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Wages and employment by level of education and occupation in Belgium

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Abstract - Increased international economic integration and skill-biased technological change are often regarded as the main drivers of the rising inequality in wages and employment witnessed in industrialized countries in recent decades as they are believed to emphasize differences between individuals in level of education. However, proponents of a task-based view of technological change and offshoring stress the evolving content of tasks as the major determinant of shifts in labour demand and argue that this does not necessarily imply a clear-cut match between the level of education and job opportunities. Belgian data from the Structure and Distribution of Earnings Survey for the period 1999-2004 suggest that the level of wages is significantly correlated with the level of education but wage growth is not. Occupation seems to explain a statistically significant part of the wage level as well as wage growth of workers. The analysis supports the view that the level of education provides less information than the occupation of workers in explaining changes in wages and employment. Overall, it appears that a policy that simply aims to increase the level of education of the active population is not warranted. In addition to the risk of over-education, such a policy is not likely to alleviate the mismatch which to some extent exists between the competencies required by employers and the competencies offered by workers and the unemployed.

Jel Classification – I21, J24, J31

Keywords – Wage inequality, returns to education, task-based view

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Executive Summary

In the 1980s and 1990s wage inequality increased dramatically in the United States and the United Kingdom. A number of continental EU countries (e.g. Germany, The Netherlands and Sweden) also witnessed rising inequality - though less pronounced - but in some EU countries inequality hardly changed (e.g. Finland) or even decreased (e.g. France). Data for Belgium indicate that between 1995 and 2006 the gross monthly wages of workers at different levels of education decreased relative to the wages of workers with at most a primary degree. This suggests that, similar to France, wage inequality based on the level of education actually decreased in Belgium. Whereas the evidence on trends in wage inequality across countries is rather mixed, the unemployment rate is substantially larger in all countries for people with low levels of education than for people with higher education degrees.

Globalization (e.g. increased competition from emerging economies) and skill-biased technological change are generally considered to be the main drivers of rising inequality in wages and employment opportunities in industrialized countries as they are believed to emphasize differences between individuals in level of education and ability.

Proponents of a task-based view of technological change and offshoring argue that activities for which information and communication technology (ICT) is used intensively, for which the knowledge involved is codified rather than tacit and for which face-to-face contact is not required, are less bound to a given location as they can be performed anywhere and the output can be easily transferred through ICT networks worldwide. The distinction between different types of tasks cannot be matched straightforwardly with the level of education required to perform them. Whereas low-skilled services occupations like restaurant workers, health aides, cleaners, janitors and hairdressers may have reasonable job opportunities, high-skilled occupations such as physical, mathematical and engineering science professionals and computing and business professionals are seen to be potentially affected by offshoring.

The Structure and Distribution of Earnings Survey contains information on the International Standard Classification of Occupations (ISCO) as well as on the International Standard Classification of Education (ISCED), which permits to analyze to which extent the wages of workers are linked to, respectively, their level of education and their occupation. Estimates for Belgium for the period 1999-2004 suggest that when accounting for statistically significant occupation effects, the marginal return to education (i.e. the increase in wages for an additional degree) increases for low levels of education and decreases for higher levels of education.

Whereas the level of wages is significantly correlated with the level of education over the period 1999-2004, the growth in wages is not. In contrast, occupation can explain part of the variance in wage growth.

Data from the Labour Force Survey at the three-digit ISCO level show substantial variation within two-digit ISCO groups in the evolution of employment for Belgium in the period 1999-2005. For example, chemical-products machine operators (ISCO 822) is the three-digit ISCO group with the strongest increase in total employment share whereas assemblers (ISCO 828) witnessed the second largest decrease in total employment share. Overall, the data on employment show that occupations that do not require a high level of education generally face slimming job opportunities although the data also clearly indicate that an analysis at the two-digit ISCO level – often imposed by data availability - blurs large differences within occupations.

Two occupations that witnessed a decrease in relative wages as well as in their share in total employment, i.e. ship and aircraft controllers and technicians (ISCO 314) and travel attendants and related workers (ISCO 511), appear on an OECD list of occupations considered to be potentially affected by offshoring. However, most occupations on the OECD list do not appear to have witnessed deterioration in their wages or employment so far.

Given that the analysis is based on surveys, the usual caveat with regard to the reliability of this type of data applies. Questions related to income are known to be very sensitive and the issue of representativeness of the sample cannot be solved indisputably. Moreover, the available data only permit to analyze a rather short period (1999-2004 for the analysis of wages and 1999-2005 for the analysis of employment). All results should therefore be considered with caution.

There are some indications that the labour market in Belgium – as also reported for other OECD countries - is being polarized between high-wage occupations at the high end and low-wage occupations at the low end of the skill spectrum. Concurrently, the average level of education increases in most occupations. It is not clear whether this indicates skill upgrading required by macro-economic factors (globalization and skill-biased technological change) that is matched by a policy-induced rise in the overall level of education or whether it suggests over-education, i.e. workers being employed in jobs that do not fully make use of their formal education but who nevertheless crowd out workers with lower education degrees. In addition to some problematic aspects of labour market polarization, the finding that job opportunities cannot be matched to the level of education in a straightforward way clearly complicates government policies that focus on matching labour demand with the supply of skills. A policy that simply aims to raise the average level of education and does not acknowledge that a substantial part of bottleneck vacancies comprises occupations for which relatively little formal education is required does not seem warranted. When considering the mismatch between the requirements of employers and the competencies offered by workers and research that suggests that employers accept experience as a partial substitute to formal education, occupation is arguably more informative than the level of formal education when analyzing the evolution of wages and employment.

Contents

List of tables

List of figures

1. Introduction

Whereas globalization and skill-biased technological change are generally believed to emphasize differences between individuals in level of education, proponents of the task-based view of technological change and offshoring argue that the link between the level of education and job opportunities is not straightforward and that occupation is more relevant. In this paper survey data are used to verify whether the evolution of wages and employment in recent years in Belgium is explained more by the level of education or by occupation. In section 2 some stylized facts are presented on recent trends in wage and earnings inequality and unemployment. Section 3 presents the task-based view of technological change and offshoring which stresses the importance of occupations in explaining job opportunities. Section 4 reports the results of the analysis of the impact of education and occupation on wages and employment in recent years in Belgium. Conclusions are formulated in section 5.

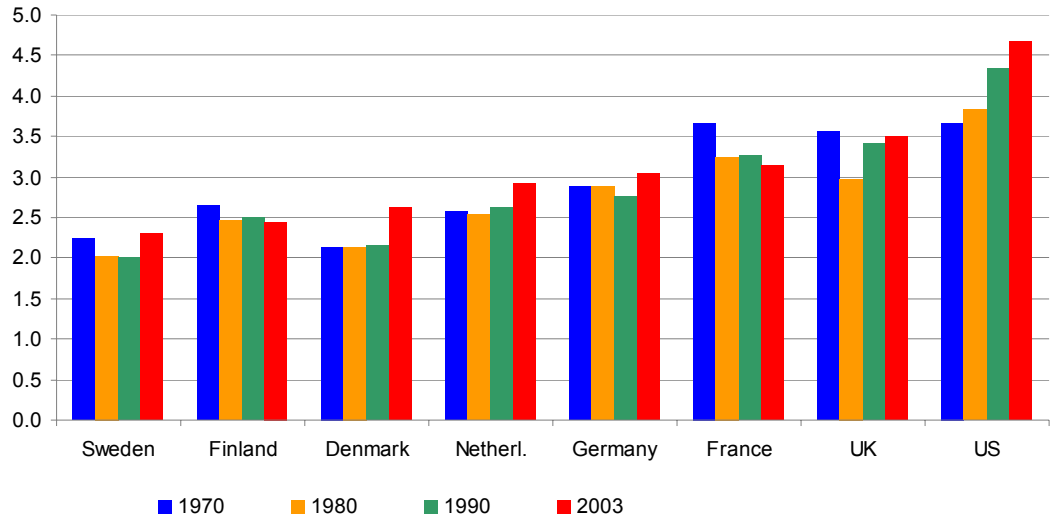
2. Stylized facts

The skill premium (i.e. the wages of high-skilled workers relative to the wages of low-skilled workers) increased dramatically in the United States and the United Kingdom in the 1980s and 1990s. A number of continental EU countries (e.g. Germany, The Netherlands and Sweden) also witnessed rising wage inequality- though less pronounced- but in other EU countries inequality hardly changed, e.g. Finland, or even decreased, e.g. France (Machin and Van Reenen 2007; European Economic Advisory Group 2008).

The diverging pattern in inequality between Anglo-Saxon countries and continental European countries is also reflected in the trend in earnings inequality, defined as the earnings of the ninth decile of the population relative to the earnings of the first decile as shown in figure 1.[1]

In the period 1970-2003, earnings inequality increased most substantially in the United States. Earnings inequality in France - which in the 1970s had the highest inequality of all countries considered - decreased considerably whereas in the United Kingdom it increased from the 1980s onwards. Inequality in other EU countries increased more moderately or even decreased (Finland).

Figure 1 Earnings inequality for a group of EU countries and the US (1970-2003)



Source: Own computations based on Eurostat data reported in European Commission (2005), data kindly provided by Mark Leszczynski (Directorate-General for Employment, Social Affairs and Equal Opportunities). Earnings inequality is defined as the earnings of the ninth decile of the population relative to the earnings of the first decile of the income distribution. These data are apparently not available for Belgium.

[1] The ninth decile earnings level implies that 90% of people earn less than the lower bound and 10% earn more than the upper bound whereas the first decile implies that 90% of the people earn more and only 10% earn less. Earnings inequality concerns the income after taxes and subsidies and therefore also reflects the impact of income distribution due to tax policy. Wage inequality concerns inequality in terms of gross wages and thereby reflects inequality in the direct returns in the labour market without considering the redistribution of tax policy. There are no data on earnings inequality for Belgium in European Commission (2005).

Statistics often only permit to distinguish high-skilled workers from low-skilled workers based on rough approximations such as non-manual/manual, non-production/production or white-collar/blue-collar.

