would be in line with a recent study, applied to France, by Cortes, Jean and Pisany-Ferry (1996). The authors noted that the development of foreign trade with emerging markets appeared to have an effect on unemployment rather than on wages and that labour market effects of trade are more likely to feed through quantities (i.e. employment) than prices (i.e. wages).

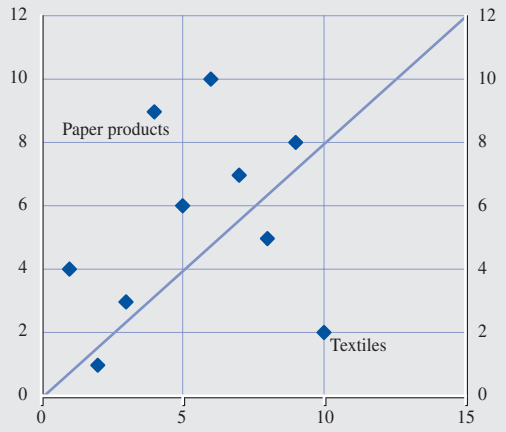
Several studies have shown average firm size in a sector to be positively related to wages (e.g. see Brown and Medoff, 1989, and Groshen, 1991) and provided a range of possible explanations.[16] It is argued that larger firms use more complex production technologies, are

16 See also Burdett and Mortensen (1998) and Masters (1999) for theoretical arguments.

Chart 15 Wage differential rank versus import penetration rank

(average 1991-1999; rankings)

y-axis = Wage differential rank
x-axis = Import penetration rank



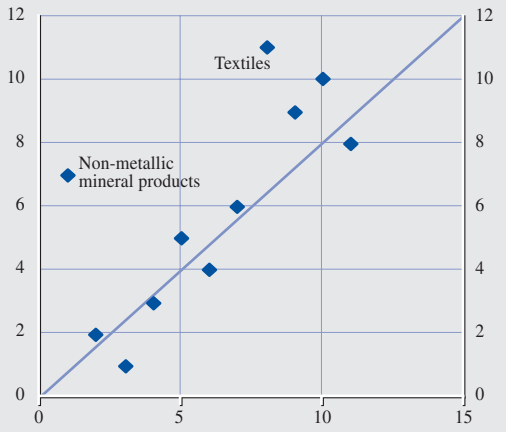
	Wage differential rank	Import penetration rank
Food products, beverages and tobacco	7	7
Textiles, textile products, leather and footwear	10	2
Wood and products of wood and cork	9	8
Pulp, paper, paper products, printing and publishing	4	9
Chemical, rubber, plastics and fuel products	1	4
Other non-metallic mineral products	6	10
Basic metals and fabricated metal products	5	6
Machinery and equipment	3	3
Transport equipment	2	1
Other manufacturing; recycling	8	5

Sources: OECD and ECB calculations.

Chart 16 Wage differential rank versus average firm size rank

(average 1991-1999; rankings)

y-axis = Wage differential rank
x-axis = Average firm size rank



	Wage differential rank	Average firm size rank
Manufacturing	5	5
Textiles, textile products, leather and footwear	11	8
Wood, wood products and cork	10	10
Pulp, paper products, printing and publishing	4	6
Chemical, rubber, plastics and fuel products	2	2
Other non-metallic mineral products	7	1
Basic metals and fabricated metal products	6	7
Machinery and equipment	3	4
Other manufacturing; recycling	9	9
Electricity, gas and water supply	1	3
Construction	8	11

Sources: OECD and ECB calculations.

more innovative and show greater capital intensity. As a consequence, larger firms hire workers who are more highly qualified or have more specialised skills than smaller firms. Besides individual characteristics, the relationship between firm size and wages may also relate – although to a lesser extent – to firm-specific effects (see Abowd, Kramarz and Margolis, 1999, or Troske, 1999 [17]). One of the reasons behind this relates to the efficiency wage theory. Worker effort cannot be fully monitored by firms. To prevent workers from shirking, firms pay wages above the market-clearing rate. As monitoring problems increase with the size of the firm, larger firms are likely to pay more for the same labour quality than smaller firms. Also according to non-competitive theories, larger firms have greater market power and higher profits, while their workforce can be relatively organised and in a position to obtain a large share of the rent. Finally, and to a lesser extent, a large firm offers elements of "disutility" (e.g. increased work division, impersonal atmosphere) for

17 Using matched longitudinal individual-firm data for France, Abowd and Kramarz (1997) found that most of the firm-size wage effect, adjusted for observed individual characteristics, is due to the tendency of large firms to employ individuals at high wage rates. These high wages embody unobservable worker characteristics (as opposed to observable qualifications) such as returns to job search and human capital. Abowd, Kramarz and Margolis (1999) found that, in France, while 90% of the firm-size wage differential is due to worker characteristics, 25% to 40% is due to the firm-specific effects (allowing for correlation between effects). For the United States, Troske (1999) showed that the firm-size premium (13%) remained important (6%) when corrected for observable skills (tenure, occupation and education) as well as the capital-labour ratio. The returns to size also appear broadly unaffected when controlling for other firm-specific variables, which confirms the importance of firm size in wage determination.

which workers may demand to be compensated. These assumptions are supported by empirical results and may partly explain why manufacturing industries, where the proportion of large firms is higher than in construction or services, pay relatively higher average wages. Chart 16 provides some evidence to support this claim. It compares wage differential rankings in manufacturing, utilities and construction with the corresponding rankings of average firm size[18]. The Spearman rank order correlation coefficient between the two set of variables is high and positive, at 0.7.

Although insufficient data is available for the euro area, other variables may play an important part in explaining wage differentials. For example, the wage bargaining system may matter a great deal. Some empirical studies have shown inter-industry wage differentials to be larger in countries with decentralised wage bargaining, such as the United States or the United Kingdom, than in countries where wage deals tend to follow developments in one particular industry or where the bargaining features elements of solidarity across industries (e.g. Hartog et al., 1997). Similarly, union density, to the extent that it helps workers to capture some share of the firms' profits, may play a role. The relatively high union density in manufacturing compared with services may be an additional explanation of the positive wage differential in manufacturing. Also, product market regulation restricting competition has been found to have a significant positive impact on wage premia in both manufacturing and non-manufacturing sectors (Jean and Nicoletti, 2001).

