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by Rebekka Christopoulou [2]

and Theodora Kosma [3]

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## Wage Dynamics Network

This paper contains research conducted within the Wage Dynamics Network (WDN). The WDN is a research network consisting of economists from the European Central Bank (ECB) and the national central banks (NCBs) of the EU countries. The WDN aims at studying in depth the features and sources of wage and labour cost dynamics and their implications for monetary policy. The specific objectives of the network are: i) identifying the sources and features of wage and labour cost dynamics that are most relevant for monetary policy and ii) clarifying the relationship between wages, labour costs and prices both at the firm and macro-economic level.

The WDN is chaired by Frank Smets (ECB). Giuseppe Bertola (Università di Torino) and Julian Messina (Universitat de Girona) act as external consultants and Ana Lamo (ECB) as Secretary.

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The paper is released in order to make the results of WDN research generally available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are the author's own and do not necessarily reflect those of the ESCB.



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*Abstract*

This paper examines changes in the Greek wage distribution over 1995-2002 and the role of skills in these changes using a matched employer-employee data set. This data set enables us to account for firm heterogeneity and obtain a more refined picture of the impact of skills. The methodology adopted is the Machado-Mata decomposition technique, which separates the part of wage changes that is due to changes in the job/employer and employee characteristics from the part due to changes in the returns to these characteristics. Our results indicate that the role of skills has been decisive. The skill return effects in combination with the composition effects of tenure, which are arguably responsive to economic developments and market conditions, have had an important contribution to the changes in the Greek wage distribution. On the other hand, the impact of predetermined demographic changes, as those captured by the age and education composition effects, has been relatively milder.

JEL classification: J31
Keywords: Returns to skill; Wage inequality; Quantile regression

## Non-technical summary

In this paper we examine how the distribution of individuals' wages has changed in Greece, over the period 1995-2002, and what has been the role of skills in these changes. Following topical trends in the literature that point to the importance of other personal characteristics beyond education in shaping wages, we focus on the analysis of a broader dimension of employees' skills. We consider the contribution of education and age-potential labour market experience that enhance ones competence irrespective of the employer and also of tenure that boosts the accumulation of firm-specific human capital.

In our analysis we use a matched employer-employee data set and separate, at each decile of the wage distribution, the part of wage changes that is due to changes in the job/employer and employee characteristics from the part that is due to changes in the returns to these characteristics. Benefiting from the matched employer-employee data set we analyze the contribution of personal skills to changes in the wage distribution controlling for firm characteristics. By accounting for firm heterogeneity we are able to gain a better insight into the impact of worker characteristics.

We find that over 1995-2002 wage inequality increased; more so for men and those at the upper end of the wage distribution. The contribution of the composition and return effects of skills to the evolution of Greek wage dynamics has been important. Of the skill composition effects tenure and education effects have had the most significant impact. The composition effects of tenure are mostly negative and by reducing wages more for those in the lower part of the wage distribution, contribute to the observed pattern of wage inequality. On the hand, the composition effects of education are positive and also contribute to higher wage inequality. This result contradicts standard expectations for a negative relationship between rising education and wage equality and it is possibly the outcome of higher wage dispersion among the high skilled.

Our analysis of the price effects of skills suggests that, even though, they are smaller in magnitude than the respective skill composition effects they have also had an important role in shaping the changes in the Greek wage distribution. The price effects of skills have formed a U-shaped pattern along the wage distribution, which, though not a proof of, can be considered as being broadly in line with the

routinization hypothesis; a variant of the of skill-biased technical change theory. As to the sign of individual price effects, the age price effects are negative while the tenure and education return effects are positive. Interestingly, the U-shaped pattern is more or less sustained for all individual skill price effects. The sign and U-shaped pattern of the age price effects could be regarded as partly reflecting the interaction between institutional changes that are not age neutral and different unobserved ability of employees along the wage distribution.

Our results imply that economic developments have had a significant contribution to the changes in the Greek wage distribution. Indeed, we find that the skill return effects in combination with the composition effects of tenure, which are arguably responsive to economic developments, have had a significant contribution. On the other hand, predetermined demographic changes, as those captured by the composition effects of age and education, have had a relatively milder impact.

## 1. Introduction

Education and job experience are traditionally seen as the most important dimensions of 'skill' for labour market participants. Highly educated and experienced workers have many job opportunities, receive high wages and enjoy good working terms and conditions. Through recent decades a variety of labour market outcomes has been linked to education in countries with different degrees of institutional flexibility. For instance, the rising wage inequalities in the 'Liberal' Anglo-Saxon countries have been attributed to the increased demand for skilled workers. Further, in the less flexible continental European countries, the relative increase in the unemployment of unskilled workers has also been attributed to the increased demand for skills (Krugman 1994; Blanchard and Wolfers 2000).

Since the early 90s, the skill-biased technical change (SBTC) hypothesis has been the prevalent explanation for the growing wage inequalities (Katz and Autor 1999; Acemoglu 2002). Briefly, SBTC assumes that technology biases labour demand in favour of the skilled and against the unskilled. Lately, however, the SBTC has been losing ground over the novel idea of 'routinization'. The 'routinization' hypothesis is a modified version of the SBTC hypothesis that takes the focus away from education and experience and moves it to the type of job content and the degree to which it can be routinized i.e., substituted by machinery and/or computers. It essentially assumes that technology increases demand for both high-skilled and low-skilled workers and decreases the demand for middle-skilled workers, as it replaces human labour mainly in routine tasks typically entailed in middle-skilled jobs (Autor, Levy and Murnane 2003; Autor, Katz and Kearny 2006, 2008; Goos and Manning 2007; Goos, Manning and Salomons 2009). While STBC and the variants of it have dominated Labour Economics a concurrent strand of the literature challenges the idea that technical change is the main driver of wage inequalities. This literature argues that inequalities by skill are mostly driven by non-market, mainly socio-demographic changes and has justly earned itself the title of the 'revisionist' (Card and DiNardo 2002; Lemieux 2006).

Along these research dynamics and since the early 1990s the effect of education on inequality and labour market outcomes in Greece has attracted the attention of researchers. Most of these studies analyse the relationship between skills and pay and

focus mainly on the education dimension of skill (Tsakloglou and Cholezas 2005 give a brief review). The bulk of the research utilizes data from the Greek Household Budget Survey that provide information on consumption expenditures, incomes and socio-economic characteristics of the households and their members. This information has allowed the estimation of the returns to skills in the Greek labour market from the mid-1970s till the late 1990s in Mincer-type wage equations. The available evidence suggests that both overall wage inequality and the returns to education declined between the mid-1970s and the 1980s, but recovered again during the 1990s. This pattern has been attributed to interactions between an expanding educational system, a stagnant demand for educated workers and changing institutional structures.

As in many other countries, the returns to education seem to have evolved differently across the wage distribution; the results are however mixed. In particular, by estimating Mincer wage equations on data from the early 1990s using quantile regressions, Martins and Pereira (2004) find that Greece is the only country out of 16 analyzed that shows higher returns to education at the lower end of the wage distribution. Conversely, Cholezas (2004) examines Greek wages for the years 1974, 1988, 1994 and 1999, and finds that in most cases returns to education follow a U-shaped pattern across the wage distribution.

In this paper we use a newly developed matched employer-employee data set, covering a recent period of time (1995-2002), to examine how the distribution of individuals' wages has changed in Greece and what has been the contribution of skills to these changes. First, following topical trends in the literature that point to the importance of other personal characteristics beyond education in shaping wages, we focus on the analysis of a broader dimension of employees' skills. In particular, we consider the contribution of education and potential labour market experience that enhance ones competence irrespective of the employer and also of tenure that boosts the accumulation of firm-specific human capital.[1] Second, benefiting from the matched employer-employee data set we analyze the contribution of personal skills to changes in the wage distribution controlling for firm characteristics; by accounting for firm heterogeneity we are able to gain a better insight into the 'true' impact of worker

[1] The relationship between wages, labour market experience and tenure has attracted the attention of many studies (e.g. Dustmann and Meghir, 2005).

characteristics.[2] Third, we employ a methodology of counterfactual decomposition, recently developed by Machado & Mata (2005). This methodology moves beyond the simple estimation of returns to skills; it allows us to separate, at each decile of the wage distribution, the part of wage changes that is attributable to compositional changes of individual and workplace characteristics (net composition effects) from the part that is attributable to changes in the returns to these characteristics (net price effects). In interpreting these decomposition results we are able examine the relative importance of economic developments and predetermined compositional changes (e.g. changes in age, educational attainment) in shaping the changes in the wage distribution in Greece. Traditionally, economic developments are assumed to influence returns. However, economic developments can also influence certain employee (i.e. tenure) and workplace characteristics. Given that we can perform the decomposition for the return and composition effects of each skill separately, economic developments can now be related not only to skill return effects but also to skill composition effects (cf. Christopoulou *et. al.* 2010).

We find that over 1995-2002 wage inequality increased; more so for men and those at the upper end of the wage distribution. The decomposition results show that the role of skills has been essential in shaping the changes in the Greek wage distribution. Specifically, the combined impact of the skill price effects and the composition effects of tenure, which are very likely responsive to economic developments, has been significant. [3] On the other hand, predetermined demographic changes as those captured by the composition effects of education and age have had a relatively milder impact.

The paper is structured as follows: Section 2 describes the data and provides a description of the economic environment in Greece the period under investigation. Section 3 provides a descriptive analysis of wage changes, section 4 presents the methodology and section 5 discusses the results. The discussion of the results is given in four stages; we comment on the value added of controlling for employer heterogeneity in section 5.1, in 5.2 we give a general introduction to the decomposition results, in 5.3 we focus on the skill effects, and in 5.4 we isolate the

[2] Arguably, omission of firm variables will lead to unbiased estimates of worker returns only if firm and worker characteristics are uncorrelated; but this is very unlikely to hold in practise (cf. Hamermesh, 2008).

[3] Economic developments are assumed to encompass market conditions, i.e. demand and supply considerations and also changes in the institutional environment.

predetermined skill effects from the part that is induced by economic developments. A final section concludes.

## 2. Data and Timing

The data used in the empirical analysis are obtained from the Greek Structure of Earnings Survey (SES), which is compiled by the National Statistical Service of Greece. The Structure of Earnings Survey was first conducted in 1995 in the EU member states with the aim of compiling a dataset comparable across countries. This dataset would then serve as a useful basis for analysing the progress of economic and social cohesion. The survey was again conducted in 2002 and it has been decided that the survey will be repeated every four years.[4]

The SES contains rich information on the structure and distribution of earnings and characteristics of employers and employees for two years: 1995 and 2002. Therefore, in comparison to household surveys that have been used in the literature to date, the SES has two important advantages. First of all, it avoids the measurement error problems of the household surveys.[5] Further, as already emphasized above, it enables controlling for both workers' and firms' characteristics when estimating wage equations. Its timing is also advantageous: it offers a more recent view of the labour market in comparison to previous studies and it coincides with a period of interesting economic developments. Next, the sample and its timing are discussed in turn.