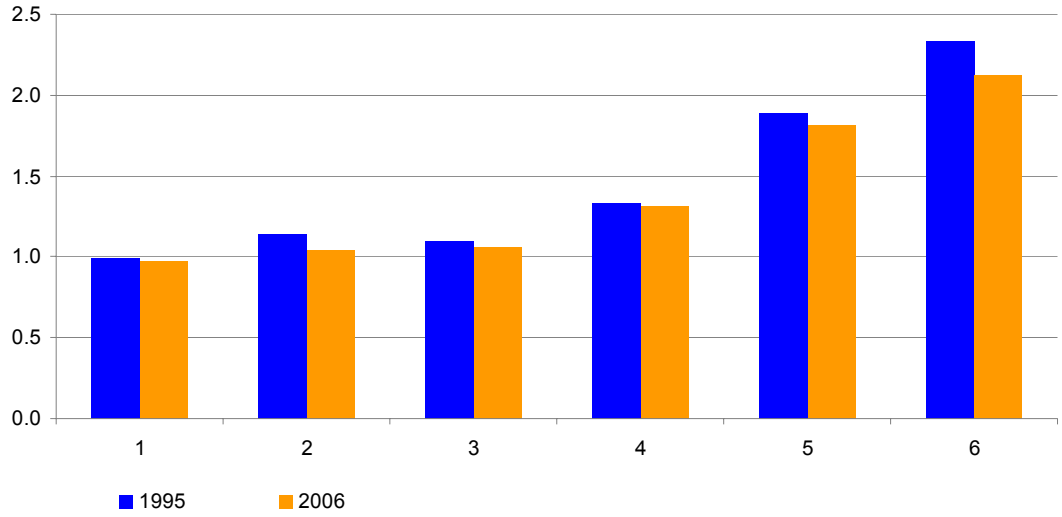
The level of education provides a more refined proxy for skills. The International Standard Classification of Education (ISCED), designed by UNESCO to facilitate the assembling, compiling and international comparison of statistics on education contains six main levels of education from pre-primary education up to the second stage of tertiary education (Table 7 in annex shows the main levels of education of the present ISCED 1997 classification, see UNESCO (1997) for more details).

Returns to education can vary substantially across fields at the same level of education as shown in a small number of studies. Estimates for Canada by Stark (2007) suggest the rate of return[2] of a bachelor's degree in 1996 in non-medical fields to be 9.9% for men and 12.1% for women and 15.1% for men and 15.9% for women in medical fields. The rate of return of a master's degree is smaller (4.1% for men and 8.6% for women in non-medical fields), ranging from -6% in humanities (men) to 23.1% in commerce (women). The rate of return of a Ph.D. is even lower, 1.3% for men and 4.3% for women. Further estimates also suggest great variance in the rate of return within major fields. Estimates for Australia show a high return to education in 1997 for *business and administration* and *engineering* and fairly low returns in *society and culture* and *science* (Borland, 2002).

In figure 2 the change between 1995 and 2006 in the premium to education in Belgium is shown using data on gross monthly wages from the Structure and Distribution of Earnings Survey. The premium is computed as the ratio of the average wages of workers at six different levels of education relative to the wages of workers with at most a primary education degree. Over the period considered, the average wages of the first three groups, i.e. workers having finished lower or upper secondary education, is almost at par with the average wage of workers without a secondary degree. The average wage of workers with a technical-vocational upper secondary degree is slightly higher than the average wage of workers with a general upper secondary degree. Workers with a tertiary education degree on average earn substantially more than workers without such a degree. In 2006 workers with a short term non-university tertiary degree earned 31% more than workers with at most a primary degree. For workers having finished university or long term non-university tertiary education the premium was 81% and for workers with a post-graduate degree the premium was 113%. However, in the period considered the premium to education decreased for all six levels of education.

[2] The rate of return is defined as the so-called internal rate of return that equates the net lifetime discounted private benefit (i.e. lifetime earnings minus the cost of investing in education such as tuition fees) with zero. See Stark (2007) for details.

Figure 2 Premium to education in Belgium (1995-2006)



Note: Own computations based on data from FPS Economy – Directorate General of Statistics, Structure and Distribution of Earnings Survey. The premium to education is computed as the ratio of gross monthly wages of six groups relative to the wages of workers with no or only a primary education degree.
Group 1: Lower secondary degree, groups 2 and 3: Upper secondary education with a general orientation and a technical-vocational orientation respectively, group 4: Short term non-university tertiary degree, group 5: University or long term non-university tertiary education and group 6: Post-graduate degree.

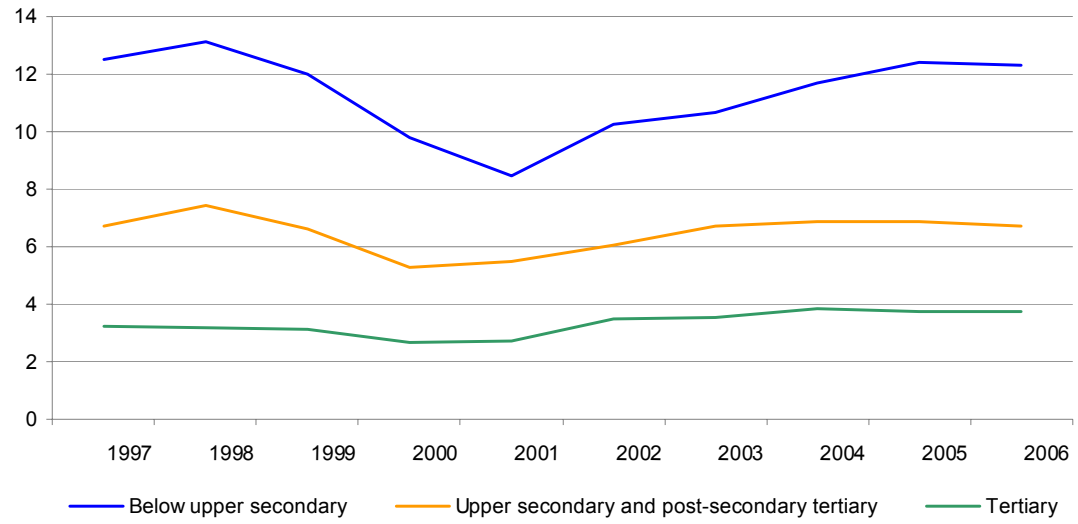
The average gross monthly wages of workers with a post-graduate degree relative to the wages of workers with at most a primary degree actually fell by 9% between 1995 and 2006.

Data on household income also indicate decreased inequality in Belgium in the same period with the Gini coefficient[3] dropping from 0.287 in the mid-1990s to 0.271 in the mid-2000s (OECD 2008 a: data figure 1.2).

Figure 3 shows the change in the unemployment rate by level of education in Belgium between 1997 and 2006. The unemployment rate is clearly higher for people with a low level of education than for people with a high level of education. The unemployment rate of people with a degree below upper secondary decreased from 13.1% in 1998 to 8.5% in 2001 but then started to rise again to 12.3% in 2006, i.e. slightly lower than in 1997. The unemployment rate of people with upper secondary and tertiary degrees was more stable with unemployment of the latter increasing moderately from 3.3% in 1997 to 3.7% in 2006.

[3] The Gini coefficient reflects the income distribution within a given population. It ranges from 0 (perfectly equal distribution) to 1 (perfectly unequal distribution).

Figure 3 Unemployment rate broken down by level of education in Belgium (1997-2006)



Source: Own drawing based on data in OECD (2008 b).

It is often argued that labour market rigidity (e.g. minimum wages, collective bargaining) prevents wages to fall to market-clearing levels in many EU countries, resulting in higher unemployment (e.g. Krugman 2000). Unions, which pre-dominantly represent low-skilled workers, appear to succeed in reducing the skill premium (e.g. Aidt and Tzannatos, 2002; Card et al., 2003). However, as a result some low-skilled workers may be priced out of the labour market may and end up unemployed. If this view holds true, some EU countries will witness an increase in unemployment of low-skilled workers rather than rising wage inequality.

In contrast with the assumption of a clear-cut trade-off between inequality and unemployment, European Commission (2005) found a positive correlation between earnings inequality (D9/D1) and the overall unemployment rate for a group of twenty six European countries and Mourre (2005) argued that there is no compelling empirical evidence of a negative impact of wage compression on total employment.

Correlations for a group of sixteen countries (EU-15 and the US) between the Gini coefficient of income inequality in the mid-2000s and (un-)employment rates in 2006 at different levels of education are reported in table 1. A trade-off between inequality and unemployment implies a negative (positive) correlation between the Gini coefficient and the unemployment (employment) rate. Only for the unemployment rate of people without a secondary education degree is the correlation negative and even in this case the correlation is not statistically significant. From lower secondary education onwards the correlation is positive though never statistically significant. The correlation between the Gini coefficient and the overall unemployment rate (all levels) is also positive (not significant), in line with the finding by European Commission (2005). For the employment rates, the sign is positive (not significant) up to ISCED 3A. The correlation between the Gini coefficient and the employment rate of people with a tertiary degree is negative and statistically significant (only at 10% for type A) which implies that the more unequal income distribution is in the group of EU-15 countries and the US, the lower the employment rate

of people with a tertiary education degree, again in contrast with an inequality-unemployment trade-off.[4]