As a means of summarising our empirical findings for the euro area, we computed rank correlations for all variables discussed above. The results are reported in Table 3. The degree of significance varies depending on the number of available observations. As far as worker characteristics are concerned, skills, the percentage of temporary employment and the share of youth have the highest correlation coefficients. Labour productivity and capital intensity are the most significant possible sector-specific determinants, while average firm size may also influence the wage structure somewhat. All these factors may be correlated with each other or may combine to explain high wage differentials. For instance, while the high positive wage differential in utilities, financial intermediation and to a lesser extent, in chemical and fuel products, is likely to result partly from the composition of the work force, it might also stem from a firm-size effect and the high labour productivity induced by high capital intensity.

Table 3 Summary: Spearman rank order correlation coefficients

Determinants	Correlation coefficient
Worker characteristics	
High-skilled employees	0.775 **
Low-skilled employees	-0.789 **
Part-time employment	-0.478
Temporary employment	-0.927 **
Self-employment	-0.891 **
Proportion of female workers	-0.339
Proportion of youth	-0.685 ***
Industry-specific	
Productivity	0.678 **
Capital intensity	0.654 **
Profitability	-0.155
Import penetration 1)	0.236
Average firm size 1)	0.709 ***

1) Service sectors not included.
** Indicates significance at 1%.
*** Indicates significance at 5%.

18 Average firm size for the euro area has been derived from the Eurostat Structural Business Statistics database on the basis of six countries: Germany, France, the Netherlands, Austria, Portugal and Finland. The data refer to 2001 and the average firm size is defined as the ratio of the average number of employees to the average number of firms in a particular industry.

4 DEVELOPMENTS IN THE EURO AREA WAGE STRUCTURE SINCE THE 1980s

In this section, we consider the developments in the inter-industry wage structure over the 1980s and 1990s. Given the lack of time series data on worker characteristics and the complexity of the factors behind these developments, which may result from a mix of shocks and institutional evolution, we will refrain from attempting to provide a conclusive explanation of changes in the wage structure. Moreover, developments in the inter-industry wage structure have to be interpreted with caution as compositional effects, such as industry-specific developments in part-time work, hours worked and skills, could blur the picture. We can compute the change over time in the inter-industry wage structure corrected for the influence of part-time employment (see Box 2) and skills, roughly proxied by educational level (see Box 3), but only for a relatively short period of time and a small number of sectors. The purpose of this section is therefore to identify some basic stylised facts rather than fully account for developments in the inter-industry wage structure.

4.1 A SLIGHT INCREASE IN WAGE DIFFERENTIATION ACROSS SECTORS SINCE THE EARLY 1980S

To follow the developments in wage differentials over time, we split our observations into four periods, corresponding to the first and second halves of the 1980s and the 1990s.[19] This choice of periods aims to capture the different phases of the economic cycle, namely the strong expansions recorded in the late 1980s and 1990s, as well as the recessions seen in the early 1980s and 1990s.

The overall ranking of inter-industry wage differentials in the euro area remained remarkably stable from the early 1980s. The rank order correlation coefficient stood very close to 1 from one period to the next. In other words, industries that paid more than the average in the early 1980s continued to pay more than the average in the late 1990s (see Annex 7). Moreover, this ranking remained stable regardless of developments in the economic cycle. In general, wage differentials across industries have either consistently increased or decreased since the early 1980s, with no evidence of any cyclical influence on the relative levels of wages across sectors of the economy.

However, while the ranking of sectors in the economy seems remarkably stable over time, a more detailed examination reveals that inter-industry wage differentials have slightly increased over the past two decades, in particular for the sectors with a positive wage differential. In 14 sectors[20] out of the 20 examined, the average wage level tended to diverge slowly from the overall economy average. The wage dispersion in the economy as a whole, measured by the weighted standard deviation of wage differentials, increased from around 19.4 percentage points in the early 1980s to 23.1 percentage points in the late 1990s (see Table 1, Annex 4).

More specifically, wage differentials in manufacturing and in utilities – on average positive – tended to increase over time. Within manufacturing, the picture varied somewhat from sector to sector. For example, wages tended to converge towards the total economy average in industries such as food or textile products and diverge in others (e.g. chemicals or transport equipment). Yet overall wage dispersion in manufacturing increased by a moderate 9% between the early 1980s and the late 1990s. In construction and in services, wage differentials – on average negative – became more negative. Increasing wage differentiation is particularly tangible in services, where wage dispersion increased by more than 20% on average from the early 1980s to the late 1990s, led by sectors such as financial intermediation (see Table 2,

19 The precise periods used are: 1980-1985, 1986-1990, 1991-1996, and 1997-1999.

20 These 14 sectors represent nearly 80% of total employment in the economy.

Box 2

HAS THE RISE IN PART-TIME WORK DISTORTED THE OVERALL WAGE STRUCTURE OVER TIME?

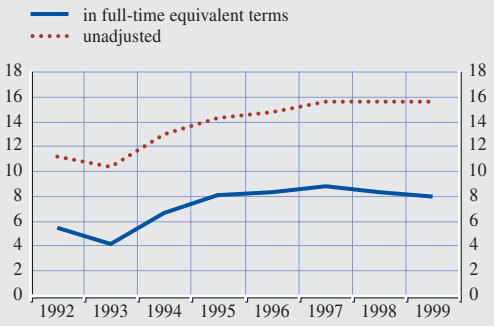
At the end of the 1990s, more than 20% of employees in services worked part-time, compared with only 7% in manufacturing. As pointed out in Section 3.2, this difference distorts the overall wage structure given that a high proportion of part-timers mechanically lowers the average number of hours worked in a sector and thus reduces average compensation. Moreover, it has been shown that part-timers tend to have a lower hourly wage than full-timers. Consequently, after correction for part-time work, the average wage level in services is estimated to be around 8% lower than in manufacturing (see Section 3.2). The ratio of part-time workers to total employees in the euro area remained fairly stable for most of the 1980s (around 10-11%) but rose markedly to nearly 17% at the end of the 1990s. Part-time work developments may have distorted the wage structure over time if this rising trend in part-time work was not the same across all sectors. This box aims to quantify the impact of the rise in part-time work on the gap between average wages in manufacturing and average wages in services.

The European Labour Force Survey provides data on part-time work and hours worked for each sector of the economy, albeit from 1992 only. Although the average annual growth rate of part-time work was quite similar in manufacturing (3.0%) and in services (3.3%) between 1992 and 1999, its impact on relative wages is likely to have been stronger in services given its higher proportion of part-time employment. In order to quantify the structural shift implied by this slight difference in growth rate, we calculated the gap between average compensation per employee in services and in manufacturing, both unadjusted and in full-time equivalent terms. The two measures, reported in the chart, show that the gap between the average wage in manufacturing and that in services increased between 1992 and 1999 whether one considers measures adjusted for full-time equivalence or not. Part-time employment growth contributed to this increase, since the gap widened less when corrected for part-time developments (+2.6 percentage points) than in non-adjusted terms (+4.5).