### *2.1. The sample*

The sample of the Structure of Earning Survey is constructed by three-dimensional stratified random sampling covering firms of more than 10 employees in sectors such as manufacturing, construction and services (NACE C-K). The process of deriving the sample is the following: in the first step a sample of firms from the firm registry is selected, in the second step the sample of the local units belonging to the firms of the first stage is selected, and in the final step a sample of employees

[4] More details on the aim of the Structure of Earning Survey can be found on the website of the National Statistical Service of Greece (www.statistics.gr).
[5] It is widely documented in the literature that household surveys are contaminated with a significant degree of measurement error. The data on wages/income are mostly affected by this measurement error; individuals do not exactly recall their income and pay components or, for various reasons, are not willing to provide accurate information on their income sources.

belonging to the local unit is selected. Before the selection, firms are classified into strata according to region, economic activity (NACE 2-digit) and firm size (defined by the number of employees in the firm).

The data available for the employees contain information on gender, age, the education level completed, tenure with the current employer. The data on job characteristics refer to the type of contract (part-time or full-time, contract of definite or indefinite length), the occupation, and whether the job entails supervisory duties. The data on employer characteristics contain information on the firm size, industry, location, main market in which the product of the firm is sold (regional, national, European or global), and the type of collective agreement enforced in the firm (national, sectoral, or firm level agreement).

The Structure of Earnings Survey also contains detailed information on the gross monthly earning of the employee, the various pay components such as overtime, irregular bonuses, hours worked and overtime hours. From the information provided we create the variable referring to hourly earnings including overtime and regular bonuses, which we use in the econometric analysis. More precisely, we use real hourly earnings (deflated by the Harmonized CPI).

Before the econometric analysis we subject the data to a thorough 'cleaning'. Incomplete or inaccurate observations are unavoidably deleted. Employees with age 15 to 65 are included; employees with earnings below the 1st and above the 99th percentiles are excluded.[6] After the data inspection and cleaning we end up with 38701 observations for 1995 and 41449 for 2002.

Table 1 provides selected information on the final 'clean' version of the sample. Firstly, following the widely-documented worldwide trend, the proportion of female employees has increased. Secondly, the average years of education have increased. Thirdly, average tenure with the same employer has decreased. This might be explained by a series of developments in the Greek economy. Specifically, there has been an increase in the proportion of employees under contracts of definite length.[7]

[6] Our analysis requires a homogeneous sample between the two cross sections. We thus have to account for some differences between the two waves of the SES. For instance, observations for sectors covered only in one wave were deleted.

[7] This is verified by the sample; the proportion of employees not having contracts of indefinite length has increased from around 2% in 1995 to 8.8% in 2002. Given the limited variability in the variable that captures alternative contract types in the 1995 wave we do not control for contract types in our regression analysis.

Also there has been an increase in newcomers in the labour force, possibly driven by the increase in the working age population. This development is also observed in our sample, as the proportion of young workers increases in the 2002 wave. Moreover, there has been a process of integrating immigrants in the Greek labour market (the SES has also started including them in the sample).[8,9]

Table 1: Sample characteristics

| Employee characteristics | | 1995 | 2002 | Change |
|---|---|---|---|---|
| Female (%) | | 31.70 | 37.36 | 5.66 |
| Years of education (average) | | 10.57 | 11.49 | 0.92 |
| Years of tenure (average) | | 10.08 | 8.26 | -1.82 |
| Age: | 15-24 years (%) | 5.92 | 7.30 | 1.38 |
| | 25-34 years (%) | 29.95 | 32.97 | 3.02 |
| | 35-44 years (%) | 34.09 | 30.26 | -3.83 |
| | 45-64 years (%) | 30.01 | 29.44 | -0.57 |
| Employer characteristics | | | | |
| Private ownership (%) | | 69.61 | 83.50 | 13.89 |
| Firm size: | 10-19 employees (%) | 9.74 | 12.35 | 2.61 |
| | 20-49 employees (%) | 21.90 | 16.71 | -5.19 |
| | 50-99 employees (%) | 21.17 | 10.88 | -10.29 |
| | >100 employees (%) | 47.19 | 60.05 | 12.86 |
| Manufacturing sector (%) | | 48.30 | 36.13 | -12.17 |

Note: % refers to % of employees in the sample.

Immigrant workers are likely to have more job mobility and also work under contracts of definite length.

There are some changes in firm characteristics that are also worth mentioning. The proportion of employees working in the private sector has increased, and so has

[8] For a detailed analysis of Greek labour market developments between 1995 and 1999 see Sabethai (2000).
[9] Controls for immigrant status are not included in our analysis due to insufficient data especially in the 1995 wave.

the proportion of employees working in bigger firms (with more than 100 employees). The former fact may be related to the process of privatizations. Finally, the manufacturing employment seems to have followed a decreasing trend the period under investigation.

*2.2. The timing: an overview of the Greek economy between 1995-2002*

Table 2 below presents various indicators that provide a general picture of the economic environment in Greece over the period 1995-2002. This period was a special period for Greece as it coincided with the years preceding the euro adoption and the need to fulfil the accession criteria. As one can see in the table, Greece 'delivered' in terms of macroeconomic performance; it experienced a high and increasing GDP growth rate (at the same time that the growth rate in two of the EU's core countries, Germany and France, as well as in the US was low and decreasing). Following the requirement for the euro adoption, inflation was also significantly reduced, with the increase in the unemployment rate being a possible consequence of policies aiming at this reduction.

In addition, the period 1995-2002 was also characterised by significant demographic, macroeconomic and institutional changes - some country-specific and some common across advanced countries. For the demographic developments, we have already gotten a flavour from the description of the sample characteristics. The Greek labour market has experienced an increase in female labour force participation, like the majority of the OECD countries. Additionally, the inflow of immigrants has also increased substantially.[10]

[10] This is documented in detail by Zografakis, Kontis and Mitrakos (2009).

Table 2: Macroeconomic background, demographics, and market regulation

| | 1995 | 2002 | Change |
|---|---|---|---|
| Real GDP growth (2000 constant prices) | 2.1 | 3.9 | 1.8 |
| Unemployment rate | 9 | 10.3 | 1.3 |
| Inflation rate | 9.8 | 3.7 | -6.1 |
| Proportion of foreign population | 2.8 (1998) | 4.1 | 1.3 |
| Female labour force participation | 44.3 | 50.1 | 5.8 |
| Population share of 15-24 year-olds | 20.4 | 19.3 | -1.1 |
| Population share of 25-49 year-olds | 51.3 | 54.4 | 3.1 |
| Population share of 50-64 year-olds | 28.3 | 26.3 | -2 |
| Trade in goods and services to GDP | 18.8 | 23.3 | 4.5 |
| Share of ICT investment in total gross fixed capital formation | 10 | 11.5 | 1.5 |
| Minimum relative to median wages of full-time workers | 0.53 | 0.46 | -0.07 |
| Strictness of employment protection legislation (range 0-6) | 3.5 | 3.5 | 0 |
| Overall product market regulation (range 0-4) | 2.8 (1998) | 2 | -0.8 |

Source: OECD Statistics

At the same time, as indicated by the measures of investment in Information and Communication Technologies (ICT), technical change was gradually transforming parts of the production process; openness was also increasing as the evolution of the ratio of trade-to-GDP shows. Coming now to institutional flexibility, there are indications that product market regulation was decreasing.[11] Employment protection legislation, on the other hand, seems to have been unchanged the period under investigation. However, despite the unchanged employment protection legislation index and the fact that the Greek system of wage bargaining is still considered to be broadly regulated (for more details see DuCaju *et.al.* 2008) the Greek labour markets were also becoming more flexible. [12] This flexibility involved the introduction of flexible working time arrangements (i.e. part-time jobs) and more flexible types of

[11] The product market regulation indicator presented in Table 2 captures mainly barriers to entry. For a detailed description of its construction see Conway et. al (2005).

[12] The perceptions and experiences of market participants may also be indicative of the 'effective' degree of employment protection the period under investigation. Specifically, evidence from EU ad hoc surveys conducted in 1999, indicates that firms do not consider the Greek labour markets to be as inflexible as they may initially seem. More precisely, Greek firms in the industry do not consider regulation as an obstacle for adjusting employment and production during demand fluctuations (for a detailed description see Sabethai, 2000 and references therein).

employment contracts such as contracts of definite length, contracts for the provision of specific services and for carrying out a specific task (for a more detailed analysis see Sabethai, 2000). [13]

Overall, the period under investigation is a period of significant economic, institutional and demographic developments. We now proceed to analyse whether the distribution of wages has changed in Greece over 1995-2002 and which are the factors that have mostly contributed to these changes.

## 3. Observed wage changes

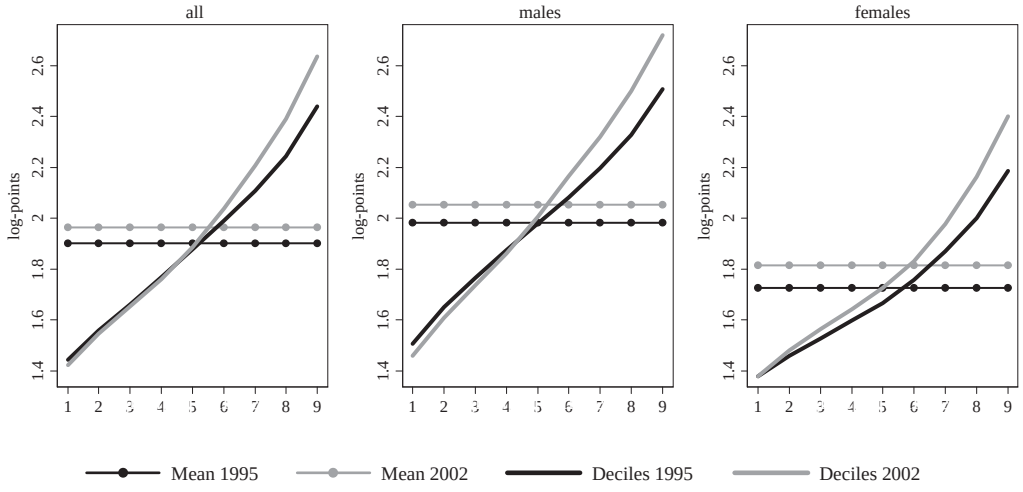
The direction, magnitude and nature of wage changes between the two sample waves is roughly indicated by changes in the measures of mean and standard deviation, which amount to 0.052 and 0.087 log points respectively, when taking men and women together. These numbers reflect a pattern of slow and asymmetrical wage movement. Still, it says little if not compared with similar changes in other countries. Christopoulou, Jimeno and Lamo (2010) provide a comparison of the two measures between Greece and eight other EU countries, for which comparable SES data is available. They show that putting Ireland's and Hungary's impressive wage growth aside, Greece's average wage change is well in line with the experiences of the other European countries. The change in the standard deviation of hourly wage, though, stands out. After Germany, Greece is the second country in the group with the biggest increase in wage dispersion (for more details see Christopoulou, Jimeno and Lamo, 2010, Table A1, p. 32).