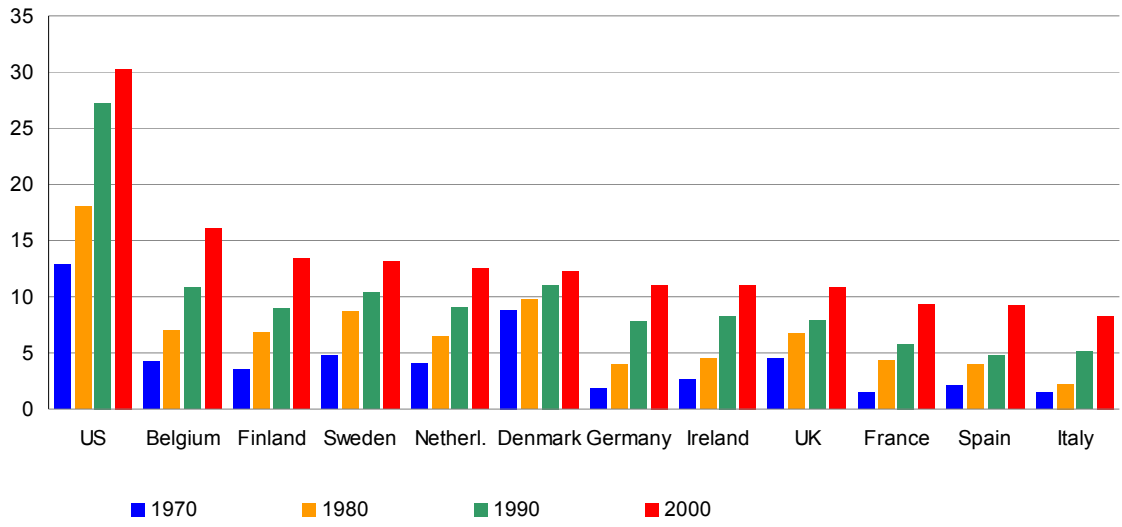
Table 1 Correlation between the Gini coefficient of income inequality (mid-2000s) and (un-) employment rates by level of education (2006) for EU-15 and the US

	Unemployment	Employment
Pre-primary and primary education	-0.20	0.17
Lower secondary education	0.03	0.13
Upper secondary level of education (technical-vocational)	0.29	0.04
Upper secondary level of education (general)	0.09	0.02
Tertiary type B	0.15	-0.61+
Tertiary type A and advanced research programmes	0.15	-0.36*
All levels	0.17	-0.32

Note: Own computations based on data from OECD (2008 a, b).
*: denotes statistically significance at 10 (one-sided) %
+: statistically significance at 1%

Figure 4 shows the strong increase in the percentage of the population with a post-secondary education degree in OECD countries in the period 1970-2000. A rise in the relative supply of highly educated workers reflected in the increase in the average level of education could explain rising skill intensity witnessed in most industries but it cannot explain rising wage inequality or rising unemployment of low-skilled workers. All other things equal, an increase in the relative supply should have resulted in a fall in the relative wage of high-skilled workers.

Figure 4 Percentage of total population older than 25 years with post-secondary education (1970-2000)



Source: Barro and Lee (2000).

[4] As unemployment and inequality are obviously determined by a large number of factors, simple correlations cannot be used to refute convincingly a trade-off between unemployment and inequality unequivocally.

Stylized facts seem to imply an increase in the relative demand for high-skilled workers. International trade competition of low-wage (low-skill abundant) countries and skill-biased technological change - e.g. due to the increased use of information and communication technology (ICT) - are generally considered to explain the shift in relative labour demand in favour of high-skilled workers (see Chusseau, Dumont and Hellier (2008) for a recent survey). The fact that data suggest that wage inequality between different levels of education actually decreased in Belgium and France is in line with an increase in the relative supply of workers with a high education degree but does not necessarily imply that labour demand did not shift in favour of high-skilled workers as in other OECD countries. It could indicate that in these countries the rise in supply outweighed the rise in demand.

3. The task-based view

A number of scholars argue that equating skills to education is oversimplified and may blur substantial labour market inequality within education groups.

Autor, Levy and Murnane (2003) reason that ICT substitutes for workers that perform manual as well as cognitive tasks that can be accomplished by following explicit programmed rules but complements for workers that perform problem-solving and complex communication tasks. Although this still implies that computers and other technical devices generally tend to bias demand in favour of highly educated workers, the distinction is not straightforward. For instance, driving a car or filling a shelf are tasks that are not (yet) sufficiently understood to be codified into software and to be performed by machines. As such they are non-routine tasks though they can be performed by workers without much formal education. Autor and Dorn (2007) report that in the United States some low-skill services occupations (e.g. *restaurant workers, health aides, cleaners, guards and hairdressers*) witnessed rapid employment growth (but modest wage growth) between 1980 and 2005.

In OECD (2005) the offshoring of ICT-intensive occupations is analyzed. Developments in ICT and the liberalization of trade in services have decreased constraints to relocate (services) jobs abroad. Activities for which ICT is used intensively, for which the knowledge involved is codified rather than tacit and face-to-face contact is not required, are less bound to a given location as they can be performed anywhere and the output can be easily transferred through ICT networks worldwide. This implies that apart from some medium- and low-skilled workers (e.g. *office clerks* and *computer associate professionals*) a number of high-skilled occupations are seen to be potentially under threat by offshoring such as *physical, mathematical and engineering science professionals* and *computing and business professionals*. Although no official statistics on the extent of offshoring exist, OECD (2005) asserts that estimates of the number of jobs already lost to offshoring in developed countries are rather small compared to the overall job turnover. However, data on occupational employment suggest that some 20% of total employment in developed countries is a potential target for ICT-enabled offshoring. Whereas this share appears to decrease in Australia, Canada and the U.S., it seems to increase in the EU, consistent with the rising share of services in total employment. Estimates suggest that the share of services jobs that are at risk of ICT-enabled offshoring is lower for Belgium than for other EU15 countries or the U.S. though the share increased between 1993 and 2005 (Michel, 2007).

Blinder (2006) and Baldwin (2006) perceive a new phase in globalization, in which the decrease in communication and coordination costs, resulting from ICT investment, increasingly leads firms to offshore jobs- for a long time considered to be non-tradable (e.g. services jobs)- to low-wage countries. The distinction between tradable and non-tradable jobs does not neatly correspond with a classification by level of education. Blinder (2006) elucidates this by pointing out

that *police officers, janitors* and *crane operators* are probably to a large extent immune to offshoring whereas *accountants, computer programmers* and even highly educated *radiologists* are not.

Egger and Grossman (2005) argue that autonomous decision-making and problem-solving abilities required to perform non-routine tasks, which are not necessarily related to formal levels of education can explain part of inequality within education groups.

Goos and Manning (2007) find that *care assistants, educational assistants, hospital ward assistants* and *actors and entertainers* belonged to the ten occupations with strongest employment growth between 1979 and 1999 in the UK and de Grip and Dijksman (2008) report a substantial decrease in the employment in the Netherlands of managers and executives but strong employment growth of assistant accountants, bookkeepers, health associate professionals, secretaries and sales persons.

The evidence provided by Lemieux (2008) of changes in wages by occupation in the United States for the period 1983-2002 points out that core ICT occupations such as *computer programmers* and *engineers* experienced a decrease in relative wages whereas occupations like *doctors, lawyers, health treatment workers* and *sales persons in finance, insurance and real estate* witnessed the highest growth in relative wages "despite" their relatively weak ICT connection. Lemieux believes that linking the task-based view of technological change to offshoring as proposed by Levy and Murnane (2006) helps to explain some of the surprising results in that the non-routine tasks performed by *computer programmers* and *scientists* may be offshored more easily than some services jobs (*doctors, lawyers, health service workers*, *sales persons* but also *gardeners*).

Becker, Ekholm and Muendler (2007) find no statistically significant impact of offshoring on the share of white-collar and blue-collar workers in the wage bill of German multinational enterprises but they do find that the share of non-routine and interactive tasks increases with offshoring with the largest impact found in the services sector.

The task-based view implies that occupation may be more important than the level of education in explaining changes in relative wages and job opportunities.

4. Wages and employment by education and occupation

The task-based view of technological change and offshoring discussed in the previous section suggests that distinguishing workers in terms of occupations rather than simply in terms of the level of education is probably more appropriate when analyzing labour market trends.

The International Standard Classification of Occupations (ISCO), created by the International Labour Organization (ILO), permits to group workers by occupation with occupation defined as "*a set of jobs whose main tasks and duties are characterised by a high degree of similarity*" and a job defined as "*a set of tasks and duties performed, or meant to be performed, by one person, including for an employer or in self employment*". The basic criteria to define ISCO groups are the skill level and skill specialization required to perform the tasks of the occupations (see table 8 in annex for a list of ISCO groups at the two-digit level and ILO (2007) for a more disaggregated list).

The ISCO classification has been updated recently as the 1988 edition was considered out of date due to technological change, ICT developments and the emergence of new occupational groups. The 2008 version (ISCO-08) merges, splits and moves ISCO-88 groups to better reflect changes in the labour market. In addition, some new categories have been created, e.g. *information and communications technology professionals* and *information and communications technicians* (see ILO (2007) for more details).

4.1. The level of wages

As the data from the Structure and Distribution of Earnings Survey contain the ISCO-88 classification of workers as well as the ISCED level of education, it is possible to discriminate between the impact of education and the impact of occupation on wages. The impact of education and age (experience) on wages is usually estimated with a human capital earnings function as proposed by Mincer (1974), in which the natural logarithm of earnings of individual workers was originally regressed on the number of years of education and the number of years of work experience. In most applications of a Mincer regression schooling and experience are discrete variables due to data limitations (Card, 1999). In this paper the following specification is used:

$$\ln(gross\,wages_i) = \alpha_0 + \beta_1 D_{Female} + \beta_2 Age + \beta_3 Age^2 + \beta_4 ISCED + \beta_5 ISCED^2 + \beta_6 ISCED^3 + \sum_{o=2}^{23} \gamma_o ISCO_o + \varepsilon_i \qquad \varepsilon_i \sim N\left(0, \sigma^2\right) \tag{1}$$

The data from the Structure and Distribution of Earnings Survey are provided on the level of groups of workers rather than on the level of individuals. Some further aggregation has to be adopted to ensure the reliability (availability) of average wages. The level of detail considered is groups of workers of the same gender in the same age cohort and in the same two-digit ISCO occupation. For each group of workers *i*, the natural logarithm of average gross monthly wages

over the period 1999-2004 is used as the dependent variable. The dummy variable D_{Female} which equals 1 for female workers and 0 for male workers is included to estimate the gender bias in earnings. The discrete variable *Age* denotes the age cohort of workers (younger than 30 years = 1; between 30 and 50 years old = 2 and older than 50 years = 3) which accounts for the impact of experience on earnings. In addition to this variable its quadratic term is considered to allow for a possible non-linear relationship (e.g. Mincer, 1974; Trostel, 2005). The variable *ISCED* denotes the ISCED level of education averaged over workers within each group and over the period considered. A quadratic as well as a cubic term are included in line with previous studies (e.g. Trostel, 2005). Finally, in contrast with most previous studies two-digit ISCO dummies are included to estimate the potential effect of occupation on wages.