In general, the overall dispersion of wages across sectors of the economy, only marginally higher with adjusted figures, rose in similar proportion between 1992 and 1999 whether wage differentials are adjusted for part-time work developments or not. However, the effect of part-time work was more substantial in some service sectors, with part-time work growing by between an average 2.5% per year in the retail and wholesale trade, and more than 4% per year in hotels and restaurants and in real estate and business services between 1992 and 1999. For example, in real estate and business services, non-adjusted figures suggest that the average wage level tended to converge towards the total economy average during the 1990s. Once corrected for the strong growth in part-time work, the average wage in this sector appears to have actually diverged from the overall economy average wage.

Chart Gap between the average wage in manufacturing and in services

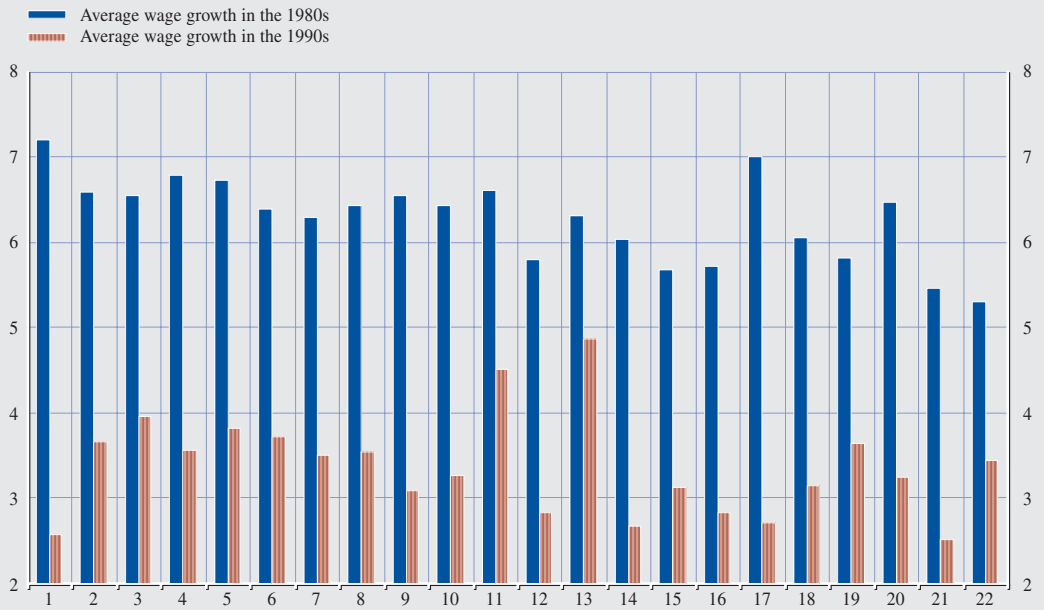
(percentage point difference)



Sources: Eurostat, OECD and ECB calculations.

Chart 17 Average wage growth in the 1980s and the 1990s

(annual percentage changes)



1 Agriculture, hunting, forestry and fishing
2 Total manufacturing
3 Food products, beverages and tobacco
4 Textiles, textile products, leather and footwear
5 Wood and products of wood and cork
6 Pulp, paper, paper products, printing and publishing
7 Chemical, rubber, plastics and fuel products
8 Other non-metallic mineral products
9 Basic metals and fabricated metal products
10 Machinery and equipment
11 Transport equipment
12 Other manufacturing; recycling
13 Electricity, gas and water supply
14 Construction
15 Total services
16 Wholesale and retail trade; repairs
17 Hotels and restaurants
18 Transport and storage
19 Post and telecommunications
20 Financial intermediation
21 Real estate, renting and business activities
22 Community, social and personal services

Sources: OECD and ECB calculations.

Annex 4). As a result, wage differentials between manufacturing and services widened slightly over time.[21]

If wage differentials tended to increase with time, then there has not been any catch-up effect on wages across sectors of the economy. Chart 17 illustrates further the absence of this effect in wage growth. Wage growth rates tend to be broadly similar across sectors in both the 1980s and the 1990s. In the 1980s, wage growth lay between 5% and 7.5%, with an average dispersion of only 0.6 percentage point across sectors. In the 1990s, while wage growth lay within a lower range (between 2.5% and 4% for most sectors), a similar dispersion was recorded.[22] The slight increase in wage differentiation over time suggests that there is limited risk of an increase in overall labour cost growth stemming from relatively low-paying sectors catching up with higher-paying sectors.

21 In contrast with this general trend of increasing wage differentiation, wage differentials in agriculture became slightly less negative over the last two decades and tended to converge with the overall economy average.

22 The difference between the average for the 1980s and that for the 1990s is largely explained by the significant reduction in average inflation between the two decades.

Box 3

HAS THE CHANGE IN THE SKILL STRUCTURE AFFECTED THE OVERALL WAGE STRUCTURE?

Educational level, broken down into three categories (lower secondary education or less, higher secondary education and tertiary education), is used as a proxy for the level of skills. This coarse measure provides a general indication of worker skills, although it cannot fully capture the level of skills required by a job, which largely affects the wage. In 1992, 22% of employees working in services had tertiary education, compared with only 13% in manufacturing. In 1999, 28% of workers in services held a tertiary education degree, compared with 16% in manufacturing. In other words, the rise in the proportion of workers with tertiary education was twice as high in services as in manufacturing. This may have influenced the wage structure, as workers with tertiary education are paid on average 93% more than those with lower secondary education or less and 30% more than those with higher secondary education.