Figure 1 and Table 3 describe the shift in the Greek wage distribution in detail, serving to reveal a very interesting picture. In the aggregate sample, real hourly wages have remained more or less constant up to the 5th decile of the distribution and have monotonically increased thereafter.

[13] Undoubtedly, labour market outcomes are not exogenous to economic developments, such as increased trade openness and product market deregulation; thus the structure of labour market institutions may evolve further in the coming years. In particular, the literature predicts that competition from low cost producers and product markets deregulation may indirectly have an impact on trade unions' power and employment regulations (for a discussion on the effects of product market regulation see Fiori et. al. 2008).

In other words, the moderate increase in mean wages has not been shared equally among employees, but rather those at the upper part of the wage distribution (high wage workers) have become better off while the wages of those at the lower part of the distribution have not increased as much. As a result wage inequality has increased and this can be attributed to increasing upper tail inequality; on the other hand, lower tail inequality has not increased as much (Table 3). Christopoulou, Jimeno and Lamo (2010) show that Germany and the Netherlands have experienced comparable increases in overall wage inequality; however, in these two countries inequality has increased more for those at the lower end of the wage distribution. In fact, the Greek experience appears to be similar to that of the US and the UK, over the same eight year period (Autor, Katz and Kearny 2006; Autor *et. al.* 2008 and Machin and Van Reenen 2007).

Figure 1: Real hourly wages by decile




When disaggregating the sample by gender, the picture becomes slightly different. Specifically, the wage movement is still concentrated at the upper part of the distribution both for men and women. For men, however, at the bottom of the distribution one can clearly see some wage falls, which wear out when moving towards the middle, switching to wage increases after the 5th decile (see Figure 1). In contrast, the wages of women have not decreased at all. Instead, starting from a low relative wage level in 1995, women have been catching up, experiencing wage

increases from the 2nd decile of the distribution onwards. As a result, the overall increase in wage inequality has been larger for men (see Table 3).

These different experiences motivate our choice to analyse wage changes both for the full sample (pooled regressions) and separately by gender. In the first case we assume that returns to characteristics are the same for both men and women and there are only intercept differences captured by a gender dummy. In the second case we allow for full heterogeneity in wage determination by estimating separate regressions for males and females.

Table 3: Key indicators of the wage distribution

| | | Std. Dev | Median | P90/P10 | P50/P10 | P90/P50 | Gini coef. |
|---|---|---|---|---|---|---|---|
| All | 1995 | 0.38 | 1.88 | 1.69 | 1.30 | 1.30 | 0.22 |
| | 2002 | 0.47 | 1.89 | 1.85 | 1.33 | 1.40 | 0.27 |
| | Change | 0.09 | 0.01 | 0.16 | 0.02 | 0.10 | 0.05 |
| Males | 1995 | 0.38 | 1.98 | 1.67 | 1.32 | 1.27 | 0.22 |
| | 2002 | 0.48 | 2.01 | 1.86 | 1.37 | 1.36 | 0.28 |
| | Change | 0.10 | 0.03 | 0.20 | 0.06 | 0.09 | 0.06 |
| Females | 1995 | 0.32 | 1.67 | 1.59 | 1.21 | 1.31 | 0.19 |
| | 2002 | 0.41 | 1.73 | 1.74 | 1.25 | 1.39 | 0.24 |
| | Change | 0.09 | 0.06 | 0.15 | 0.04 | 0.08 | 0.05 |

## 4. The Methodology

The analysis relies on the estimation of extended Mincer equations for log (real) hourly wages at different deciles of the wage distribution for each year t, using the quantile regressions method:

$$\ln w_{it}^{\vartheta} = a_t^{\vartheta} + \sum_j \beta_{jt}^{\vartheta} X_{jit}^{\vartheta} + \varepsilon_{it}^{\vartheta}, \qquad with\ Q_{\vartheta}(\ln w \mid X) = \beta^{\vartheta} X^{\vartheta}$$

where $w_i$ represents the wage of individual $i$, $X$ is the vector of observable labour market characteristics, $a^{\partial}$ is a constant, and $\beta^{\vartheta}$ is the vector of parameters. $Q_{\vartheta}(lnw|X)$ denotes the $\vartheta th$ conditional quantile of $lnw$ given $X$. $\varepsilon$ is the stochastic error. Given these estimates, we decompose the change between the 1995 and 2002 log wage

distributions into a part that is due to changes in labour market characteristics and a part that is due to changes in the returns to these characteristics. The decomposition by decile is performed using the quantile decomposition approach recently developed by Machado and Mata (2005). [14] This decomposition method can be considered as a generalization of the Oaxaca and Blinder (1973) technique; the latter by focusing exclusively on the mean of the wage distribution could not be informative in the analysis of wage inequality. The decomposition is performed on the basis of the following idea. Two counterfactual densities are estimated: (i) the wage density corresponding to the 1995 distribution of characteristics with returns held constant at 2002 levels, and (ii) the wage density corresponding to the 2002 distribution of characteristics with returns held constant at 1995 levels.

The linearity of the quantile regression implies:

$$\ln w_{02}^{\vartheta} - \ln w_{95}^{\vartheta} = \left(a_{02}^{\vartheta} - a_{95}^{\vartheta}\right) + \sum_{j} \beta_{j02}^{\vartheta}\left(\overline{X}_{j02}^{\vartheta} - \overline{X}_{j95}^{\vartheta}\right) + \sum_{j}\left(\beta_{j02}^{\vartheta} - \beta_{j95}^{\vartheta}\right)\overline{X}_{j95}^{\vartheta} + \left(\bar{\varepsilon}_{02}^{\vartheta} - \bar{\varepsilon}_{95}^{\vartheta}\right)$$

where $w_t^{\vartheta}$ is the $\vartheta th$ decile of the wage distribution in year $t$, $\overline{X}_{jt}^{\vartheta}$ is the vector of mean characteristics of decile $\vartheta$ at year $t$, and $\bar{\varepsilon}_t^{\vartheta}$ is the mean of the unobserved component.

We carry out the computation of mean characteristics by decile according to the adaptation of the Machado-Mata bootstrap method by Albrecht, Bjorklund and Vroman (2003). To describe it in simple terms, for each year, we draw a random sub-sample of 100 observations (i.e. individuals) from the whole sample. We sort the observations of the sub-sample by hourly pay and obtain the resulting decile values of the variables of interest. We repeat these steps 500 times, obtaining 500 values per

[14] Various methodologies have been developed to analyze changes in the distribution of wages. One methodology that has been widely used in the literature is the one developed by DiNardo *et.al* (1996). This technique, however, does not explicitly model the role of prices (see Autor *et. al* 2005). The Machado and Mata methodology by being parametric can decompose the changes in the wage distribution into the part that is due to changes in the distribution of covariates and the part that is due to changes in the coefficients (for a discussion see Machado and Mata, 2005). Another quantile based decomposition technique, which is in the spirit of the Machado and Mata methodology, has recently been developed by Melly (2005 and 2006). This technique is numerically identical to that of Machado and Mata as the number of simulations goes to infinity (see Melly, 2006). It is a useful alternative to the Machado Mata method if one is interested in analysing the changes in the distribution of wages that are also due to changes in the residuals. The latter effects are, though, beyond the scope of the present study.

variable in each decile. We then calculate the average of these 500 values in each decile, ending up with 10 values per variable (i.e. one for each decile).

Once the mean characteristics have been calculated, the wage changes by decile over the period 1995-2002 are decomposed as follows: $\left(a_{02}^{\vartheta} - a_{95}^{\vartheta}\right)$ is due to changes in unobserved features common among employees and due to changes in the reference categories (dummies); $\sum_j \beta_{j02}^{\vartheta}\left(\overline{X}_{j02}^{\vartheta} - \overline{X}_{j95}^{\vartheta}\right)$ is due to changes in (employer or employee) observable characteristics net of any price effects (composition effect); $\sum_j \left(\beta_{j02}^{\vartheta} - \beta_{j95}^{\vartheta}\right)\overline{X}_{j95}^{\vartheta}$ is due to changes in the returns to (employer or employee) characteristics net of any composition effects (price effects); and $\left(\overline{\varepsilon}_{02}^{\vartheta} - \overline{\varepsilon}_{95}^{\vartheta}\right)$ is due to changes in the remaining unobserved component.

Customarily in the empirical analysis of Mincer equations X only includes variables representing individual/employee characteristics (i.e. educational level, age, age squared, tenure, tenure squared, a constant, and a gender dummy). An important reason for this is that the arrival of matched employer-employee datasets has been relatively recent. In a sweeping review of the international literature, Abowd and Kramarz (1999) note that virtually all papers using matched employer-employee data appeared after the late 1990s and, in their majority, the databases used have been European. Taking advantage of the information available in the Greek Structure of Earnings Survey we introduce variables that control for job and employer characteristics when analyzing the contribution of skills to changes in the wage distribution.

## 5. Results

In this section we first estimate Mincer equations in two alternative specifications; one including only employee characteristics -specification 1- and one including employee as well as employer and job characteristics - specification 2 - (subscripts *t* and *i* are suppressed for simplicity):

$$\ln w^{\vartheta} = a^{\vartheta} + \sum_j \beta_j^{\vartheta} X_j^{\vartheta} + \varepsilon^{\vartheta} \qquad (1)$$

$$\ln w^{\vartheta} = a^{\vartheta} + \sum_{j} \beta_{j}^{\vartheta} X_{j}^{\vartheta} + \sum_{\kappa} \beta_{\kappa}^{\vartheta} X_{\kappa}^{\vartheta} + \varepsilon^{\vartheta} \quad (2)$$

*j* now indicates individual characteristics and *k* employer or job characteristics.[15] We perform this exercise in order to compare the results of the two specifications and examine to what extent our understanding of the sources of earnings variations is refined when we control for both worker and workplace heterogeneity as opposed to controlling for worker heterogeneity only. We next continue with the analysis and the interpretation of the detailed decomposition results. These decomposition results are based on the estimation of our preferred specification, the extended specification 2 that accounts for firm heterogeneity.