Table 2 reports the result of an Ordinary Least Squares (OLS) estimation of specification (1). Male corporate managers (ISCO 12) are the benchmark in the regression.

In the period 1999-2004 women in Belgium earned statistically significant less than men, conditional upon age, level of education and occupation. The gender bias ranges from 188 euro less (gross monthly wages) for women with a lower secondary level of education (ISCED 2) younger than 30 years up to 1254 euro less for women with the highest educational degree (ISCED 6) older than 50 years.

The coefficient of the squared term of *Age* is not statistically significant, suggesting a linear relationship between earnings and experience. Including third- and fourth-order terms of *Age* in specification (1) does not result in statistically significant coefficients of any of the higher order terms[5]. This contrasts with evidence of a quartic relationship (i.e. a fourth-order polynomial) found by Murphy and Welch (1990) and Trostel (2005). This could be due to the fact that in our estimation only three age cohorts are included rather than the actual number of years of work experience for which no data are available in the Structure and Distribution of Earnings Survey.

In line with the estimates for twelve countries in the period 1985-1995 reported by Trostel (2005) a third-order polynomial of the level of education (ISCED) provides the best fit. All three coefficients are highly statistically significant. However, the signs are exactly opposite to the signs found by Trostel (2005), suggesting that the marginal rate to education decreases up to a given level of education but then increases again. The different result may be explained by the difference in education variable. Instead of the number of years of schooling used by Trostel (2005) the Structure and Distribution of Earnings Survey contains information on the highest level of education (ISCED) completed.

In figure 5 the results of the wage estimation reported in table 2 are used to show the relationship between the level of education and the wages of different occupations for the three age groups considered. In each age group male workers are distinguished from female workers. The figure maps the average ISCED level of the different ISCO occupations (x-axis) against the

[5] The results of this estimation are not reported but available upon request

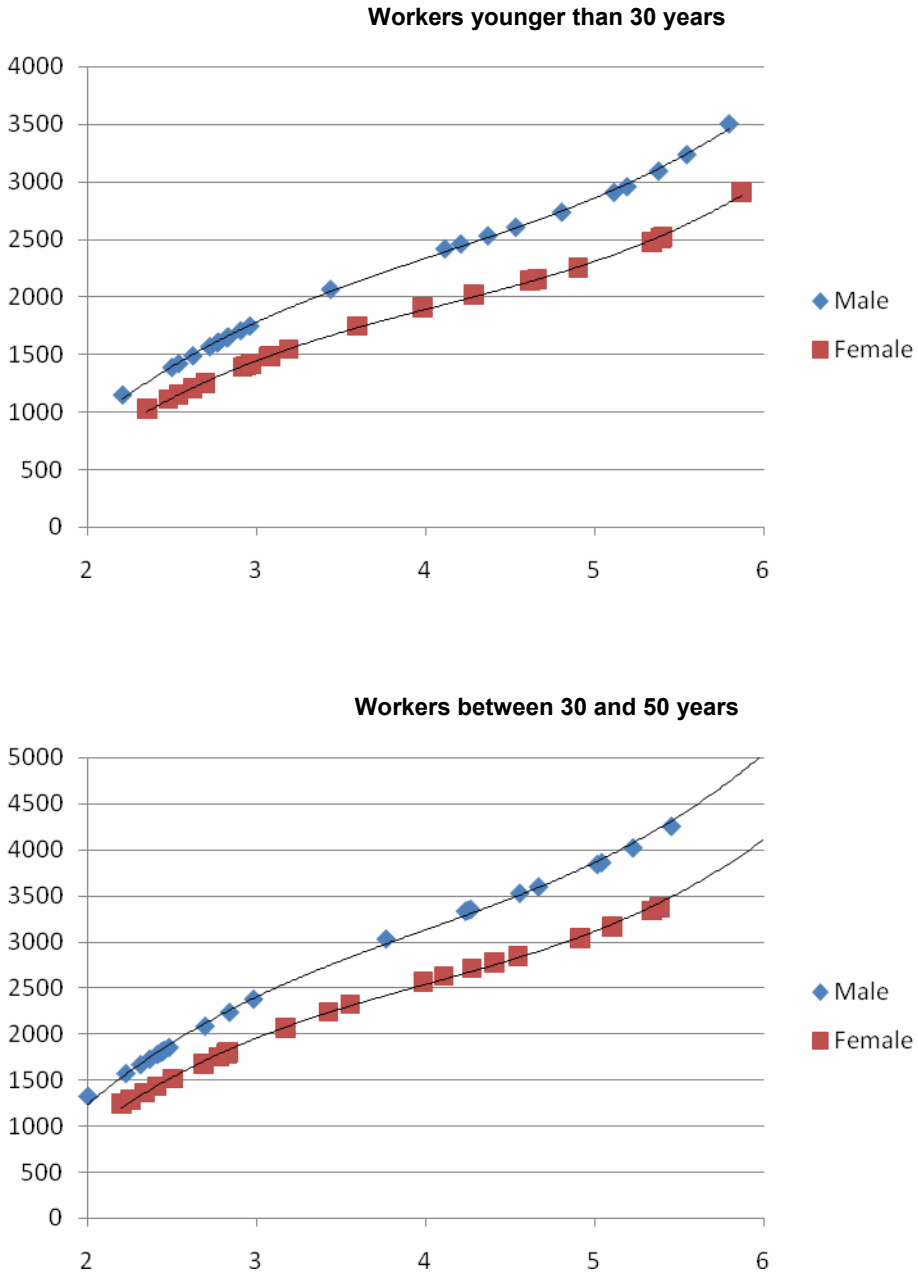
average gross monthly wages in the period 1999-2004 (y-axis). The strong positive link between the level of education and wages is obvious.

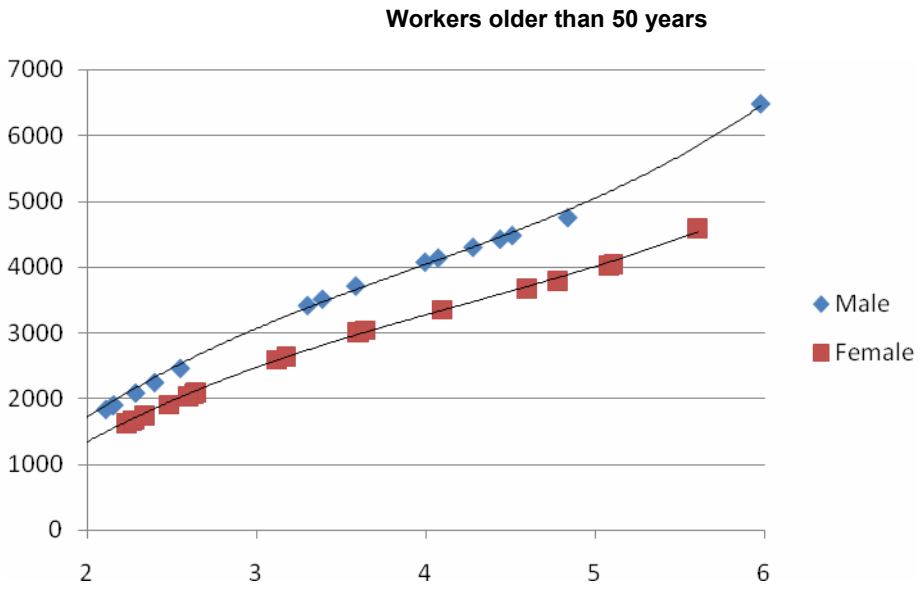
Table 2 Impact of gender, age, education (ISCED) and occupation (ISCO) on gross wages in Belgium (1999-2004)

variable	coefficient	t-value	p-value
INTERCEPT	3.61	6.36	[.00]
FEMALE	-0.21	-12.34	[.00]
AGE	0.37	5.96	[.00]
AGE^2	-0.02	-1.58	[.12]
ISCED	2.26	5.00	[.00]
$ISCED^2$	-0.46	-3.64	[.00]
$ISCED^3$	0.03	3.01	[.00]
ISCO 13	-0.02	-0.26	[.80]
ISCO 21	-0.26	-6.95	[.00]
ISCO 22	-0.42	-4.45	[.00]
ISCO 23	-0.25	-3.92	[.00]
ISCO 24	-0.14	-3.35	[.00]
ISCO 31	-0.24	-3.24	[.00]
ISCO 32	-0.34	-5.50	[.00]
ISCO 33	-0.37	-4.74	[.00]
ISCO 34	-0.23	-3.33	[.00]
ISCO 41	-0.26	-2.89	[.00]
ISCO 42	-0.37	-2.71	[.01]
ISCO 51	-0.28	-1.95	[.05]
ISCO 52	-0.42	-3.39	[.00]
ISCO 71	-0.01	-0.07	[.94]
ISCO 72	-0.13	-0.93	[.36]
ISCO 73	-0.20	-1.41	[.16]
ISCO 74	-0.17	-1.09	[.28]
ISCO 81	-0.03	-0.22	[.83]
ISCO 82	-0.07	-0.50	[.62]
ISCO 83	0.05	0.34	[.74]
ISCO 91	-0.22	-1.27	[.21]
ISCO 93	-0.04	-0.22	[.83]
Adjusted R-squared: 0.94			

Note: The results reported are those of an Ordinary Least Squares (OLS) estimation in which the natural logarithm of the average monthly gross wages of workers over the period 1999-2004 is regressed on a dummy for female workers; a first-order and quadratic term of the age group workers belong to (younger than 30 years, between 30 and 50 years and older than 50 years); a first-order, quadratic and cubic term of the average level of education (ISCED) and dummies of the two-digit ISCO group. See table 7 for a list of ISCED levels and table 8 in annex for a description of the ISCO groups.