In order to correct the wage structure for the effect of skill composition, we combined the information provided by the Survey of Structure of Earnings (1995) on the average gross monthly earnings of full-time employees by educational level in different sectors and that yielded by the European Labour Force Survey on the employment breakdown by educational level in different sectors, available annually since 1992. In the following equation, E and W denote the level of employment and wages respectively, while the subscripts *i*, *s*, and *t* correspond to economic sector, educational level (low: L, medium: M, high: H) and year. We correct the wage structure by computing the inter-industry wage W*c* in "low-skilled equivalent" terms, supposing that all the workers only have lower secondary education or less:

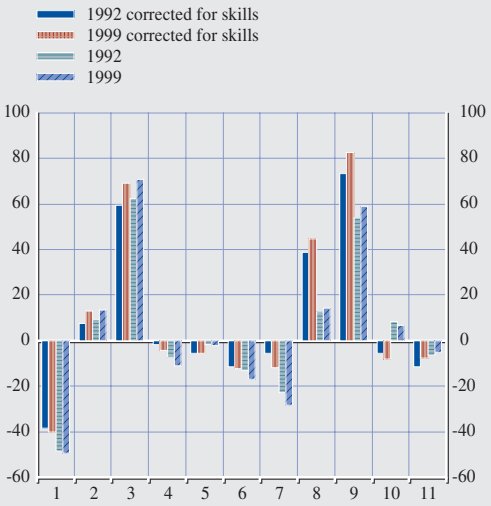
$$Wc_{it} = \frac{W_{it}}{\sum_{s \in \{L,M,H\}} \frac{E_{ist}}{E_{it}} \cdot \frac{W_{is1995}}{W_{iL1995}}}$$

Chart A compares the unadjusted and skill-adjusted wage structure over time (in 1992 and 1999). Several features appear. First, the overall ranking of inter-industry wage differentials in the euro area were unchanged after correction for skills. Second, although the dispersion[1] across sectors of average wages adjusted for skills is slightly higher than the non-adjusted measure, the dispersion of skill-adjusted wages rose to a similar extent to the dispersion of non-adjusted wages. Looking more closely, the increase in the gap between average wages in total services and in manufacturing between 1992 and 1999 was, as displayed in Chart B, even slightly higher after correction for changes in the skill structure, which confirmed that *movements* in skill composition cannot explain *developments* in wage structure.[2]

1 The weighted standard deviation of wage differentials.
2 In most sectors, skill effects contributed to an underestimation of the change in wage differentials between 1992 and 1999. The exceptions are whole sale and retail trade, and to a much lesser extent, construction, where the change in skill composition contributed positively to changes in differentials.

Chart A Effect of skills on the inter-industry wage structure

(percentage difference from the total economy average)

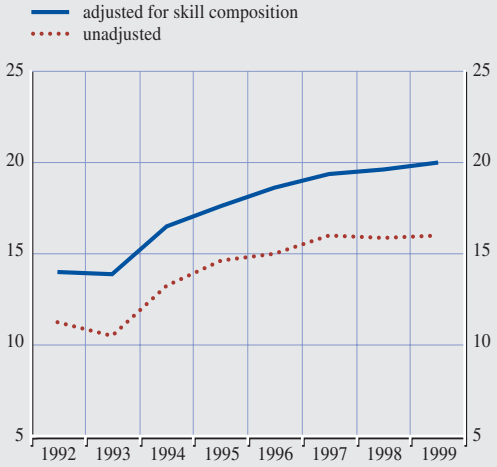


1 Agriculture, hunting forestry and fishing
2 Total manufacturing
3 Electricity, gas and water supply
4 Construction
5 Total services
6 Wholesale and retail trade; repairs
7 Hotels and restaurants
8 Transport, storage, post and telecommunications
9 Financial intermediation
10 Real estate, renting and business activities
11 Community, social and personal services

Sources: Eurostat, OECD and ECB calculations

Chart B Gap between the average wage in manufacturing and in services

(percentage point difference)



Sources: Eurostat, OECD and ECB calculations

Conversely and as already mentioned in Section 3.4.1, inter-industry skill structure may distort somewhat the wage structure at a given point in time, although the ranking of sectors is unaffected except in services.[3] When adjusted for skill structure, the wage differential between manufacturing and total services in 1999 widens to 20%, from 16% for non-adjusted data, reflecting the fact that manufacturing has a higher proportion of low-skilled workers than services as well as a lower proportion of employees with tertiary education.

3 When correcting for the effect of skill structure, the negative wage differential in 1999 increases for community services but significantly decreases for hotels and restaurants, wholesale and retail trade, construction and agriculture owing to the large proportion of workers with lower secondary education or less in these sectors. Conversely, the positive wage differential in 1999 increases for utilities, transport, storage and communication, and financial intermediation. In financial intermediation services, this is largely due to the relatively small wage differential across educational levels, which may be partly explained by the fact that stock options, an increasingly important part of remuneration of high-skilled employees, are not always included in national accounts definitions of compensation of employees. A striking feature is the wage gap in real estate, renting and business activities, which turns negative when corrected for the effects of skill structure, owing to the high wage differential across educational levels.

4.2 POSSIBLE FACTORS BEHIND THE INCREASING WAGE DIFFERENTIATION

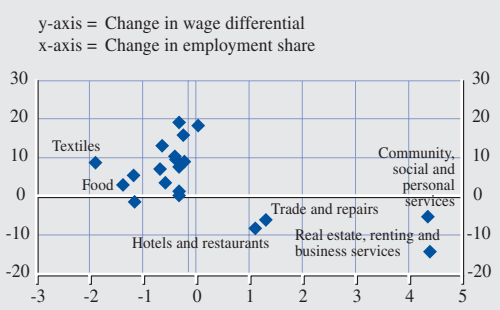
Several factors may lie behind the general trend of increasing wage differentiation. First, inter-industry differences in part-time working developments have influenced the wage structure somewhat, as suggested in Box 2. In particular, particularly strong part-time employment growth in some services, such as hotels and restaurants as well as real estate and business services, have strongly influenced the movement of relative wages compared with the total economy average. However, at a less disaggregated level, while part-time employment growth has contributed to a widening of the wage gap between manufacturing and services, it explains no more than half of this increase. Second, unlike part-time work, the change in inter-industry skill composition partly offset the increase in the wage gap between manufacturing and services in the 1990s. At a more disaggregated level, it only marginally affected the wage structure, increasing wage differentials only in wholesale and retail trade, and, to a much lesser extent, construction. This is broadly in line with the findings of Piketty (1998)[23].

On the whole, developments in key worker characteristics such as the part-time employment rate and skill composition seem unable to account per se for the increasing wage gap between industry and services or the increase in wage dispersion in the 1990s. Although, at a more disaggregated level, they partly contributed to changes in the wage differential in a few sectors, they have just accentuated or mitigated wage differential developments without altering their direction in general. This indicates the existence of other factors.