### *5.1. The added value of controlling for employer heterogeneity*

Regressions using worker-based datasets typically explain about 30% of wage variation. This is also the case for the Greek results derived from Household Budget Survey data (see for instance Table 7 in Tsakloglou and Cholezas (2005)). With this as a benchmark, Table 4 presents the estimated $R^2$ values corresponding to our OLS estimations from the SES database by specification, year, and gender-group. Markedly, regressions using only individual characteristics explain 40-53% of wage variation, which is already a significant improvement in explanatory power. However, the incorporation of controls for employer/job characteristics increases the proportion explained even further, to as much as 63%. A similar pattern appears when looking at the residual standard deviation (RSD), the classic measure of within-group wage inequality a la Juhn, Murphy, and Pierce (1991, 1993), which is also reported in Table 4. Within-group or 'unexplained' wage inequality appears larger for specification 1 than for specification 2 for all years and samples.

At the same time, the inclusion of employer characteristics also alters the wage effects of the key worker characteristics. For example, if one looks at the estimated OLS coefficients (Table A1 in the Appendix), while specification 1 suggests that the return to 1 additional year of education is about 3.3% in 1995 this falls to 1.7% once

[15] The variables used to capture individual characteristics are: years of education, tenure in years, tenure squared, age dummies, dummy for gender, dummy for vocational degree. The variables used to capture the respective employer and job characteristics are: sector dummies (2-digit NACE), occupational dummies (1-digit ISCO), size dummies, dummy for private ownership, dummies for the main market for the firms' products, regional dummies, and dummies for collective agreements.

the regression is estimated using information on both employers and employees in specification 2.

Table 4: Estimated $R^2$-adjusted and RSD from OLS regressions

| | | 1995 | | | 2002 | | |
|---|---|---|---|---|---|---|---|
| | | All | Males | Females | All | Males | Females |
| $R^2$-adj. | Spec. 1 | 0.47 | 0.40 | 0.43 | 0.53 | 0.52 | 0.45 |
| | Spec. 2 | 0.58 | 0.53 | 0.57 | 0.63 | 0.62 | 0.60 |
| RSD | Spec. 1 | 0.28 | 0.29 | 0.29 | 0.32 | 0.33 | 0.33 |
| | Spec. 2 | 0.25 | 0.25 | 0.28 | 0.28 | 0.29 | 0.30 |

Such differences between the two specifications are also manifest in the results of the quantile regressions.[16] Briefly, in line with Choleza's (2004) findings for Greece and similar findings for other countries (e.g. Machado and Mata 2005 for Portugal; Izquierdo and Lacuesta 2006 for Spain), the returns to education appear to increase across the wage distribution in both specifications. [17] Also, they increase across time at every point of the distribution in both specifications. However, the increases suggested by specification 1 are always larger in magnitude than the increases suggested by specification 2. The same applies to the coefficients of the gender dummy. In both specifications, they reflect a gender wage gap that increases in high paid jobs and decreases in time.[18] However, the magnitudes suggested are always higher for specification 1. The story is similar for the majority of the coefficients on employee characteristics. [19]

[16] Detailed quantile regression results are presented in Tables A1-A6 in the Appendix.

[17] It should be noted that this result is at odds with the findings of Martins and Pereira (2004) for Greece; they find that returns to education are higher at the lower quantiles. This counterintuitive result may be due to the hourly earnings variable they use and/or due to the fact that they do not account for employer characteristics. They use net hourly earnings. As the authors claim the latter measure is influenced by progressive taxation; this may provide inaccurate results for the returns to education for Greece - returns to education are eroded at higher wage quantiles.

[18] Our findings on the gender wage gap are in line with a long-standing tradition, starting with Bergman's (1971, 1974) pioneering work in the early 1970s, and subsequently followed by a long list of literature. The reasons for it stretch from discrimination on the demand-side to female self-selection in certain occupations on the supply-side. Women may select occupations that require smaller human capital investment, as they anticipate shorter and less continuous work-lives, or occupations more compatible with the performance of household work or occupations that are traditionally dominated by women. Evidence on gender discrimination in the Greek labour market from a series of empirical studies also endorses the segregation assumption (e.g. Patrinos and Lambropoulos 1993; Kanellopoulos and Mavromaras 2002; Papapetrou 2004).

[19] The results on employer characteristics, in specification 2, are in line with the finding of studies using similar data sets. For instance, we find that larger firms pay in general higher wages (cf. Arai, 2003 for evidence on Sweden; Magda *et. al* 2008 for evidence on various EU countries). Interestingly,

Qualitatively, the two specifications provide the same results for the employee characteristics but the magnitude of the effects differ. Specification 1 tends to systematically overestimate the returns to employee characteristics. This however, does not come as a surprise as specification 1 does not control for firm heterogeneity. As Hamermesh (2008) argues if one has a lot of information on workers and little on firms the results will show that worker characteristics matter a lot. On the other hand if one has a lot of information on firms the results will show that firm characteristics matter a lot. [20] Accounting for more heterogeneity leads to a better insight into the 'true' impact of employer and employee characteristics and specification 2 is a way towards this direction. [21]

Figure 2 presents the respective decomposition outcomes for each specification, i.e. the breakdown of observed wage changes into composition and price effects by decile. Interestingly, the contribution of price and composition effects differs significantly between specifications. Specification 1 underestimates the contribution of composition effects along the entire wage distribution. It tends also to overestimate the contribution of price effects at high deciles and to underestimate it at low deciles.[22] Specifically, in specification 1, the composition effects at the 9th decile are 0.12 log points higher than at the 1st decile, while the same difference for the price effects is 0.21. Likewise, the difference between the 9th and 5th deciles is 0.17 for composition and 0.14 for price effects, respectively. In contrast, in specification 2, the composition effects at the 9th decile are 0.22 log points higher than at the 1st decile, while the same difference for the price effects is 0.05; the respective differences between the 9th and the 5th deciles are 0.24 for composition and 0.02 for price effects. An important common result of the two specifications should, however, be

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the relative wage loss of the employees working in smaller firms is higher at higher wage deciles. Also, workers covered by a firm level agreement seem to earn higher wages (cf. Magda *et. al*. 2008). The results are not presented due to space consideration but are available upon request.

[20] For instance, studies analysing the impact of firm profitability on wages show that the effect of firm profits on wages is significantly lower when estimated from regressions that control for both firm and employee characteristic than when estimated from regressions that control for firm characteristics only (cf. Arai, 2003; Nekby 2003).

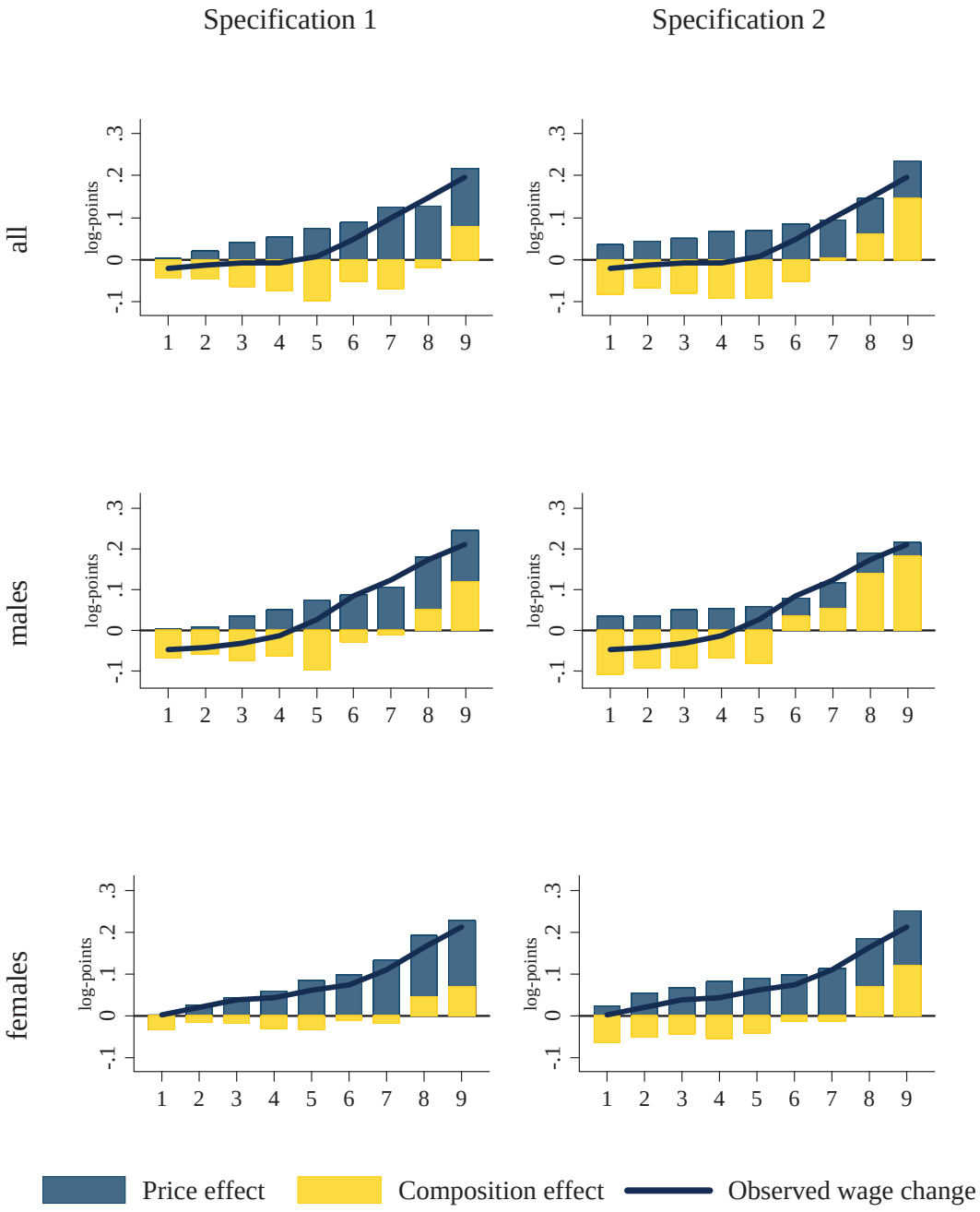
[21] Arguably, some of the variables capturing firm and job characteristics may be endogenous (outcome variables) and thus lead to selection bias. Among the variables included the occupation variable may perhaps be considered as endogenous (see Angrist and Pischke , 2009 for a rule of thumb for detecting 'outcome' variables). We, however, proceed with the analysis of specification 2 as, in an accounting exercise like ours that does not exclusively aim at estimating the causal wage effect of occupational status, it is constructive to know what part of the change in the wages, at different deciles, can be explained by firm, job and worker returns and characteristics (cf. Albrecht et al. 2003).