Figure 5 **Relationship between the level of education (ISCED) and gross monthly wages by age group (1999-2004)**





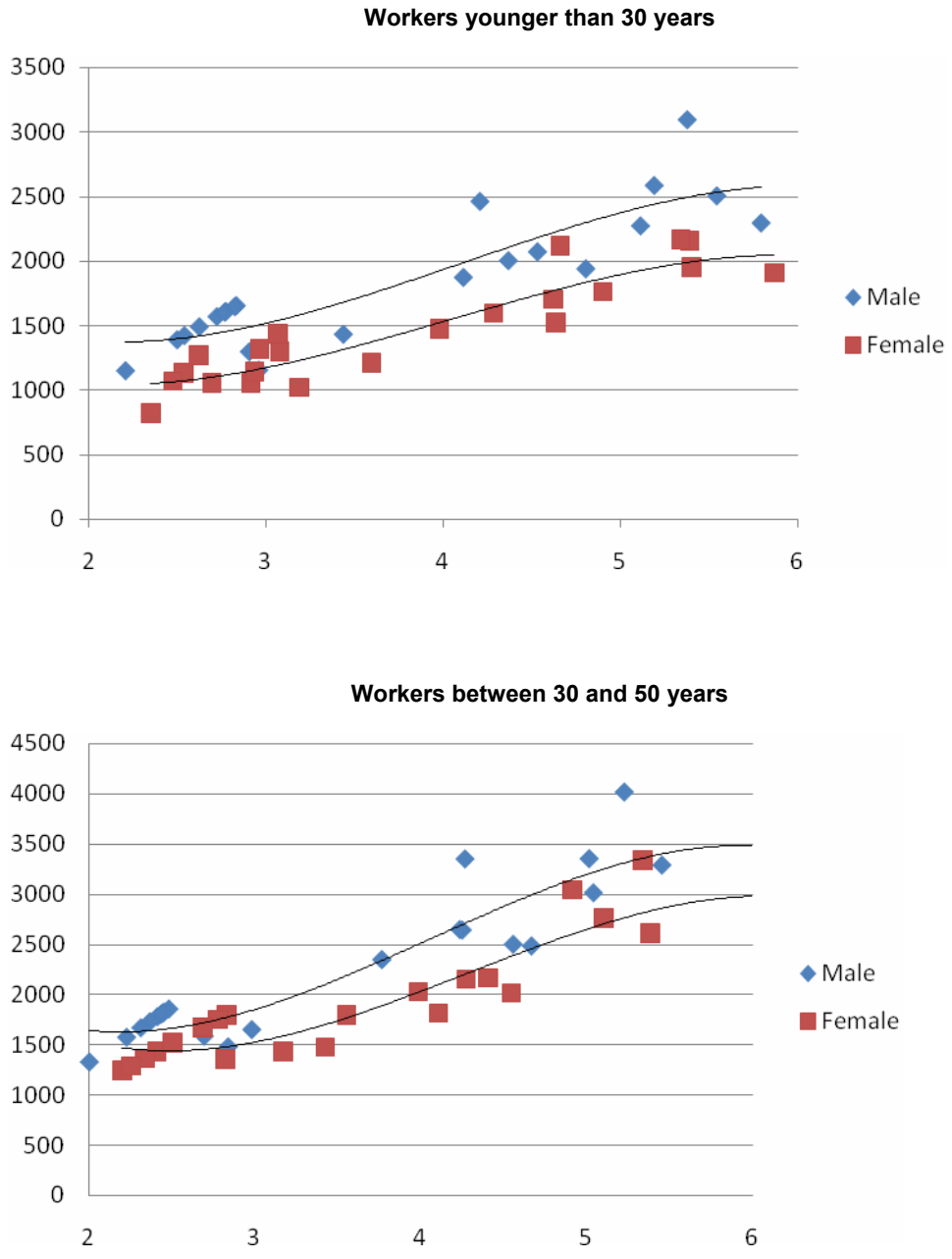
Note: The x-axis shows the average ISCED level of different ISCO occupations and the y-axis the corresponding average gross monthly wages. The wages are not true observations but estimates derived from the regression reported in table 2.

However, as mentioned before, the relationship is not linear and suggests diminishing marginal returns to education between the upper secondary level of education and post-secondary non-tertiary education and increasing marginal returns to education between the first stage of tertiary education (ISCED 5) and the second stage of tertiary education (ISCED 6). Workers with an upper secondary degree (ISCED 3) earn on average 81% more than if they would only have a lower secondary degree (ISCED 2) whereas if they would have a post-secondary non-tertiary degree (ISCED 4) they would earn 33% more. Workers having finished the first stage of tertiary education (ISCED 5) earn 20% more than those with an ISCED level 4 and those with an advanced research qualification (ISCED 6) earn on average 33% more than workers with an ISCED 5 degree.

The coefficients of twelve out of twenty three two-digit ISCO dummies are negative and statistically significant. Somewhat surprisingly they correspond to high- and medium-skilled occupations whereas none of the negative coefficients of the low-skilled occupations is statistically significant. So, conditional on gender, age and the level of education all high-skilled occupations (except managers of small enterprises) but none of the low-skilled occupations earn significantly less than the benchmark of corporate managers (ISCO 12).

The estimates imply that male life science and health professionals (ISCO 22) older than 50 years earn on average 2236 euro less per month (gross) than male corporate managers although they have an average ISCED level of 5.98 (close to the maximum of 6) compared to the average of 4.51 for male corporate managers in the same age cohort. Male physical, mathematical and engineering science professionals (ISCO 21) older than 50 years earn 1075 euro less than the benchmark group despite having an average ISCED level of 4.84.

Figure 6 **Relationship between the level of education (ISCED) and gross monthly wages by age cohort, accounting for statistically significant occupation (ISCO) effects (1999-2004)**



Note: The x-axis shows the average ISCED level of different ISCO occupations and the y-axis the corresponding average gross monthly wages. The wages are not true observations but estimates derived from the regression reported in table 2 in which the statistically significant coefficients of the two-digit ISCO dummy variables have been taken into account.

The impact of occupations on wages is shown graphically in figure 6, which similar to figure 5 maps the average ISCED level of the different ISCO occupations against the average gross monthly wages in the period 1999-2004 but in addition accounts for the coefficients of the two-digit ISCO dummy variables that are found to be statistically significant. Fitting a third-order polynomial now results in a cubic relationship between wages and education with opposite signs to the 'pure' relationship mapped in figure 6. This cubic relationship is in line with the third-order polynomial found by Trostel (2005) with increasing marginal returns to education for low levels of education and decreasing marginal returns for high levels of education.

A possible problem with the OLS estimation of specification (1) is the so-called ability bias, i.e. workers with a high education degree may have chosen higher education because of higher ability with the latter being the main explanation of higher earnings. This will lead to overestimation of the link between education and wages. Studies seem to suggest that the ability bias in OLS estimations is not very large. Moreover, possible solutions such as instrumental variable estimation in which variables that affect education but not ability are included may, in addition to the difficulty of finding valid instruments, also result in biased estimates as pointed out by Card (1999).

Some alternative specifications have been considered to check the robustness of the results reported in table 2.

Specification (1) does not contain information on the industry in which groups of workers are employed. The two-digit OECD industry code is provided in the Structure and Distribution of Earnings Survey but a breakdown by two-digit ISCO code and two-digit OECD code would result

in many empty cells or cells with insufficient observations to provide reliable estimates of wages. Aggregating occupations at the one-digit ISCO level permits to consider groups of workers at the two-digit OECD level. Using these data in specification (1) provides a worse fit (i.e. substantially lower adjusted R-squared and statistically significant Ramsey's RESET test[6]) than the regression with two-digit ISCO dummy variables. These results suggest that data on occupation provides more information on variation in wages of groups of workers than data on the industry to which they belong.

Specification (1) does not account for a possible link between the level of education and occupation. For instance, occupations such as *physical, mathematical and engineering science professionals* (ISCO 21); *life science and health professionals* (ISCO 22) and *teaching professionals* (ISCO 23) clearly imply high levels of education whereas *sales and services elementary occupations* (ISCO 91) and *labourers in mining, construction, manufacturing and transport* (ISCO 93) probably do not. To verify this link, the average ISCED level was interacted with the ISCO dummies and included in specification (1). In this estimation no coefficients of the level of education are significant whereas the coefficients of most ISCO dummies and a number of interaction terms are. However, Ramsey's RESET test is highly significant which suggests that a specification with the interaction terms is not correctly specified. These results should therefore be considered with caution.

A regression in which the yearly gross monthly wages instead of wages averaged over the period 1999-2004 are considered as the dependent variable results in similar estimates although in this estimation all two-digit ISCO dummy variables are statistically significant. However, this specification provides a less accurate fit and Ramsey's RESET is again highly significant.

In most studies a semi-log specification is used to estimate the impact of education on earnings as it is found to provide the best fit (Card, 1999). Using the level of wages rather than the logarithm in estimating specification (1) provides a worse fit.

[6] Ramsey's RESET tests for the absence of relevant nonlinear (mostly quadratic) terms. Statistical significance may indicate misspecification of the functional form but also the omission of relevant variables.

4.2. Wage growth

Proponents of the task-based view argue that occupation rather than the level of education determines the extent to which workers are affected by technological change and offshoring. This implies that although there is a positive correlation between the level of education and the level of wages (i.e. there is a positive return to education), as shown in the previous subsection, occupation may offer a better explanation for recent changes in the level of wages, i.e. wage growth. To test this assumption the relative growth rate (%) of wages over the period 1999-2004 is used as the dependent variable in specification (1) instead of the wage level. The results of this Ordinary Least Squares regression are reported in table 3.

In addition to the variables considered in the estimation with the level of monthly wages, the relative growth rate of the ISCED level over the period considered is included to account for the possible impact of skill upgrading within two-digit ISCO groups.

Not too surprisingly, the right-hand side variables explain a smaller part of the variance in the growth rate of wages than in the level of wages (R-squared of 0.33 compared to the R-squared of 0.94 reported in table 2). In contrast with the wage level regression results, the coefficient of the level of education is not statistically significant at all which seems in line with the relative stability of the premiums to education between 1995 and 2006 shown in figure 2. Apparently, gender did not have a statistically significant impact on wage growth.