Although a possible candidate a priori, the intense inter-industry reallocation and restructuring of the euro area economy induced by the fast-moving process of integration and the strong competitive pressure exerted on product markets in the last two decades does not emerge as a major factor. Between 1980 and 1999, the share of services in total euro area employment rose from around 58% to 73%. Meanwhile, the corresponding share of manufacturing declined from 23% to 16%. We would expect industries losing jobs to experience a decline in their relative wages, according to a "wage curve" effect[24]. But the evidence shown in Chart 18 points to a negative relationship between developments in employment shares and in wage differentials. Industries witnessing (small) reductions in their employment shares experienced an increase in their average relative wage (e.g. textiles), whereas those which saw an increase in their employment share (e.g. real estate, renting and business services) saw a decline in their relative average wage. This may reflect a reverse causality between wages and employment[25] or the existence of other determinants.

Chart 18 Changes in employment share versus changes in wage differential

(percentage points; 1980-1985 versus 1997-1999)



Sources: OECD and ECB calculations.

The widening pay gap between manufacturing and services may also be partly related to the fact that services tend to be less unionised than

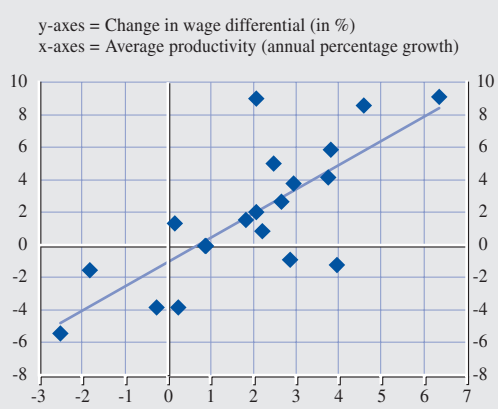
23 In the wholesale and retail trade, changes in skill composition accounted for half the increase in the (negative) wage differential between 1992 and 1999. Piketty (1998) shows that some services, particularly retail trade, have expanded by hiring lower skilled (and thus, lower paid) workers.

24 An effect in which the level of wages for a specific category (region, industry, occupation, skill, etc.) depends negatively upon the unemployment rate in that category.

25 Relatively low wages in services might have contributed to the development of these sectors.

Chart 19 Annual productivity growth versus changes in wage differentials

(1992-1999)



manufacturing and workers may thus achieve lower wages.

Finally, according to standard economic theory, wages are determined, at least in the long run, by labour productivity growth; indeed, labour productivity developments appear to play a crucial role here. Chart 19 shows that changes in inter-industry wage differentials in the 1990s are highly correlated with labour productivity growth over the same period. For instance, relatively high productivity growth in manufacturing, utilities, post and telecommunications, and financial intermediation seems related to increasing (positive) wage differentials. Conversely, the relatively low productivity growth in construction, wholesale and retail trade, and hotels and restaurants appears to be in line with a worsening of the negative wage differentials in the 1990s.[26] As a general rule, the widening pay gap between manufacturing and services may partly be related to the fact that, during the 1990s, labour productivity growth was much higher in manufacturing (2.7% on average each year) than in services (0.6% per year on average).

26 Of course, changes in part-time work and wage structure, discussed earlier, may partly account for co-movements in productivity and wage differentials.

5 CONCLUSION

The descriptive picture of inter-industry wage differentials in the euro area reveals a great deal of variation in average wage levels across various sectors of the economy. In particular, the average wage in services appears to be 16% lower than that in manufacturing. This gap is affected by the composition of the workforce, in terms of skills or hours worked. When corrected for the high proportion of part-time workers in services, the wage gap between manufacturing and services is reduced to 8%. Conversely, a correction for the skill composition of the labour force (proxied by the level of education) increases the gap from 16% to 20%, which partly offsets the effect of part-time work. However, the ranking of industries according to relative wage differentials remains largely unchanged after these corrections. Wage dispersion is high in the two main sectors of the economy, and is somewhat larger in manufacturing than in services. The substantial degree of wage differentiation in the euro area is remarkably similar to that in the United States, although it is somewhat less marked within services.

A review of empirical evidence enabled us to examine various factors which, according to the literature, are likely to play a role in explaining the persistence of inter-industry wage differentials in the euro area. Indeed, wage differentials appear highly correlated with skills (proxied by either the level of education or the proportion of employees in vocational training) and the proportions of temporary, self-employed and young workers in different sectors of the economic activity. Simultaneously, they seem to be correlated with sector or firm-specific factors, in particular average firm size and capital intensity. On the other hand, other possible factors – worker characteristics such as the proportions of female and part-time workers, and industry-specific characteristics such as import penetration ratios or the average profit share – appear to have little bearing on inter-industry wage differentials. Further research would be needed to fully identify the factors behind the persistence of inter-industry wage differentials in the euro area.

Looking at the relative rankings of average wages across industries, the euro area wage structure remained broadly unchanged throughout the review period. In other words, industries that paid relatively more in the early 1980s continued to pay relatively more at the end of the 1990s, and vice-versa. Also, the overall ranking of inter-industry wage differentials remained remarkably insensitive to the economic cycle. Finally, average wage growth tended to consistently decline over the last two decades, with no specific industry driving overall euro area wage developments.

Looking at more detailed results, the dispersion of wages across industries actually appears to have increased with time, even though the ranking of industries remained broadly unchanged. For example, the gap between the average wage in manufacturing and in services increased with time. This holds true even when corrected for developments in part-time work and the skill composition of the labour force. By and large, this would suggest that there is only a limited probability of a wage convergence with low-paying industries catching up with higher-paying industries.

Although the strong growth in part-time employment cannot fully explain the increase in wage dispersion across sectors of the economy, it contributed to a further increase in the gap between average wages in services and in manufacturing. Conversely, the varying rates of increase in educational level offset (to a marginal extent) the rise in the wage gap between manufacturing and services. Interestingly, the inter-industry reallocation recorded in the euro area during the last two decades does not emerge as a very relevant factor for increasing wage differentiation. Noticeably, labour productivity developments appear to be a major driving force behind changes in inter-industry relative wages. The widening of the gap between average wages in manufacturing and in services may be partly related to the fact labour productivity growth was three times as high in manufacturing as in services during the 1990s.