[22] The composition and price effects from specification 2 are due to both employee and employer/job characteristics.

acknowledged. Both specifications suggest that 'price' effects have been favourable for wages throughout the wage distribution, and that the slight wage-falls that took place at the lower deciles are attributable to the negative composition effects.

Controlling for employer characteristics is thus essential not only for obtaining an insight into the 'true' returns to skills but also for identifying the factors that shape the changes in the wage distribution. The role of price/return effects would have been overestimated if inference was based on a model that did not control for the observable firm heterogeneity.

Figure 2: Breakdown of wage changes into composition and price effects by decile




*5.2. Aggregate price and composition effects*

We now proceed to the analysis of the results of specification 2. First, we briefly look into the aggregate composition and return effects of employee and employer/job characteristics. As Figure 2 indicates composition effects are negative except for the

upper deciles. Therefore, they have a considerable inequality increasing effect as they tend to push wages downwards for those at the lower deciles of the wage distribution and raise them for those at high deciles. Hence, even if the returns to the employers' and employees' characteristics had remained constant, compositional changes would imply a significant increase in wage inequality. Moreover, even though the overall return effects have been positive throughout the distribution, they tend to favour slightly those at high wage deciles; they thus also have a mild inequality increasing effect.

What is also interesting is the difference in the importance of price and composition effects between men and women. When looking at men only, composition effects are larger in absolute value at most deciles; for women, though, it is the price effects that dominate. In fact, the domination of the price effects is strong enough to make no allowance for wage falls. Thus, the changes in the wage distribution among women are not driven by their changing composition but rather by increases in the returns to their labour market characteristics. These results are broadly indicative of the fact that women are catching up.

Next we continue to analyse in detail the contribution of price and composition effects of skills. Knowing how the composition and return effects of skills influence wage changes and wage inequality is important. Firstly, this can be a potential useful starting point for assessing now and in the future the impact of policies aiming at increasing the educational attainment of the labour force or of policies that increase job mobility and affect tenure and the formation of firm-specific human capital (i.e. more flexible employment contracts). Secondly, it would be also interesting to know whether the various returns to skill effects follow patterns that are in line with the skill-biased technical change or the variants of it.

### *5.3. Wage changes due to skill*

Table 5 presents in turn the breakdown of wage changes into price and composition effects of each employee characteristic/skill obtained from the full sample estimation and the separate estimation by gender. The list of employee characteristics we control for is: age as a proxy of general labour market experience,

years of education, tenure as an indicator of job-specific experience[23], a dummy variable for holders of vocational degrees and a dummy variable for females (in the full sample estimations).[24]

The decomposition results for age are presented in two categories: the youth or minimal experience category that refers to employees with years of age between 15 and 24, and the prime-age adult or medium-high experience category that refers to employees with years of age between 25 and 54; the latter category aggregates the effects of three age-bundles (i.e., 25-34, 35-44, 45-54).[25] The decomposition results for tenure include the combined effects of tenure and tenure-squared.

Table 5a: Composition and price effects due to employee characteristics by decile, all

| | | P10 | P20 | P30 | P40 | P50 | P60 | P70 | P80 | P90 |
|---|---|---|---|---|---|---|---|---|---|---|
| Observed wage change | | -.0214 | -.0141 | -.0080 | -.0077 | -.0074 | .0480 | .0997 | .1474 | .1953 |
| Total composition effects | | -.0819 | -.0682 | -.0794 | -.0936 | -.0921 | -.0522 | -.0002 | .0596 | .1452 |
| of which due to: | Age (if < 25) | -.0096 | -.0175 | -.0062 | -.0064 | -.0068 | .0012 | -.0006 | -.0007 | -.0023 |
| | Age (if > 24) | .0056 | .0016 | -.0047 | -.0005 | -.0065 | -.0119 | -.0074 | -.0074 | .0035 |
| | Education | .0106 | .0172 | .0151 | .0150 | .0134 | .0214 | .0108 | .0202 | .0308 |
| | Tenure | -.0567 | -.0581 | -.0580 | -.0668 | -.0803 | -.0574 | -.0495 | -.0331 | .0088 |
| | Vocat. degree | -.0003 | -.0003 | -.0006 | -.0006 | -.0006 | -.0001 | -.0002 | .0003 | .0000 |
| | All skills | -.0504 | -.0571 | -.0544 | -.0593 | -.0808 | -.0468 | -.0469 | -.0207 | .0408 |
| | Sex (female) | .0010 | .0010 | -.0077 | -.0086 | -.0018 | -.0123 | -.0159 | -.0138 | -.0103 |
| Total price effects | | .0349 | .0418 | .0512 | .0647 | .0683 | .0829 | .0948 | .0847 | .0888 |
| of which due to: | Age (if < 25) | -.0050 | -.0045 | -.0039 | -.0017 | -.0010 | -.0006 | -.0008 | -.0002 | -.0002 |
| | Age (if > 24) | -.0280 | -.0523 | -.0533 | -.0603 | -.0690 | -.0666 | -.0619 | -.0600 | -.0457 |
| | Education | .0395 | .0359 | .0306 | .0263 | .0223 | .0296 | .0273 | .0311 | .0341 |
| | Tenure | .0240 | .0185 | .0118 | .0101 | .0069 | .0083 | .0134 | .0176 | .0211 |
| | Vocat. degree | -.0012 | -.0016 | -.0029 | -.0041 | -.0049 | -.0070 | -.0070 | -.0086 | -.0061 |
| | All skills | .0293 | -.0040 | -.0177 | -.0279 | -.0457 | -.0363 | -.0290 | -.0201 | .0032 |
| | Sex (female) | .0067 | .0155 | .0154 | .0117 | .0117 | .0087 | .0085 | .0065 | .0027 |

[23] Age and tenure are separately included in the regression to account for the wage effects of general labour market experience and the effects of firm-specific experience respectively (e.g. Machado and Mata, 2005; Izquierdo and Lacuesta 2006). One could argue that there is some association between age/experience and tenure. In large cross-sections, however, this association is weakened by the fact that different individuals may have different levels of labour market experience when entering their current job.

[24] The information on age is given in age categories/bundles rather than in years; thus regressions include a dummy variable per age bundle.

[25] Employees between 55-64 years of age constitute the reference category.

Table 5b: Composition and price effects due to employee characteristics by decile, males

| | | P10 | P20 | P30 | P40 | P50 | P60 | P70 | P80 | P90 |
|---|---|---|---|---|---|---|---|---|---|---|
| Observed wage change | | -.0457 | -.0412 | -.0297 | -.0129 | .0269 | .0835 | .1237 | .1741 | .2111 |
| Total composition effects | | -.1066 | -.0920 | -.0905 | -.0666 | -.0804 | .0345 | .0537 | .1389 | .1820 |
| of which due to: | Age (if < 25) | -.0142 | -.0215 | -.0085 | .0017 | -.0042 | -.0038 | -.0014 | -.0008 | -.0008 |
| | Age (if > 24) | -.0008 | -.0061 | -.0129 | -.0038 | -.0145 | -.0138 | -.0058 | .0091 | .0111 |
| | Education | .0098 | .0295 | .0228 | .0158 | .0134 | .0229 | .0193 | .0168 | .0288 |
| | Tenure | -.0619 | -.0723 | -.0739 | -.0701 | -.0757 | -.0464 | -.0357 | .0016 | .0233 |
| | Vocat. degree | -.0005 | -.0013 | -.0004 | -.0004 | -.0002 | .0000 | .0002 | .0000 | .0017 |
| | All skills | -.0677 | -.0718 | -.0730 | -.0567 | -.0812 | -.0413 | -.0234 | .0267 | .0641 |
| Total price effects | | .0358 | .0342 | .0515 | .0533 | .0590 | .0442 | .0619 | .0507 | .0331 |
| of which due to: | Age (if < 25) | -.0044 | -.0021 | -.0017 | -.0014 | -.0004 | .0000 | .0000 | .0000 | .0000 |
| | Age (if > 24) | -.0247 | -.0579 | -.0499 | -.0598 | -.0652 | -.0637 | -.0637 | -.0613 | -.0452 |
| | Education | .0367 | .0330 | .0335 | .0255 | .0403 | .0375 | .0525 | .0471 | .0400 |
| | Tenure | .0191 | .0143 | .0106 | .0008 | .0009 | .0027 | .0076 | .0177 | .0329 |
| | Vocat. degree | -.0034 | -.0031 | -.0044 | -.0065 | -.0079 | -.0088 | -.0128 | -.0087 | -.0111 |
| | All skills | .0233 | -.0158 | -.0119 | -.0414 | -.0323 | -.0323 | -.0164 | -.0053 | .0166 |

Table 5c: Composition and price effects due to employee characteristics by decile, females

| | | P10 | P20 | P30 | P40 | P50 | P60 | P70 | P80 | P90 |
|---|---|---|---|---|---|---|---|---|---|---|
| Observed wage change | | .0006 | .0206 | .0367 | .0431 | .0605 | .0739 | .1089 | .1627 | .2135 |
| Total composition effects | | -.0657 | -.0513 | -.0436 | -.0539 | -.0423 | -.0142 | -.0148 | .0681 | .1207 |
| of which due to: | Age (if < 25) | -.0035 | .0000 | -.0045 | -.0046 | -.0023 | -.0049 | -.0015 | .0022 | .0020 |
| | Age (if > 24) | -.0007 | -.0011 | -.0082 | -.0014 | -.0032 | .0029 | .0013 | .0007 | .0146 |
| | Education | .0073 | .0194 | .0160 | .0125 | .0145 | .0156 | .0115 | .0215 | .0127 |
| | Tenure | -.0451 | -.0556 | -.0384 | -.0466 | -.0526 | -.0436 | -.0386 | -.0172 | .0069 |
| | Vocat. degree | .0004 | -.0001 | -.0002 | -.0007 | -.0011 | -.0005 | -.0007 | -.0001 | .0000 |
| | All skills | -.0416 | -.0374 | -.0354 | -.0407 | -.0447 | -.0306 | -.0280 | .0071 | .0362 |
| Total price effects | | .0224 | .0527 | .0671 | .0826 | .0883 | .0963 | .1123 | .1168 | .1303 |
| of which due to: | Age (if < 25) | -.0089 | -.0078 | -.0060 | -.0046 | -.0041 | -.0034 | -.0040 | -.0016 | -.0020 |
| | Age (if > 24) | -.0355 | -.0516 | -.0642 | -.0730 | -.0650 | -.0714 | -.0929 | -.0914 | -.0679 |
| | Education | .0410 | .0484 | .0333 | .0288 | .0210 | .0181 | .0184 | .0251 | .0186 |
| | Tenure | .0262 | .0270 | .0225 | .0232 | .0283 | .0280 | .0243 | .0174 | .0222 |
| | Vocat. degree | .0000 | -.0002 | -.0004 | -.0003 | -.0006 | -.0006 | -.0009 | -.0010 | -.0029 |
| | All skills | .0227 | .0158 | -.0148 | -.0260 | -.0203 | -.0293 | -.0552 | -.0515 | -.0320 |

Looking, first, at the contribution of the skill composition effects, already provides confirmation of their leading role in the determination of wage changes. The

estimated composition effects of all skills together are negative for most deciles. In addition, they account for the largest part of overall composition effects, especially up to the 7th decile, for as long as the overall composition effects are negative. Their relative significance is much lower at the two highest wage deciles, where the key role is played by employer characteristics. [26]

The negative part of the skill composition effects appears to come primarily from the tenure variable. The negative tenure effects are, in turn, a good reflection of the decrease in the per capita levels of job-specific experience in the sample, at all but the last two wage deciles.[27] Tenure composition effects tend to decrease wages relatively more in the lower deciles with a consequent push towards higher wage inequality**.** In contrast, age effects do not have an equally noticeable contribution to the way the wage distribution evolved. The respective composition effects are smaller in magnitude and follow no regular pattern across the distribution.