The linear as well as the quadratic term of the variable *Age* are significant, with the signs of the coefficients indicating a concave relationship between experience and wage growth in the period 1999-2004.

The coefficient of the variable reflecting skill upgrading within ISCO occupations, i.e. relative growth of the ISCED level over the period considered, is not statistically significant

Estimates based on the Structure and Distribution of Earnings Survey of 1995 imply that 22 up to 24% of Belgian workers were over-educated, i.e. workers having a level of formal education that is higher than the level necessary to perform their job. The data also seem to indicate that experience may compensate for a low education degree and that employers allow competencies acquired through experience to substitute for formal education (Karakaya, Plasman and Rycx, 2007).[7] The statistical insignificance of the education variables and the significance of the age and occupation variables seem to lend support to this view.

[7] Karakaya, Plasman and Rycx (2007) summarize the advantages as well as the substantial limitations of different approaches used to estimate the degree of over-education.

Table 3 Impact of gender, age, education (ISCED) and occupation (ISCO) on wage growth (1999-2004)

variable	coefficient	t-value	p-value
INTERCEPT	0.86	0.02	[.99]
FEMALE	-0.70	-0.40	[.69]
AGE	12.18	2.18	[.03]
AGE^2	-3.62	-2.41	[.02]
AVERAGE ISCED LEVEL	10.11	0.22	[.82]
$(AVERAGE\ ISCED\ LEVEL)^2$	-1.31	-0.10	[.92]
$(AVERAGE\ ISCED\ LEVEL)^3$	-0.04	-0.03	[.97]
GROWTH ISCED LEVEL	0.16	1.47	[.14]
ISCO 13	-9.92	-1.45	[.15]
ISCO 21	-4.20	-1.25	[.21]
ISCO 22	-7.74	-0.84	[.40]
ISCO 23	-19.74	-2.84	[.01]
ISCO 24	-6.35	-1.44	[.15]
ISCO 31	-18.81	-2.20	[.03]
ISCO 32	-14.68	-1.59	[.11]
ISCO 33	-16.36	-0.99	[.32]
ISCO 34	-11.48	-1.48	[.14]
ISCO 41	-13.54	-1.40	[.16]
ISCO 42	-2.66	-0.21	[.83]
ISCO 51	-29.58	-2.16	[.03]
ISCO 52	-8.13	-0.67	[.50]
ISCO 71	-19.43	-1.25	[.21]
ISCO 72	-10.23	-0.75	[.46]
ISCO 73	-11.96	-0.85	[.40]
ISCO 74	-10.77	-0.72	[.47]
ISCO 81	-19.42	-1.35	[.18]
ISCO 82	-15.53	-1.11	[.27]
ISCO 83	-10.42	-0.70	[.49]
ISCO 91	-9.46	-0.58	[.56]
ISCO 93	-7.83	-0.51	[.61]
Adjusted R-squared: 0.33			

Note: The results reported are those of an Ordinary Least Squares (OLS) estimation in which the relative growth rate (%) of monthly gross wages of workers over the period 1999-2004 is regressed on a dummy for female workers; a first-order and a quadratic term of the age cohort workers belong to; a first-order, quadratic and cubic term of the average level of education (ISCED); the growth rate of the average ISCED level over the period considered and dummies of the two-digit ISCO group.

The coefficients of all ISCO dummy variables are negative, indicating that- all other things equal- the benchmark group of *corporate managers* (ISCO 12) further increased their relative wages with respect to all other occupations. However, only three coefficients are statistically significant at 5%. The statistically significant negative coefficient for *physical and engineering science associate professionals* (ISCO 31) seems to corroborate the task-based view as it contains *computer associate professionals* (ISCO 312) listed by OECD (2005) as an occupation that is potentially at risk by off-shoring. The finding is in line with the decrease in relative wages witnessed by *computer programmers* and *engineers* in the United States in the period 1983-2002 as reported by Lemieux (2008). For none of the other ISCO groups listed by OECD (2005) a statistically significant negative impact is found.

The significant negative coefficients for high-skilled *teaching professionals* (ISCO 23) and medium-low-skilled *personal and protective services workers* (ISCO 51) seem at odds with the task-based view as these occupations do generally not perform the kind of routine tasks that can be easily offshored.

As mentioned before, Autor and Dorn (2007) found that in the United States low-skill services occupations such as *personal and protective services workers* witnessed little change in their wages but rather strong growth in employment. On the other hand *transportation ticket and reservation agents*- very close in definition to *travel attendants and related workers* (ISCO 511)- appears on the list of occupations considered to be potentially affected by offshoring in the US (OECD 2005).

The results of the wage growth regression suggest that the level of education has become less relevant to explain differences in wages between workers. Occupation on the other hand offers some explanation for the variation in wage growth, to some extent in line with the task-based view of technological change and offshoring, i.e. some high-skilled occupations being affected by the possible ICT-enhanced relocation abroad.

Falling (rising) wages for a given occupation may be due to a decrease (increase) in demand or an increase (decrease) in supply. For a more elaborated view of labour market opportunities changes in employment need to be taken into account.

4.3. Employment

In section 2 it is argued that wage rigidity may cause unemployment of low-skilled workers if labour unions tie down the skill premium. The deteriorated position in the labour market of certain groups of workers may therefore show in employment and job opportunities rather than in (changes in) relative wages. In this section the evolution of employment in recent years and projections of future employment growth by occupation are analyzed.

The European Centre for the Development of Vocational Training (Cedefop) made forecasts of employment trends by occupation and qualification until 2015 for all EU Member States. The demand for occupations and qualifications is derived from multi-sector macroeconomic employment projections and Labour Force Survey data. A distinction is made between expansion demand which results from future changes in employment levels and replacement demand which results from retirement and labour mobility. The overall shift from manufacturing towards services decreases the demand for workers with skills that are specific to manufacturing (e.g. craft and related workers (ISCO 7)) in favour of workers with skills required in services. In addition to these industry effects, investment in ICT, globalization and other factors may shift demand within industries in favour of specific occupations (technicians and associate professionals (ISCO 3)) at the expense of other occupations (clerks (ISCO 4)). Whereas overall projected job opportunities are most promising for high-skilled workers, strong employment growth is forecasted for low-skilled service workers and shop and market sales workers (ISCO 5) and ele-

mentary occupations (ISCO 9) which seems to corroborate the hypothesis of a polarizing labour market with high job growth at the high-wage end as well as at the low-wage end of the skill spectrum. Another possible concern is over-qualification, suggested by the rising level of education within most occupations which can be explained by higher levels required but also by the strong increase in the supply of workers with higher levels of education (Cedefop, 2007: p. 47).

Country-specific projections are also provided by Cedefop (2007). Table 4 shows the growth rate (%) in employment by occupation projected for the period 2006-2015 at the one-digit ISCO level for Belgium and the EU-25. In the coming years *technicians and associate professionals* and *plant and machine operators and assemblers* are projected to witness a strong increase in employment in Belgium whereas *armed forces*, *skilled agricultural and fishery workers* and *craft and related trades workers* are prognosed to see their employment drop by more than 10%. Negative projected employment growth does not necessarily imply that there are no job opportunities. Except for armed forces, all one-digit ISCO groups are projected to have a positive total of job openings, which sums expansion demand and replacement demand: e.g. for armed forces expansion demand is projected to be -10,000 and replacement demand 7,000 which results in a net total of 3,000 jobs being lost. For craft and related trades workers expansion demand is projected to be -59,000 but as replacement demand is projected to be 129,000 a positive total of job openings of 70,000 is expected for the period 2006-2015, i.e. equal to 17% of the employment level in 2006.

The most remarkable projection for Belgium is undoubtedly that of all occupations, low-skilled plant and machine operators and assemblers are expected to have the highest growth in employment. Although for the EU-25 this ISCO group is also expected to witness positive employment growth, the projected growth rate for Belgium of 26.5% is substantially higher than the EU-25 average of 3%. No explanation for this difference is provided in Cedefop (2007).

Table 4 Projected employment growth by one-digit ISCO occupation for Belgium (2006-2015)

ISCO	Description	Growth (%)	
		Belgium	EU-25
0	Armed forces	-33.5	-3.9
1	Legislators, senior officials and managers	13.5	14.7
2	Professionals	5.4	13.2
3	Technicians and associate professionals	25.7	14.0
4	Clerks	0.1	-5.3
5	Service workers and shop and market sales workers	5.8	8.5
6	Skilled agricultural and fishery workers	-12.6	-21.6
7	Craft and related trades workers	-14.4	-5.0
8	Plant and machine operators and assemblers	26.5	3.0
9	Elementary occupations	4.6	15.5

Note: Data from Cedefop (2007). The last two columns show the projected growth rate in employment over the period 2006-2015 for Belgium and the EU-25 respectively.

Projected employment growth for the period 2006-2015 at the two-digit ISCO level, only provided for the EU-25 as a whole, shows substantial variance within one-digit occupations. For

example, whereas office clerks (ISCO 41) have a projected annual employment growth rate of -1.1%, the annual growth rate for customer services clerks (ISCO 42) is projected to be +1.3%. For elementary occupations projected annual employment growth ranges from -1.3% for agricultural, fishery and related labourers (ISCO 92) to +2% for sales and services elementary occupations (ISCO 91).

According to the Flemish Public Employment and vocational training Service (VDAB) there was a large shortage of people with a vocational or technical secondary degree in the period 2000-2006 in the Flemish Region. Vacancies for which no diploma is required are on the rise whereas few occupations requiring a university degree appear on the list of bottleneck vacancies. Among the persistent bottleneck vacancies are low-skilled occupations such as *cleaners*, *cooks*, *waiters*, *farm-hands* and *heavy truck and lorry drivers* (VDAB 2006, 2007).

As the Labour Force Survey provides data on employment at the three-digit ISCO level, the evolution of employment by occupation in Belgium can be analyzed at a more disaggregated level.[8]

Table 5 reports the twenty ISCO groups that witnessed the highest relative growth (%) in their share in total employment over the period 1999-2005 and table 6 the twenty ISCO groups with the highest relative fall (%) in their employment share. In the last column the share in total employment at the beginning of the period (1999) is given. As the three-digit level is considered these shares are rather low. The very high growth rate in the employment share of some occupations should be considered with these low shares in mind, i.e. a relatively small increase in absolute numbers can result in very high relative growth rates.