ANNEX I

DATA SOURCES

The main data source is the Structural Analysis database (STAN) of the Organisation for Economic Co-operation and Development (OECD). This database provides annual compensation payment and employment data disaggregated by industry, as well as other relevant series on output and capital stock on a national basis, from 1970 until 2001. STAN is primarily based on national accounts data and uses data from other sources (such as industrial surveys or censuses to estimate missing details). Therefore there can be a varying degree of accuracy depending on the countries and on the industries considered. The main variables used in this Occasional Paper are defined in STAN documentation as follows:

- **Compensation of employees** comprises wages and salaries of employees paid by producers as well as supplements such as contributions to social security, private pensions, health insurance, life insurance and similar schemes.[27]

- **The number of employees** includes all persons in employment and excludes the self-employed and unpaid family workers. The domestic concept of employment generally used by OECD countries is that of all persons engaged in the domestic production of a country, whether or not they are resident in that country.

27 Some financial but non-wage benefits, such as stock options, are not always included in national account definitions of compensation of employees. This increasingly important part of remuneration is not recorded in a harmonised way either within the EU or between the EU and the United States.

Country	General source
Belgium	Nationale Bank van België/Banque Nationale de Belgique, National Accounts Institute and Financial and Economic Statistics division; industrial classification: NACE Rev. 1; base year = 1995
Germany	Statistisches Bundesamt; industrial classification: NACE Rev. 1; base year = 1995; data prior to 1991 refers to west Germany only
Spain	Instituto Nacional de Estadística; industrial classification: NACE Rev. 1; base year = 1995
France	INSEE, Comptes Nationaux; industrial classification: NACE Rev. 1; base year = 1995
Italy	ISTAT; industrial classification: NACE Rev. 1; base year = 1995
The Netherlands	Centraal Bureau voor de Statistiek; industrial classification: NACE Rev. 1; base year = 1995
Austria	Statistik Austria; industrial classification: NACE Rev. 1; base year = 1995
Portugal	Instituto Nacional de Estatística; Industrial classification: NACE Rev. 1;base year = 1995
Finland	Statistics Finland; industrial classification: NACE Rev. 1; base year = 1995
United Kingdom	Office of National Statistics; industrial classification: UK SIC 92 (fully compatible with NACE Rev. 1); base year = 1995
United States	Bureau of Economic Analysis; industrial classification: US SIC 1987; base year = 1996

ANNEX 2

AVAILABLE INDUSTRIAL BREAKDOWN AND RELATIVE WEIGHT OF EACH SECTOR

LEVELS OF DISAGGREGATION USED (BASED ON ISIC REV. 3)

Sectors (Smaller fonts show sub-divisions of larger sectors)	ISIC Rev. 3	Employment share in 1997-99
Agriculture, hunting, forestry and fishing	01-05	2.2
Total manufacturing	**15-37**	**21.5**
Food products, beverages and tobacco	15-16	2.6
Textiles, textile products, leather and footwear	17-19	2.2
Wood, products of wood and cork	20	0.6
Pulp, paper, paper products, printing and publishing	21-22	1.7
Chemicals, rubber, plastics and fuel products	23-25	2.4
Other non-metallic products	26	1.1
Basic metals and fabricated metal products	27-28	3.0
Machinery and equipment	29-33	2.1
Transport equipment	34-35	4.7
Other manufacturing; recycling	36-37	1.1
Electricity, gas and water supply	40-41	0.9
Construction	45	7.0
Total services	**50-99**	**68.5**
Wholesale and retail trade, restaurants and hotels, repairs	50-55	17.4
Wholesale and retail trade, repairs	50-52	13.8
Hotels and restaurants	55	3.6
Transport, storage and communication	60-64	5.8
Transport and storage	60-63	4.2
Post and telecommunications	64	1.6
Finance, insurance, real estate and business services	65-74	12.8
Financial intermediation	65-67	3.4
Real estate, renting and business activities	70-74	9.5
Community, social and personal services	75-99	32.4
Total	**1-05, 15-37, 40-41, 45, 50-99**	**100.0**

ANNEX 3

THE SPEARMAN RANK ORDER CORRELATION COEFFICIENT

The Spearman rank order correlation coefficient is the rank statistic proposed by Spearman in 1904 as a measure of the strength of the relationship between two variables. In other words, the Spearman rank correlation coefficient can be used to explore a question such as:

What is the relationship between the proportion of part-time workers and the relative wage differential, when those variables are both measured by ranking scales?

The Spearman rank correlation coefficient is defined as:

$$R' = 1 - 6\sum \frac{d^2}{N(N^2 - 1)}$$

where d is the difference in statistical rank of corresponding variables and N the number of ranks. For a perfect positive correlation, the coefficient equals 1; for a perfect negative correlation, the coefficient equals -1; when the correlation is not perfect, the coefficient lies between -1 and 1.

The use of this indicator appears appropriate in our analysis as we are interested in the strength and the direction of the relationship between the *ranking* of inter-industry wage differentials and a series of other variables. However, standard correlation coefficients provide a broadly similar picture.

ANNEX 4

MEASURES OF WAGE DISPERSION

Table 1 Average weighted standard deviation of wages and unit labour costs

(percentage points; total economy)

Compensation per employee	1980-85	1986-90	1991-96	1997-99
Euro area	19.4	20.2	21.4	23.1
United Kingdom	24.0	29.2	31.9	30.5
United States	26.3	26.0	27.9	28.9
Unit labour costs	**1980-85**	**1986-90**	**1991-96**	**1997-99**
Euro area	-	28.0	29.3	31.4

Table 2 Average weighted standard deviation of compensation per employee

(in percentage points; total economy)

In manufacturing	1980-85	1986-90	1991-96	1997-99
Euro area	22.7	22.7	23.2	24.7
United Kingdom	25.2	28.7	30.1	25.0
United States	28.0	26.8	28.8	27.4
In services	**1980-85**	**1986-90**	**1991-96**	**1997-99**
Euro area	13.7	15.5	16.6	17.8
United Kingdom	18.0	22.9	23.4	23.8
United States	18.7	19.8	22.6	25.4