Education is the only skill that has had a positive composition effect at all wage deciles. However, had returns to education remained constant, the increase in educational attainment would have lead to wage increases across the broad but it would have also led to more wage inequality. Specifically, for the aggregate sample, the composition effect of education at the 9th wage decile is 2.90 times higher than that at the 1st decile. For males, the respective ratio is 2.93 and, for females, it is 1.74. This result is rather surprising, given that rising education increases the proportion of the skilled in the labour force and induces their relative wages to fall pushing towards lower wage inequality. However, there is another factor to consider. Wages tend to be more dispersed among high skilled workers and, therefore, rising education also pushes towards more wage inequality. Which effect dominates is an empirical issue. For the case of Greece in the period 1995-2002 the evidence seems to be consistent with the latter effect being the dominant one. Our results are similar with the ones provided for Spain over the same period by Izquierdo and Lacuesta (2006) and for Portugal over 1986-1995 by Machado and Mata (2005).

[26] The disaggregation of the overall composition effect into its components reveals that it is mainly the aggregate employer/job composition effects that contribute to the wage increases at the upper deciles of the wage distribution. For the complete accounting of the decomposition results see Table A7 in the Appendix.

[27] The evolution of mean tenure by decile is presented in Figure A1 in the Appendix, along with all the (bootstrapped) mean employee characteristics ($X_{jt}$).

We turn now our focus on the price effects of skills. As already mentioned, aggregate price effects have had a significant contribution to overall wage changes, but their contribution to wage inequality has been relatively mild as they have been more equally spread across the distribution. However, if one looks at the price effects due to skill only observes a rather different picture. Evidently, even though overall price effects appear to have pushed wages upwards, the price effects due to skill, while smaller in magnitude than the skill composition effects, are also mostly negative (except for those at the 1st and 9th decile). Further, they tend to be larger in absolute value at the middle wage deciles. [28] For clarity of exposition, Figure 3 plots the price effects due to education, general labour market experience of prime age adults (age > 24)[29] and job-specific experience (tenure) by decile and gender. Total skill price effects are also plotted, indicated by the shaded area. Noticeably, the total price effects of skills form a U-shaped pattern across the wage distribution. [30] Thus, had the composition of skills remained constant the change in the returns to skills would tend to decrease the wages of almost all employees but mostly of those in the middle of the wage distribution. It was mentioned earlier that the increase in the overall wage inequality is driven mainly by the higher upper tail inequality and that the increases in the lower tail inequality were more contained. Obviously, the U-shaped pattern of skill return effects contributes to this pattern of wage inequality.

This pattern of return effects may be associated with a deteriorating market valuation of the skills of employees in the middle of the wage distribution relative to those of employees in the lower and upper part of the distribution. This U-shaped

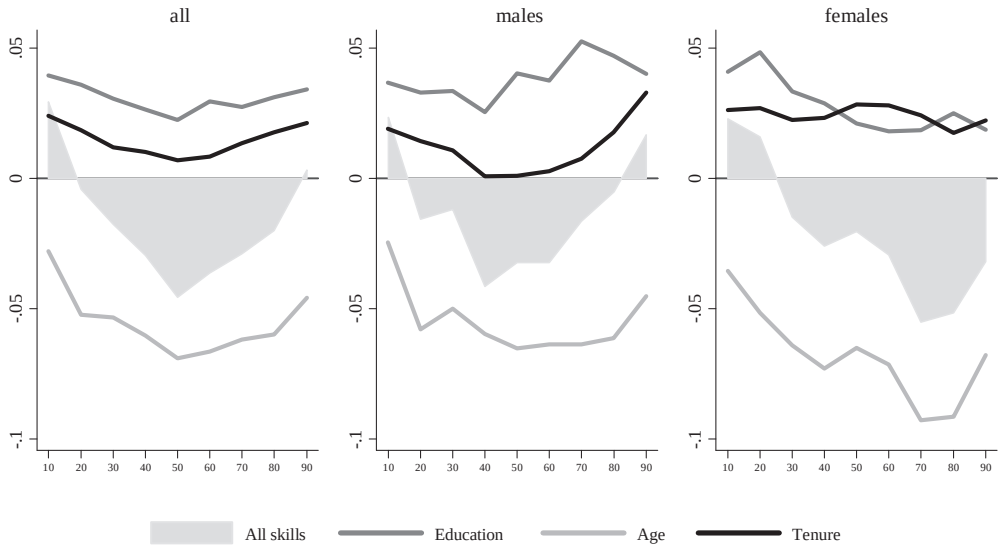
[28] The disaggregation of the overall return effects into their components indicates that the constant mainly contributes to the observed wage increases. On the other hand, the return effects of employee and employer/job characteristics tend to decrease wages at most deciles. (see Table A7 in the Appendix). The fact that the effects of the constant seem to determine the sign of the overall return effects should not be considered surprising. Melly (2005) in his analysis for the US over the period 1973-1989 shows that the negative coefficient effects on the median wage change are mainly due to the negative constant effect and not due to the sign of the return effects.

[29] In Tables 5a-5c the age return effects of both younger workers (age<25) and prime age adults (age>24) are presented and both are negative. In the Figures, though, we focus on the analysis of the price effects of prime age adults who are expected to have completed their education and be more permanently attached to the labour market (cf. Beaudry and Green, 2000). In any case, since the age return effects of younger workers are very small the thrust of the results would not change.

[30] This U-shaped pattern is also reflected in the changes of the estimated returns from the regressions over 1995-2002 for most skill variables (see Figure A2 in the Appendix). Interestingly, our estimates of the changes in the returns to education over 1995-2002 differ from the equivalent estimates of Cholezas (2004) over 1994-1999. In contrast to our U-shaped pattern, Cholezas finds that changes in the returns to education increase monotonically when moving along the wage distribution. However, apart from the difference in the period under study, Choleza's findings are derived without controlling for employer characteristics.

pattern can be considered as being broadly in line with the routinization hypothesis. The routization hypothesis refers to technical change that tends to substitute medium-skill jobs. Therefore, the decreasing return to skills for the employees in the middle part of the distribution can be, partly, the outcome of a lower relative demand for the skills of these employees. [31]

Figure 3: Changes in price effects due to skill by decile




When men and women are examined separately the following interesting results emerge. For the sample of males the U-shape pattern is reinforced by a more pronounced positive part at the upper deciles of the distribution. For women the estimated price-effects display a downward trend when moving along the wage distribution, with the price effects at the low and upper wage deciles keeping their advantage in comparison to the price effects in the middle of the distribution; however the positive price effects observed for men at the upper deciles are not sustained. This could be taken as evidence of the so called 'glass-ceiling'.[32]

However, the evolution of the aggregate skill price-effects across wage deciles only draws part of the picture. Equally important is to examine the evolution of the

[31] A formal test of the routinization hypothesis would require an analysis of relative employment quantities. A direct test of any hypothesis is, however, beyond the purpose of the current study.

[32] 'Glass-ceiling' refers to the situation where the labour market performance of women follows that of men up to a point after which their wages fall behind those of men (see Albrecht et. al., 2003 and Albrecht et. al., 2009). Positive return effects of skills, in the upper deciles, that are present only in the case of men could be a manifestation of this situation.

price effects of each skill separately. Interestingly, the U-shaped pattern is more or less sustained for all individual skill price effects. In all samples and deciles, the price effects of education and tenure are positive while the respective return effects of age are negative and relatively higher in absolute value. [33] Thus, if the education and tenure distribution had remained constant the change in their returns would tend to increase wages. On the other hand, if the age composition of the labour force was held constant the change in the returns to age would tend to decrease wages.

Institutional changes that are effectively not age neutral is one of the explanations usually put forward in the literature for the deteriorating labour market outcomes of younger workers. [34] Given that the employment relationships of older workers are more or less settled the new arrangements are likely to have influenced the evolution of earnings of younger workers more (see Rosolia and Torini, 2007 who provide an analysis for Italy). As mentioned in previous sections important changes relating mainly to employment contract arrangements have taken place in Greece the period under investigation. [35] Therefore, changes in the institutional environment could possibly lie behind the observed negative age effects. Interestingly, the age return effects are not uniform across the wage distribution and tend to be more negative for those in the middle of the distribution. In relation to the shape of age return effects a supplementary to the routinization hypothesis explanation could be provided. In particular, the institutional changes that took place in Greece are not of the nature that would harm low wage earners, as minimum wages are still in effect and the system can be considered as being broadly regulated (see Du Caju *et. al.*, 2008). However, the flexible employment contract arrangements in interaction with differences in unobserved labour market relevant skills may lead to divergent labour

[33] We have also decomposed the age return effects of the prime age adults into their components and observed that the age return effects are negative for all age categories. However, for the younger workers (25-34) and those between 35-44 years of age the effects are, in most deciles, relatively more negative; interestingly, the U-shape pattern is driven to a large extent by these two age categories.

[34] In many countries institutional changes that aim at increasing labour market flexibility entail the inception of fixed-term contracts. The wages of employees working under temporary contracts are found to be on average lower than those of employees working under permanent contracts (eg. De la Rica and Felgueroso, 2003). Further, recent evidence for Portugal shows that temporary employment contracts tend to be concentrated to younger and less educated workers (Portugal and Varejao, 2009).

[35] Machado and Mata (2005) argue that changes in workers' unobserved ability or in institutions may be reflected in coefficient changes. Arguably, in our case the age dummies may also capture, apart from returns to general labour market experience, unobserved characteristics of the workers in these age categories or institutional changes that have an impact on these worker categories.

market outcomes for those in the middle and the upper part of the distribution.[36] In particular, any higher unobserved ability of those in the upper part of the distribution would tend to outweigh to some extent the impact of non-favourable institutional arrangements.