The twenty ISCO occupations with the strongest relative employment growth contain six low-skilled occupations: Chemical-products machine operators (ISCO 822); shoe cleaning and other street services elementary occupations (ISCO 912); domestic and related helpers, cleaners and launderers (ISCO 913); industrial robot operators (817); messengers, porters, doorkeepers and related workers (ISCO 915) and miners, shotfirers, stone cutters and carvers (ISCO 711). The strong growth rate of nursing and midwifery associate professionals (ISCO 323) and legal professionals (ISCO 242) is in line with the recent strong growth in employment in the Netherlands of health associate professionals and legal professionals as reported by de Grip and Dijksman (2008).

In contrast with the Structure and Distribution of Earnings Survey data used for the analysis of wages, the Labour Force Survey data also take into account public sector employment (administration, education, health). This is clearly reflected in some of the occupations that rank high in table 5, e.g. nursing and midwifery associate professionals; legislators and senior government

[8] Regressing the growth rate (%) in the share in total employment at the aggregated two-digit ISCO level on the determinants considered in the wage regressions only results in statistically significant coefficients for the two-digit ISCO dummy variables, i.e. age, gender nor the level of education seem to have played a significant role in employment growth in the period 1999-2005. However, there are indications of misspecification so these results should be taken with some caution.

officials; other teaching associate professionals and public service administrative professionals. The strong employment growth of some (private sector) occupations such as domestic and related helpers, cleaners and launderers, can be explained by deliberate government support.

The top twenty of occupations with the highest employment growth contains four three-digit ISCO groups that appear on the OECD (2005) list of being potentially affected by offshoring: Mathematicians, statisticians and related professionals (ISCO 212); other specialist managers (ISCO 123); legal professionals (ISCO 242) and client information clerks (ISCO 422).[9] None of the three-digit ISCO groups on the OECD list of potentially affected occupations appear in the top 20 of occupations with the largest decrease in the relative employment share in the period 1999-2005.

Actually, only six out of fifteen ISCO groups on the OECD list saw their share in total employment decrease, i.e. physicists, chemists and related professionals (ISCO 211); archivists, librarians and related information professionals (ISCO 243); computer associate professionals (ISCO 312); finance and sales associate professionals (ISCO 341); secretaries and keyboard-operating clerks (ISCO 411) and numerical clerks (ISCO 412).

Table 5 The twenty ISCO groups with the highest relative increase in total employment share in Belgium (1999-2005)

ISCO	Description	Growth 1999-2005	Share (%) 1999
822	Chemical-products machine operators	818.71	0.18
323	Nursing and midwifery associate professionals	499.01	0.09
111	Legislators and senior government officials	447.96	0.05
334	Other teaching associate professionals	151.46	0.11
247	Public service administrative professionals	108.97	0.31
912	Shoe cleaning and other street services elementary occupations	104.62	0.00
235	Other teaching professionals	98.55	0.13
212	Mathematicians, statisticians and related professionals	71.55	0.01
413	Material-recording and transport clerks	64.83	0.74
345	Police inspectors and detectives	54.61	0.20
913	Domestic and related helpers, cleaners and launderers	44.97	2.28
315	Safety and quality inspectors	44.52	0.16
123	Other specialist managers	41.69	2.34
817	Industrial robot operators	41.68	0.14
915	Messengers, porters, doorkeepers and related workers	39.65	0.25
242	Legal professionals	36.78	0.57
521	Fashion and other models	35.02	0.06
122	Production and operations managers	32.91	1.27
422	Client information clerks	30.67	0.46
711	Miners, shotfirers, stone cutters and carvers	27.57	0.09

Note: Own computations based on Labour Force Survey data. The last column shows the share in total employment in 1999.

[9] Cedefop (2007) projects an annual growth rate in employment of 1.3% for the period 2006-2015 for customer services clerks (ISCO 42), well above the average of 0.7%. On the other hand, the annual growth rate projected for *office clerks* (ISCO 41) is -1.1%.

Table 6 The twenty ISCO groups with the highest relative decrease in total employment share in Belgium (1999-2005)

ISCO	Description	Growth 1999-2005	Share (%) 1999
813	Glass, ceramics and related plant operators	-70.26	0.01
828	Assemblers	-62.90	1.00
234	Special education teaching professionals	-62.14	0.05
733	Handicraft workers in wood, textile, leather and related materials	-56.20	0.01
744	Pelt, leather and shoemaking trades workers	-51.91	0.08
732	Potters, glass-makers and related trades workers	-50.98	0.17
815	Chemical-processing-plant operators	-50.62	0.23
914	Building caretakers, window and related cleaners	-50.27	2.65
816	Power-production and related plant operators	-48.48	0.06
821	Metal- and mineral-products machine operators	-46.44	0.33
246	Religious professionals	-46.00	0.11
834	Ships' deck crews and related workers	-40.33	0.03
314	Ship and aircraft controllers and technicians	-38.87	0.21
743	Textile, garment and related trades workers	-38.08	0.66
916	Garbage collectors and related labourers	-37.20	0.20
814	Wood-processing- and papermaking-plant operators	-36.36	0.13
344	Customs, tax and related government associate professionals	-34.23	0.08
826	Textile-, fur- and leather-products machine operators	-33.39	0.25
933	Transport labourers and freight handlers	-32.58	3.31
812	Metal-processing plant operators	-31.74	0.15

Note: Own computations based on Labour Force Survey data. The last column shows the share in total employment in 1999.

Sixteen of the twenty occupations with the largest decrease in the total employment share are low-skilled.

Two of the twenty occupations with the strongest decrease in total employment share belong to two-digit ISCO groups for which a significantly negative coefficient is found in the wage growth equation, i.e. special education teaching professionals (ISCO 234) and ship and aircraft controllers and technicians (ISCO 314) whereas travel attendants and related workers (ISCO 511)- with a decrease in total employment share of more than 19%- is a subgroup of ISCO 51, i.e. the third two-digit ISCO group with a statistically significant negative coefficient in the wage growth equation. ISCO 314 and ISCO 511 correspond closely in description to two Current Population Survey (CPS) occupations on the list for the U.S. of occupations potentially affected by outsourcing (see OECD 2005), i.e. Air traffic controllers (CPS 227) and Transportation ticket and reservation agents (CPS 318). Though not in the group of twenty occupations with the highest decrease in employment, another ISCO 31 subgroup which occurs on the OECD list of "offshorable" occupations, i.e. computer associate professionals (ISCO 312), also witnessed a drop in employment in Belgium.

The Labour Force Survey data on the evolution of employment at the three-digit ISCO level reveal substantial variation within two-digit ISCO groups. For example, whereas chemical-products machine operators (ISCO 822) is the three-digit ISCO group with the strongest increase in total employment share over the period 1999-2005, assemblers (ISCO 828) witnessed the sec-

ond largest decrease in total employment share over the same period. Subgroups of ISCO 91- with an annual employment growth rate for the whole EU-25 projected by Cedefop (2007) at 2%- belonged to the twenty occupations with the highest employment growth in the period 1999-2005 (i.e. *shoe cleaning and other street services elementary occupations; domestic and related helpers; cleaners and launderers* and *messengers, porters, doorkeepers and related workers*) as well as to the twenty occupations with the highest decrease in employment share (*building caretakers*; *window and related cleaners* and *garbage collectors and related labourers*). This indicates that even an analysis of wages and job opportunities at the two-digit ISCO level blurs large differences within occupations.

5. Conclusions

Globalization and skill-biased technological change are generally considered to explain a substantial part of rising inequality in labour markets in developed economies as they are perceived to have driven up the returns to education by increasing (decreasing) the demand for high-skilled (low-skilled) workers. The task-based view of technological change and offshoring, proposed recently by a number of scholars, posits that the positive link between workers' level of education and their job opportunities is not clear-cut. Activities that use information and communication technology intensively and for which face-to-face contact is not required can relatively easily be relocated abroad. As a result, a number of high-skilled occupations are considered to be at risk of being offshored rather swiftly.

Data for Belgium from the Structure and Distribution of Earnings Survey show that in the period 1999-2004 gross monthly wages were highly correlated with the level of education. The relationship between wages and the level of education suggests decreasing marginal returns to education up to the first stage of tertiary education and an increasing marginal return between this level of education and the second stage of tertiary education (i.e. mainly Ph.D.). However, occupation seems to add relevant information. All high- and medium-skilled occupations earn significantly less than the benchmark group of male corporate managers, conditional on age, gender and level of education whereas the coefficients for low-skilled occupations are not statistically significant. When taking into account the effects of occupation, the marginal return to education appears, in line with previous estimates, to increase for low levels of education and to decrease for higher levels of education.

In a regression with wage growth rather than the wage level as dependent variable, the coefficients of gender and the level of education are not statistically significant. On the other hand, statistically significant negative coefficients are found for three two-digit International Standard Classification of Occupations (ISCO) groups, i.e. medium-skilled physical and engineering science associate professionals (ISCO 31), high-skilled teaching professionals (ISCO 23) and medium-low-skilled personal and protective services workers (ISCO 51). The negative coefficient of teaching professionals does not seem in line with the task-based view as this occupation implies tasks that do not appear to be easily "offshorable". On the other hand, a three-digit subgroup of ISCO 31 is on the OECD list of occupations considered to be potentially affected by offshoring, i.e. computer associate professionals (ISCO 312).

Data on employment for Belgium in the period 1999-2005 from the Labour Force Survey are provided at the three-digit ISCO level which allows for an analysis at a lower level of aggregation. These data reveal substantial variation within two-digit ISCO groups in terms of the evolution in employment shares.