ANNEX 5

A CLOSER LOOK AT INDIVIDUAL EURO AREA COUNTRIES: WAGE DIFFERENTIALS ACROSS SELECTED EURO AREA COUNTRIES

1980-85	Germany	France	Italy	Spain	Netherlands
Agriculture, hunting, forestry and fishing	-39%	-37%	-48%	-64%	-24%
Food products, beverages and tobacco	-23%	0%	-7%	-2%	7%
Textiles, textiles products, leather and footwear	-35%	-22%	-28%	-29%	-7%
Wood and products of wood and cork	-14%	-22%	-35%	-26%	-2%
Pulp, paper, paper products, printing and publishing	-1%	13%	8%	13%	-9%
Chemical, rubber, plastics and fuel products	37%	37%	29%	51%	30%
Other non-metallic mineral products	-2%	13%	-3%	4%	14%
Basic metals and fabricated metal products	9%	7%	-5%	15%	4%
Machinery and equipment	13%	26%	6%	28%	9%
Transport equipment	34%	15%	4%	31%	4%
Other manufacturing, recycling	-12%	-15%	-9%	-20%	-21%
Electricity, gas and water supply	40%	51%	74%	85%	62%
Construction	-8%	-6%	-21%	-13%	9%
Wholesale and retail trade, repairs	-15%	-9%	-12%	-25%	-17%
Hotels and restaurants	-33%	-4%	29%	-3%	-40%
Transport and storage	2%	14%	47%	30%	17%
Post and telecommunications	3%	-4%	13%	20%	-12%
Financial intermediation	38%	6%	109%	78%	41%
Real estate, renting and business activities	0%	27%	5%	25%	-11%
Community, social and personal services	1%	-11%	-1%	2%	3%
Correlation coefficients					
Germany	1.00	0.78	0.70	0.90	0.78
France	0.78	1.00	0.62	0.86	0.66
Italy	0.70	0.62	1.00	0.89	0.64
Spain	0.90	0.86	0.89	1.00	0.78
Netherlands	0.78	0.66	0.64	0.78	1.00

1997-99	Germany	France	Italy	Spain	Netherlands
Agriculture, hunting, forestry and fishing	-36%	-43%	-51%	-59%	-26%
Food products, beverages and tobacco	-20%	-5%	5%	-2%	13%
Textiles, textiles products, leather and footwear	-13%	-19%	-28%	-29%	-7%
Wood and products of wood and cork	-5%	-21%	-29%	-23%	2%
Pulp, paper, paper products, printing and publishing	5%	21%	16%	19%	-2%
Chemical, rubber, plastics and fuel products	44%	41%	28%	54%	49%
Other non-metallic mineral products	15%	15%	1%	7%	18%
Basic metals and fabricated metal products	16%	11%	-1%	11%	17%
Machinery and equipment	35%	28%	14%	31%	24%
Transport equipment	58%	23%	13%	33%	14%
Other manufacturing, recycling	-2%	-11%	-20%	-21%	-18%
Electricity, gas and water supply	57%	67%	75%	85%	51%
Construction	-11%	-4%	-17%	-8%	14%
Wholesale and retail trade, repairs	-18%	-10%	-15%	-29%	-17%
Hotels and restaurants	-49%	-6%	6%	-7%	-49%
Transport and storage	1%	6%	50%	33%	19%
Post and telecommunications	13%	5%	18%	31%	-2%
Financial intermediation	43%	40%	95%	89%	43%
Real estate, renting and business activities	-6%	19%	-9%	24%	-7%
Community, social and personal services	-4%	-13%	-4%	-3%	0%
Correlation coefficients					
Germany	1.00	0.83	0.66	0.81	0.84
France	0.83	1.00	0.82	0.94	0.77
Italy	0.66	0.82	1.00	0.93	0.69
Spain	0.81	0.94	0.93	1.00	0.78
Netherlands	0.84	0.77	0.69	0.78	1.00

ANNEX 6

WAGE STRUCTURE COMPARISONS BETWEEN THE EURO AREA, THE UNITED STATES AND THE UNITED KINGDOM

Table 1 Correlations between wage differentials in economic areas

Euro area with	1980-85	1986-90	1991-96	1997-99
United Kingdom	0.519	0.679	0.776	0.850
United States	0.774	0.847	0.903	0.948
United Kingdom with	**1980-85**	**1986-90**	**1991-96**	**1997-99**
Euro area	0.519	0.679	0.776	0.850
United States	0.500	0.690	0.902	0.902
United States with	**1980-85**	**1986-90**	**1991-96**	**1997-99**
Euro area	0.774	0.847	0.903	0.948
United Kingdom	0.500	0.690	0.902	0.902

Table 2 Correlations between wage differential rankings in economic areas

Euro area with	1980-85	1986-90	1991-96	1997-99
United Kingdom	-	-	-	0.902
United States	0.770	0.881	0.911	0.961
United Kingdom with	**1980-85**	**1986-90**	**1991-96**	**1997-99**
Euro area	-	-	-	0.902
United States	-	-	-	0.896
United States with	**1980-85**	**1986-90**	**1991-96**	**1997-99**
Euro area	0.770	0.881	0.911	0.961
United Kingdom	-	-	-	0.896

Note: "-" Data prior to 1997 do not exist.

Table 3 Rank correlations across time

(base period 1997-99)	1980-85	1986-90	1991-96
Euro area	0.956	0.974	0.988
United States	0.892	0.953	0.977

ANNEX 7

WAGE DIFFERENTIALS AND RANKINGS

Table 1 Euro area

Labour compensation per employee Percentage differentials	1980-85	rank	1986-90	rank	1991-96	rank	1997-99	rank	rank[1)]
Agriculture, hunting, forestry and fishing	-53%	20	-49%	20	-48%	20	-50%	20	0
Food products, beverages and tobacco	-13%	15	-11%	14	-10%	14	-10%	13	2
Textiles, textile products, leather and footwear	-41%	19	-36%	19	-34%	19	-32%	19	0
Wood and products of wood and cork	-29%	18	-25%	18	-21%	17	-19%	17	1
Pulp, paper, paper products, printing and publishing	6%	9	9%	9	11%	7	14%	8	1
Chemical, rubber, plastics and fuel products	37%	3	41%	3	42%	3	45%	3	0
Other non-metallic mineral products	-5%	12	0%	11	4%	11	6%	11	1
Basic metals and fabricated metal products	6%	8	10%	8	10%	8	12%	9	-1
Machinery and equipment	18%	6	22%	5	27%	5	32%	5	1
Transport equipment	23%	4	29%	4	35%	4	42%	4	0
Other manufacturing, recycling	-18%	16	-17%	16	-16%	16	-16%	15	1
Electricity, gas and water supply	54%	1	54%	1	63%	1	70%	1	0
Construction	-9%	13	-10%	13	-8%	13	-10%	14	-1
Wholesale and retail trade; repairs	-11%	14	-12%	15	-14%	15	-17%	16	-2
Hotels and restaurants	-20%	17	-21%	17	-25%	18	-28%	18	-1
Transport and storage	14%	7	15%	6	15%	6	14%	7	0
Post and telecommunications	6%	10	3%	10	9%	9	15%	6	4
Financial intermediation	40%	2	51%	2	56%	2	59%	2	0
Real estate, renting and business activities	21%	5	14%	7	8%	10	6%	10	-5
Community, social and personal services	0%	11	-5%	12	-6%	12	-5%	12	-1

1) Change in rank between first and last periods. An increase in rank (+) means that the wage differential in the respective category has increased.