### *5.4. Economic developments versus predetermined changes*

We have now seen the contribution of skills to wage-inequality in detail. But, how do these results inform us about the relative importance of economic developments and predetermined composition effects in shaping wage inequality the period under investigation?

To examine the relative importance of economic developments we need to add to the skill price effects, which are undoubtedly influenced by market conditions, the part of the skill composition effects that could also be responsive to economic developments. In the group of our skill-variables, we identify tenure as the only one whose composition effects are not strictly predetermined; in fact, we expect the market unresponsive part of tenure composition to be low.[37] For instance, tenure may be responsive to changes in the institutional environment that increase job mobility (i.e. inception of contracts of definite length and contracts that relate to the completion of a specific task).[38] Further, a non negligible part of tenure composition effects is determined by the employers according to market conditions. In periods of high demand, we expect reduced firing to increase tenure and increased hiring to decrease it, and vice versa in periods of low demand.

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[36] Differences in unobserved labour quality have been frequently proposed as an explanation for wage differences between groups of workers. Bound and Johnson (1992) argue that unobserved labour quality in interaction with technical change can explain the change in the structure of wages in the US in the 1980s. In a similar reasoning, Albrecht *et. al.* (2009) argue that the low dispersion in labour market relevant skills in Sweden may lie behind the contained increases in wage inequality.

[37] One could of course argue that education and age composition may also be responsive to economic developments and market conditions. For instance, increasing returns to education could affect incentives and lead employees to acquire more education (e.g Acemoglou 2002). Further, an increase in the number of years devoted to education will in turn postpone the entry to the labour market; therefore, the age composition of the labour force may also be influenced. However, this is a process that is not instant and takes time. Given, the short time period covered by our sample it is not clear what part of the changes in education and age is exogenous and what part is responsive to economic developments. We prefer to treat age and education as exogenous and consider the responsive to economic developments skill effects obtained as a lower bound of the respective effects.

[38] We have referred in the previous section to the possible impact of institutional changes on the pattern of age price effects. As mentioned here tenure levels may also be influenced by some of these institutional changes. In such case, the age price effects are likely to capture the impact of these institutional arrangements on wages that is beyond the one relating to tenure.

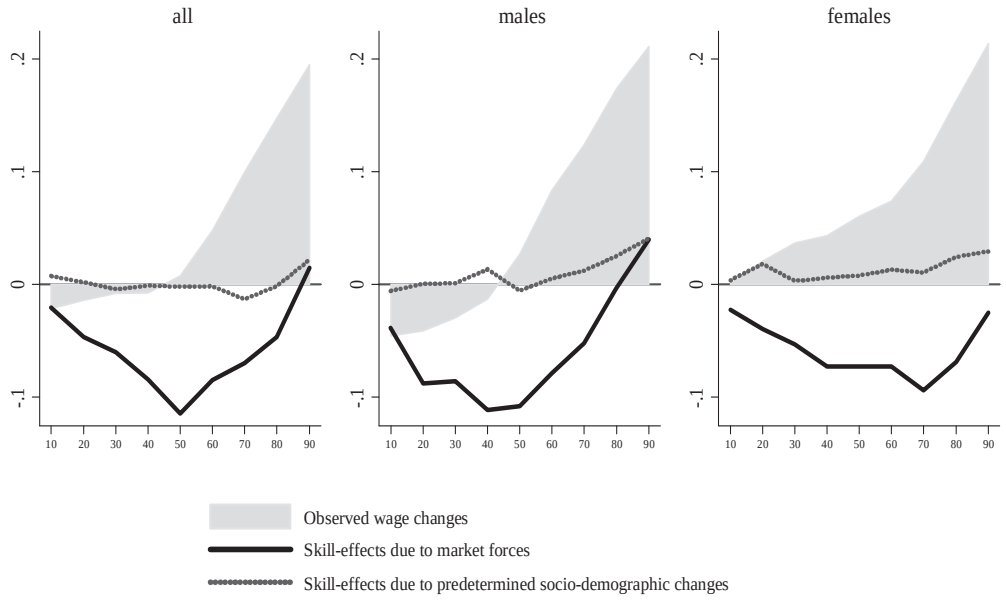
Hence, we aggregate the total price-effects of skill with the tenure composition effect and call it the responsive to market conditions and economic developments part of skill effects. Then, in Figure 4, we plot it against the sum of the skill composition effects that are exclusively attributable to predetermined demographic changes – education and age composition effects. One can see that the responsive to economic developments skill effects are important in magnitude; in contrast, the predetermined skill composition effects are of relatively smaller scale. Interestingly, the U-shape pattern of return effects observed in Figure 3 is sustained with the addition of the tenure composition effects to the skill price-effects; it should be pointed though that the slightly positive skill price effects in the lower and upper deciles are now outweighed and a positive part is only present for males and only at the upper deciles.

Figure 4 also plots the overall observed wage changes (indicated by the shaded area). This serves to illustrate another important point. The skill effects attributable to economic developments have also contributed to the observed pattern of wage inequality, i.e. towards the upper-tail wage inequality and the wage-compression observed in the lower half of the distribution. Obviously, they tend to decrease more the wages of those in the middle of the distribution as compared to the wages of those in the lower and upper deciles.

Another interesting point that emerges from Figure 4 is that skills, despite playing an important role in shaping the changes in the wage distribution over the period 1995-2002, give only part of the picture. We need to also look into the effects that tend to outweigh the negative skill price and composition effects and contribute to the observed wage increases. It is the effect of the constant across the wage distribution and of the employer/job composition effects in the upper deciles that outweigh the negative skill price and composition effects making no allowance for extensive wage falls. Interestingly, the employer/job composition effects contribute also to the increases in the overall wage inequality. In particular, had the returns to employer and job characteristics remained constant their changing composition would tend to increase overall wage inequality, as they tend to decrease wages at low deciles and increase them at high deciles (see Table A7 in the Appendix). The fact that the employer/job characteristics are also very likely responsive to market conditions further reinforces the case for the importance of economic developments in influencing the pattern of wage changes. Conclusively, we are more inclined to side

against the 'revisionists' view, in general, and the conclusion of Tsakloglou and Cholezas (2005) about Greece in particular, which assign economic developments a secondary role in the determination of wage inequality. [39]

Figure 4: Skill-effects by source and observed wage changes




## 6. Conclusion

In this paper we have examined how the distribution of wages has changed in Greece over 1995-2002 and what has been the contribution of skills to these changes. We have used a matched employer-employee dataset, which allowed us to control for both worker and job/employer heterogeneity. Building on the regression results, we used the Machado-Mata decomposition method to separate the part of the wage changes that is due to changes in the employer/job and workers characteristics from the part due to changes in the returns to these characteristics. Ultimately, this enabled us to analyse the contribution of the price and composition effects of each skill separately and join together the skill price effects and the part of the composition

[39] Christopoulou, Jimeno and Lamo (2010) in their analysis of nine EU countries covering the same period and using the Structure of Earning Survey also find that economic developments are the most relevant in explaining the observed wage dynamics.

effects of skills that is responsive to market conditions. The latter exercise proves useful in our attempt to examine the relative importance of economic developments and predetermined compositional changes in shaping the observed changes in the wage distribution.

The evidence suggests a small increase in Greek average wages combined with a significant increase in wage inequality, mostly due to significantly higher relative wage increases at the upper tail of the distribution. The contribution of skills to the evolution of Greek wage dynamics has been important. Briefly, the composition effects of skills are mostly negative. Their negative part is mainly due to the tenure composition effects which, by reducing wages more for those in the lower part of the wage distribution, contribute to the observed pattern of wage inequality. Markedly, the composition effects of education despite being positive also contribute to higher wage inequality. This result contradicts standard expectations for a negative relationship between rising education and wage equality and it is possibly the outcome of higher wage dispersion among the high skilled.

The price effects due to skill have also been mostly negative but their magnitude is relatively smaller. Interestingly, they have formed a U-shaped pattern along the wage distribution. This U-shaped pattern of skill price effects, though not a proof of, can be considered as being broadly in line with the routinization hypothesis; a variant of the of skill-biased technical change theory. As to the individual skill price effects, tenure and education price effects are positive and the negative part of the skill price effects is mainly due to the age price effects. The sign and shape of the age price effects could be regarded as being the outcome of the interaction between institutional changes that are not age neutral and different unobserved ability of employees along the wage distribution.

Noticeably, it is the effects of the constant across the wage distribution and of the employer/job composition effects in the upper deciles of the wage distribution that outweigh the negative skill price and composition effects making no allowance for extensive wage falls. In interpreting our decomposition results we can argue that economic developments, through their combined influence on the price effects of skills and the market driven part of the skill composition effects have had an important role in shaping Greek wage dynamics. On the other hand, the skill effects that are attributable to predetermined compositional changes were of relatively smaller scale.