In line with the claim that job opportunities are not perfectly linked to the level of education of workers, some of the occupations that witnessed the highest growth in their share in total employment are occupations with the lowest average level of education, e.g. *shoe cleaning and other street services elementary occupations*, *domestic and related helpers, cleaners and launderers* and *messenger, porters, doorkeepers and related workers*. A number of occupations that appear on the OECD list of occupations considered as potentially affected by offhsoring are also among the occupations with the strongest growth in employment shares. In Belgium only six of the fifteen occupations on the OECD list experienced a decrease in their share in total employment share over the period 1999-2005.

The occupations with the strongest decline in employment shares are predominantly low-skilled and medium-skilled.

The position of three occupations seems to have deteriorated significantly in recent years in Belgium, both in terms of relative wages and in terms of relative employment: *Special education teaching professionals*, s*hip and aircraft controllers and technicians* and *travel attendants and related workers*. As none of these occupations are considered to be low-skilled, the evidence corroborates the view that there is no clear-cut relationship between the labour market position and the level of education of workers. Moreover, the last two occupations correspond with two occupations on the list for the US of occupations potentially affected by offshoring.

The statistical evidence reported in this paper permits only to verify whether the impact of the level of education and the type of occupation on wages and job opportunities is in line with a task-based view of technological change and offshoring. No causal inference, e.g. that offshoring actually has had an impact on wages and employment, can be drawn from the analysis in this paper. Moreover, it should be kept in mind that job opportunities for occupations result from expansion demand (which may be negative) as well as from replacement demand (e.g. due to retirement).

As the analysis and estimations presented in this paper are based on survey data, the conclusions should be taken with some caution. Mistakes, inconsistencies and misinterpretations were controlled for in the Structure and Distribution of Earnings Survey and the sample appears to be representative of the population of enterprises though with a slight underrepresentation of small units and overrepresentation of large units (STATBEL 2000). However, with survey data the reliability of the answers is always an issue that cannot easily be verified, especially with a sensitive topic like earnings. For some combinations of gender, age, education and occupation few observations are provided which poses a problem of representativeness at the level of aggregation used in the analysis.

The evolution of wages and employment in the future will not necessarily be in line with the trends of the recent past suggested by the analysis of the relative short period for which data are available at present, i.e. 1999-2004 for wages and 1999-2005 for employment.

The data for Belgium seem to be in line with indications reported in some previous studies of the labour market in OECD countries being polarized between high-wage occupations at the high end and low-wage occupations at the low end of the skill spectrum. At the same time the average level of education increases in most occupations. This could be an indication of skill upgrading required by technological and organizational change that is matched by a rising overall level of education but it could also point at over-qualification (over-education), i.e. workers being employed in jobs that do not fully make use of their formal education but who nevertheless crowd out workers with lower education degrees. In addition to some problematic aspects of labour market polarization, the projected strong job opportunities for specific low-skilled occupations and the high variation within occupations clearly complicate government policies that try to match the demand with the supply of skills as a policy that simply aims to raise the average level of education does not seem warranted. Policymakers should acknowledge that a substantial part of bottleneck vacancies apply to occupations for which relatively little formal education is required and that employers may consider competencies acquired by workers through job experience to substitute for formal education.

Overall, the analysis reported in this paper indicates that occupation is probably more informative than the level of formal education in understanding the mismatch between the requirements of employers and the competencies offered by the active population.

6. References

Aidt, T. and Tzannatos, Z. (2002), Unions and Collective Bargaining: Economic Effects in a Global Environment, World Bank, Washington, DC.

Autor, D. and D. Dorn (2007), Inequality and Specialization: The Growth of Low-Skill Service Jobs in the United States, mimeo.

Autor, D.H., Katz, L.F. and M.S. Kearney (2006), 'Measuring and Interpreting Trends in Economic Inequality', *American Economic Review* 96 (2), 189-194.

Autor, D.H., Levy, F. and R.J. Murnane (2003), 'The Skill Content of Recent Technological Change: An Empirical Exploration', *Quarterly Journal of Economics* 118(4), 1279-1334.

Baldwin, R. (2006), *Globalisation: The Great Unbundling(s)*, Economic Council of Finland, Helsinki.

Barro, R. J. and J.-W. Lee (2000), *International Data on Educational Attainment: Updates and Implications*, CID Working Paper No. 42, appendix table A1.

Becker, S.O., Ekholm, K. and M.-A. Muendler (2007), Offshoring and the Onshore Composition of Occupations, Tasks and Skills, mimeo.

Blinder, A.S. (2006), 'Offshoring: The Next Industrial Revolution', *Foreign Affairs* 85(2), 11-28.

Borland, J. (2002), *New Estimates of the Private Rate of Return to University Education in Australia*, Melbourne Institute Working Paper No. 14/02, The University of Melbourne.

Card, D., Lemieux, T., and Riddell, W.C. (2003), *Unionisation and wage inequality: a comparative study of the US, the UK, and Canada*, Working Paper No. 9473, NBER, Cambridge, MA.

Card, D. (1999), The Causal Effect of Education on Earnings, in: Ashenfelter, O. and D. Card (eds.), Handbook of Labor Economics (Volume 3A), Elsevier Science, Amsterdam.

Cedefop (2007), *Future Skill Needs in Europe- Medium-Term Forecast Synthesis Report*, Office for Official Publications of the European Communities, Luxembourg.

Chusseau, N., Dumont, M. and J. Hellier (2008), 'Explaining Rising Inequality: Skill-biased Technical Change and North-South Trade', *Journal of Economic Surveys* 22 (3), 409-457.

Egger, H. and V. Grossmann (2005), 'Non-Routine Tasks, Restructuring of Firms, and Wage Inequality Within and Between Skill-Groups', *Journal of Economics* 86(3), 197-228.

European Commission (2005), *Employment in Europe 2005*, Brussels.

European Economic Advisory Group (2008), *Europe in a Globalised World*, Seventh Report on the European Economy, Ifo Institute for Economic Research, Munich.

Goos, M. and A. Manning (2007), 'Lousy and Lovely Jobs: The Rising Polarization of Work in Britain', *The Review of Economics and Statistics* 89(1), 118-133.

Grip, A. de and S. Dijksman (2008), 'Winnaars en verliezers op de arbeidsmarkt 2000-2005', *Tijdschrift voor Arbeidsvraagstukken* 24(1), 6-15.

International Labour Organization (1990), *International Standard Classification of Occupations (ISCO-88)*, International Labour Office, Geneva.

International Labour Organization (2007), *Meeting of Experts on Labour Statistics*, International Labour Office, Geneva.

Karakaya, G., R. Plasman and F. Rycx (2007), 'Overeducation on the Belgian Labour Market: Evaluation and Analysis of the Explanatory Factors through two types of approaches', *Compare: A Journal of Comparative Education* 37(4), 513-532.

Krugman, P. (2000), 'Technology, Trade and Factor Prices', *Journal of International Economics* 50(1), 51-71.

Lemieux, T. (2008), 'The Changing Nature of Wage Inequality', *Journal of Population Economics* 21, 21-48.

Levy, F. and R.J. Murnane (2006), How Computerized Work and Globalization Shape Human Skill Demands, MIT Working Paper.

Machin, S. and J. Van Reenen (2007), *Changes in Wage Inequality*, Special paper No. 18, Centre for Economic Performance, London.

Michel, B. (2007), *Potential OCT-enabled Offshoring of Service Jobs in Begium*, Working Paper 6-07, Federal Planning Bureau, Brussels.

Mincer, J. (1974), *Schooling, Experience and Earnings*, National Bureau of Economic Research, New York.

Mourre, G. (2005), *Wage compression and employment in Europe: First evidence from the structure of earnings survey 2002*, Economic papers n° 232, Directorate-General for Economic and Financial Affairs, European Commission, Brussels.

Murphy, K. M. and F. Welch (1990), 'Empirical Age-Earnings Profiles', *Journal of Labor Economics* 8(2), 202-229.

OECD (2005), *Potential Offshoring of ICT-Intensive Using Occupations*, Directorate for Science, Technology and Industry, DSTI/ICCP/IE(2004)19/Final, Paris.

OECD (2008 a), Growing Unequal? Income Distribution and Poverty in OECD Countries, Paris.

OECD (2008 b), Education at a Glance 2008: OECD Indicators, Paris.

Stark, A. (2007), Which Fields Pay, Which Fields Don't? An Examination of the Returns to University Education in Canada by Detailed Field of Study, Department of Finance, Canada.

STATBEL (2000), Structure and Distribution of Earnings Survey: Analysis 1995, Statistics Belgium Working Paper.

Trostel, P.A. (2005), 'Nonlinearity in the Return to Education', *Journal of Applied Economics* VII (1), 191-202.

UNESCO (1997), International Standard Classification of Education I S C E D 1997, Montreal.

VDAB (2006, 2007), Analyse Vacatures Knelpuntberoepen, VDAB Studiedienst, Brussel.

7. Annex

Table 7 International Standard Classification of Education (ISCED) 1997 levels of education

	ISCED 1997
6	- Second stage of tertiary education (leading to an advanced research qualification)
5a	- First stage of tertiary education, 1st degree (medium duration)
5b	- First stage of tertiary education (short or medium duration)
4	- Post-secondary, non-tertiary education
3a	- Upper secondary level of education (general)
3b-3c	- Upper secondary level of education (technical-vocational)
2	- Lower secondary level of education
1	- Primary level of education

Source: International Labour Organization (2007).

Table 8 International Standard Classification of Occupations (ISCO-88)

Code (two-digit)	Description
12	Corporate managers
13	Managers of small enterprises
21	Physical, mathematical and engineering science professionals
22	Life science and health professionals
23	Teaching professionals
24	Other professionals
31	Physical and engineering science associate professionals
32	Life science and health associate professionals
33	Teaching associate professionals
34	Other associate professionals
41	Office clerks
42	Customer services clerks
51	Personal and protective services workers
52	Models, salespersons and demonstrators
71	Extraction and building trades workers
72	Metal, machinery and related trades workers
73	Precision, handicraft, craft printing and related trades workers
74	Other craft and related trades workers
81	Stationary plant and related operators
82	Machine operators and assemblers
83	Drivers and mobile plant operators
91	Sales and services elementary occupations
93	Labourers in mining, construction, manufacturing and transport

Source: International Labour Organization (1990).