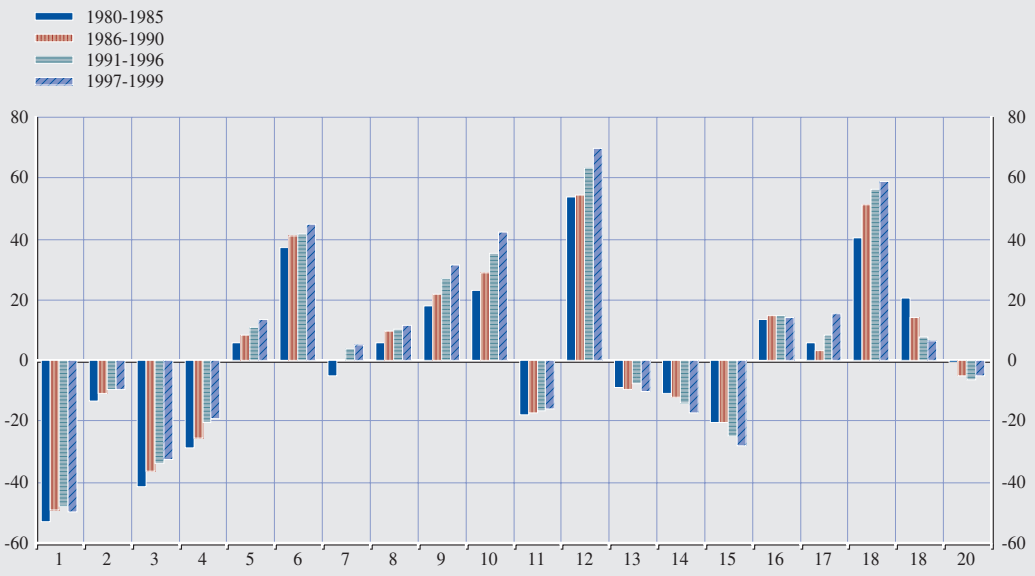
Table 2 United kingdom

Labour compensation per employee Percentage differentials	1980-85	rank	1986-90	rank	1991-96	rank	1997-99	rank	rank
Agriculture, hunting, forestry and fishing	-46%		-32%		-26%		-29%	18	..
Food products, beverages and tobacco	26%		42%		46%		32%	10	..
Textiles, textile products, leather and footwear	-30%		-25%		-17%		-16%	16	..
Wood and products of wood and cork	6%		-3%		-9%		-24%	17	..
Pulp, paper, paper products, printing and publishing	49%		62%		59%		49%	6	..
Chemical, rubber, plastics and fuel products	20%		39%		78%		80%	3	..
Other non-metallic mineral products	4%		17%		39%		39%	8	..
Basic metals and fabricated metal products	13%		17%		29%		28%	11	..
Machinery and equipment	-1%		21%		39%		36%	9	..
Transport equipment	9%		36%		78%		75%	4	..
Other manufacturing, recycling	14%		18%		9%		-10%	15	..
Electricity, gas and water supply	3%		23%		72%		123%	1	..
Construction	-19%		-14%		-5%		-3%	13	..
Wholesale and retail trade; repairs	..		..		-34%		-32%	19	..
Hotels and restaurants	..		..		-48%		-56%	20	..
Transport and storage	..		..		..		50%	5	..
Post and telecommunications	..		..		..		86%	2	..
Financial intermediation	..		..		29%		40%	7	..
Real estate, renting and business activities	..		..		-14%		-10%	14	..
Community, social and personal services	13%		0%		-1%		-3%	12	..

Table 3 United States

Labour compensation per employee Percentage differentials	1980-85	rank	1986-90	rank	1991-96	rank	1997-99	rank	rank
Agriculture, hunting, forestry and fishing	-53%	20	-49%	20	-45%	20	-43%	20	0
Food products, beverages and tobacco	17%	12	13%	12	10%	11	5%	13	-1
Textiles, textile products, leather and footwear	-27%	18	-26%	17	-26%	17	-24%	17	1
Wood and products of wood and cork	-3%	14	-6%	15	-10%	16	-13%	16	-2
Pulp, paper, paper products, printing and publishing	21%	9	22%	10	22%	8	20%	8	1
Chemical, rubber, plastics and fuel products	53%	4	50%	3	53%	4	52%	5	-1
Other non-metallic mineral products	27%	8	25%	9	21%	9	17%	9	-1
Basic metals and fabricated metal products	42%	5	34%	6	31%	7	23%	7	-2
Machinery and equipment	37%	7	41%	5	45%	6	47%	6	1
Transport equipment	79%	1	73%	1	79%	1	65%	3	-2
Manufacturing nec; recycling	-8%	15	-7%	16	-6%	15	-7%	15	0
Electricity, gas and water supply	67%	2	70%	2	73%	2	74%	1	1
Construction	18%	10	14%	11	8%	12	5%	12	-2
Wholesale and retail trade; repairs	-25%	17	-28%	18	-30%	18	-29%	18	-1
Hotels and restaurants	-39%	19	-40%	19	-39%	19	-39%	19	0
Transport and storage	37%	6	25%	8	16%	10	9%	11	-5
Post and telecommunications	58%	3	50%	4	56%	3	59%	4	-1
Financial intermediation	17%	11	31%	7	48%	5	66%	2	9
Real estate, renting and business activities	0%	13	6%	13	6%	13	11%	10	3
Community, social and personal services	-9%	16	-5%	14	-4%	14	-6%	14	2

Chart 1 Wage differentials in the euro area



1 Agriculture, hunting, forestry and fishing
2 Food products, beverages and tobacco
3 Textiles, textile products, leather and footwear
4 Wood and products of wood and cork
5 Pulp, paper, paper products, printing and publishing
6 Chemical, rubber, plastics and fuel products
7 Other non-metallic mineral products
8 Basic metals and fabricated metal products
9 Machinery and equipment
10 Transport equipment
11 Manufacturing nec; recycling
12 Electricity, gas and water supply
13 Construction
14 Wholesale and retail trade; repairs
15 Hotels and restaurants
16 Transport and storage
17 Post and telecommunications
18 Financial intermediation
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