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# A Appendix

Table A1: OLS and quantile estimation results, Sample: all, Year: 1995

| | OLS | Quantile estimations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | | | | Specification 1 | | | | | |
| Min. years of education | 0.0333 | 0.0216 | 0.0242 | 0.0266 | 0.0285 | 0.0311 | 0.0336 | 0.0362 | 0.0390 | 0.0426 |
| | [0.0004]*** | [0.0004]*** | [0.0004]*** | [0.0004]*** | [0.0005]*** | [0.0005]*** | [0.0006]*** | [0.0006]*** | [0.0007]*** | [0.0009]*** |
| Vocational degree | 0.0678 | 0.0879 | 0.0879 | 0.0799 | 0.0831 | 0.0804 | 0.0761 | 0.0652 | 0.0498 | 0.0334 |
| | [0.0060]*** | [0.0068]*** | [0.0065]*** | [0.0060]*** | [0.0071]*** | [0.0075]*** | [0.0076]*** | [0.0084]*** | [0.0095]*** | [0.0114]*** |
| Age:15-24 years old | -0.2806 | -0.1407 | -0.1608 | -0.1907 | -0.2239 | -0.2530 | -0.2792 | -0.3050 | -0.3381 | -0.4094 |
| | [0.0086]*** | [0.0096]*** | [0.0092]*** | [0.0086]*** | [0.0101]*** | [0.0107]*** | [0.0109]*** | [0.0121]*** | [0.0138]*** | [0.0168]*** |
| Age:25-34 years old | -0.1258 | -0.0636 | -0.0701 | -0.0789 | -0.0975 | -0.1104 | -0.1216 | -0.1388 | -0.1433 | -0.1693 |
| | [0.0064]*** | [0.0072]*** | [0.0070]*** | [0.0064]*** | [0.0076]*** | [0.0081]*** | [0.0082]*** | [0.0092]*** | [0.0105]*** | [0.0127]*** |
| Age:35-44 years old | 0.0051 | 0.0378 | 0.0381 | 0.0397 | 0.0223 | 0.0154 | 0.0081 | -0.0019 | -0.0013 | -0.0181 |
| | [0.0061] | [0.0068]*** | [0.0065]*** | [0.0060]*** | [0.0072]*** | [0.0076]** | [0.0077] | [0.0085] | [0.0097] | [0.0117] |
| Age:45-54 years old | 0.0475 | 0.0519 | 0.0605 | 0.0613 | 0.0535 | 0.0509 | 0.0476 | 0.0422 | 0.0426 | 0.0402 |
| | [0.0060]*** | [0.0068]*** | [0.0065]*** | [0.0060]*** | [0.0070]*** | [0.0075]*** | [0.0076]*** | [0.0084]*** | [0.0095]*** | [0.0113]*** |
| Tenure in years | 0.0267 | 0.0283 | 0.0286 | 0.0288 | 0.0290 | 0.0291 | 0.0283 | 0.0283 | 0.0259 | 0.0213 |
| | [0.0007]*** | [0.0008]*** | [0.0007]*** | [0.0007]*** | [0.0008]*** | [0.0008]*** | [0.0008]*** | [0.0009]*** | [0.0010]*** | [0.0013]*** |
| Tenure squared/100 | -0.0283 | -0.0307 | -0.0284 | -0.0286 | -0.0290 | -0.0297 | -0.0276 | -0.0310 | -0.0265 | -0.0204 |
| | [0.0023]*** | [0.0028]*** | [0.0026]*** | [0.0024]*** | [0.0028]*** | [0.0030]*** | [0.0030]*** | [0.0033]*** | [0.0037]*** | [0.0044]*** |
| Sex: female | -0.1799 | -0.1002 | -0.1248 | -0.1446 | -0.1594 | -0.1773 | -0.1916 | -0.2122 | -0.2404 | -0.2674 |
| | [0.0032]*** | [0.0037]*** | [0.0035]*** | [0.0032]*** | [0.0037]*** | [0.0040]*** | [0.0040]*** | [0.0044]*** | [0.0049]*** | [0.0059]*** |
| Constant | 1.4314 | 1.1521 | 1.2213 | 1.2764 | 1.3395 | 1.3936 | 1.4550 | 1.5290 | 1.6302 | 1.8066 |
| | [0.0074]*** | [0.0077]*** | [0.0076]*** | [0.0072]*** | [0.0086]*** | [0.0092]*** | [0.0094]*** | [0.0104]*** | [0.0118]*** | [0.0140]*** |
| Observations | 38071 | 38071 | 38071 | 38071 | 38071 | 38071 | 38071 | 38071 | 38071 | 38071 |
| R-squared | 0.47 | | | | | | | | | |
| | | | | | Specification 2 | | | | | |
| Min. years of education | 0.0173 | 0.0122 | 0.0137 | 0.0150 | 0.0157 | 0.0164 | 0.0164 | 0.0177 | 0.0184 | 0.0194 |
| | [0.0006]*** | [0.0007]*** | [0.0007]*** | [0.0006]*** | [0.0006]*** | [0.0006]*** | [0.0007]*** | [0.0007]*** | [0.0008]*** | [0.0012]*** |
| Vocational degree | 0.0643 | 0.0549 | 0.0551 | 0.0645 | 0.0686 | 0.0692 | 0.0705 | 0.0745 | 0.0607 | 0.0727 |
| | [0.0057]*** | [0.0076]*** | [0.0072]*** | [0.0061]*** | [0.0060]*** | [0.0064]*** | [0.0069]*** | [0.0072]*** | [0.0082]*** | [0.0120]*** |
| Age:15-24 years old | -0.2202 | -0.1249 | -0.1540 | -0.1679 | -0.1796 | -0.1874 | -0.2082 | -0.2284 | -0.2596 | -0.2953 |
| | [0.0078]*** | [0.0103]*** | [0.0098]*** | [0.0083]*** | [0.0082]*** | [0.0087]*** | [0.0094]*** | [0.0098]*** | [0.0113]*** | [0.0166]*** |
| Age:25-34 years old | -0.1031 | -0.0604 | -0.0692 | -0.0751 | -0.0824 | -0.0829 | -0.0947 | -0.1088 | -0.1191 | -0.1363 |
| | [0.0059]*** | [0.0076]*** | [0.0074]*** | [0.0062]*** | [0.0062]*** | [0.0065]*** | [0.0070]*** | [0.0075]*** | [0.0086]*** | [0.0126]*** |
| Age:35-44 years old | 0.0100 | 0.0345 | 0.0279 | 0.0236 | 0.0174 | 0.0211 | 0.0141 | 0.0067 | -0.0022 | -0.0107 |
| | [0.0055]* | [0.0072]*** | [0.0069]*** | [0.0059]*** | [0.0058]*** | [0.0061]*** | [0.0066]** | [0.0069] | [0.0079] | [0.0116] |
| Age:45-54 years old | 0.0420 | 0.0533 | 0.0492 | 0.0447 | 0.0423 | 0.0472 | 0.0389 | 0.0363 | 0.0295 | 0.0259 |
| | [0.0054]*** | [0.0072]*** | [0.0069]*** | [0.0058]*** | [0.0057]*** | [0.0060]*** | [0.0065]*** | [0.0068]*** | [0.0078]*** | [0.0113]** |
| Tenure in years | 0.0221 | 0.0228 | 0.0234 | 0.0237 | 0.0233 | 0.0226 | 0.0221 | 0.0208 | 0.0194 | 0.0171 |
| | [0.0006]*** | [0.0008]*** | [0.0008]*** | [0.0007]*** | [0.0006]*** | [0.0007]*** | [0.0007]*** | [0.0008]*** | [0.0009]*** | [0.0013]*** |
| Tenure squared/100 | -0.0197 | -0.0209 | -0.0205 | -0.0203 | -0.0183 | -0.0159 | -0.0155 | -0.0144 | -0.0148 | -0.0137 |
| | [0.0021]*** | [0.0030]*** | [0.0028]*** | [0.0023]*** | [0.0023]*** | [0.0024]*** | [0.0026]*** | [0.0027]*** | [0.0030]*** | [0.0045]*** |
| Sex: female | -0.1513 | -0.0876 | -0.1100 | -0.1239 | -0.1354 | -0.1487 | -0.1594 | -0.1725 | -0.1889 | -0.2059 |
| | [0.0031]*** | [0.0044]*** | [0.0041]*** | [0.0034]*** | [0.0033]*** | [0.0034]*** | [0.0037]*** | [0.0038]*** | [0.0043]*** | [0.0062]*** |
| Constant | 1.6430 | 1.3550 | 1.4441 | 1.4700 | 1.4914 | 1.6031 | 1.6843 | 1.7810 | 1.8638 | 2.0734 |
| | [0.0346]*** | [0.0436]*** | [0.0433]*** | [0.0369]*** | [0.0360]*** | [0.0381]*** | [0.0407]*** | [0.0432]*** | [0.0491]*** | [0.0690]*** |
| Observations | 37901 | 37901 | 37901 | 37901 | 37901 | 37901 | 37901 | 37901 | 37901 | 37901 |
| R-squared | 0.58 | | | | | | | | | |

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors in brackets. Specification 1 controls only for the individual characteristics listed. Specification 2 also controls for observable employer and job characteristics, namely: sector, occupation, firm ownership, region, firm size, main product market and level of collective agreement coverage.

Table A2: OLS and quantile estimation results, Sample: all, Year: 2002

| | OLS | Quantile estimations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | | | | Specification 1 | | | | | |
| Min. years of education | 0.0498 | 0.0335 | 0.0377 | 0.0416 | 0.0450 | 0.0473 | 0.0500 | 0.0525 | 0.0551 | 0.0602 |
| | [0.0005]*** | [0.0006]*** | [0.0005]*** | [0.0005]*** | [0.0006]*** | [0.0005]*** | [0.0007]*** | [0.0007]*** | [0.0009]*** | [0.0011]*** |
| Vocational degree | -0.0462 | -0.0045 | -0.0296 | -0.0428 | -0.0512 | -0.0457 | -0.0504 | -0.0527 | -0.0598 | -0.0614 |
| | [0.0057]*** | [0.0077] | [0.0061]*** | [0.0062]*** | [0.0062]*** | [0.0060]*** | [0.0075]*** | [0.0076]*** | [0.0086]*** | [0.0104]*** |
| Age:15-24 years old | -0.3486 | -0.1722 | -0.1989 | -0.2298 | -0.2813 | -0.3321 | -0.3796 | -0.4140 | -0.4776 | -0.5348 |
| | [0.0094]*** | [0.0126]*** | [0.0100]*** | [0.0102]*** | [0.0103]*** | [0.0098]*** | [0.0124]*** | [0.0127]*** | [0.0144]*** | [0.0173]*** |
| Age:25-34 years old | -0.2141 | -0.1011 | -0.1211 | -0.1429 | -0.1774 | -0.2068 | -0.2404 | -0.2540 | -0.2851 | -0.3153 |
| | [0.0078]*** | [0.0103]*** | [0.0082]*** | [0.0084]*** | [0.0085]*** | [0.0081]*** | [0.0103]*** | [0.0105]*** | [0.0119]*** | [0.0144]*** |
| Age:35-44 years old | -0.0699 | -0.0238 | -0.0228 | -0.0231 | -0.0376 | -0.0581 | -0.0779 | -0.0833 | -0.1132 | -0.1313 |
| | [0.0075]*** | [0.0100]** | [0.0080]*** | [0.0081]*** | [0.0082]*** | [0.0079]*** | [0.0010]*** | [0.0101]*** | [0.0114]*** | [0.0138]*** |
| Age:45-54 years old | -0.0111 | 0.0354 | 0.0372 | 0.0323 | 0.0132 | -0.0081 | -0.0249 | -0.0321 | -0.0534 | -0.0601 |
| | [0.0073] | [0.0099]*** | [0.0078]*** | [0.0080]*** | [0.0080]* | [0.0078] | [0.0097]** | [0.0098]*** | [0.0110]*** | [0.0133]*** |
| Tenure in years | 0.0299 | 0.0315 | 0.0300 | 0.0300 | 0.0301 | 0.0308 | 0.0307 | 0.0303 | 0.0295 | 0.0269 |
| | [0.0006]*** | [0.0009]*** | [0.0007]*** | [0.0007]*** | [0.0007]*** | [0.0007]*** | [0.0008]*** | [0.0008]*** | [0.0009]*** | [0.0011]*** |
| Tenure squared/100 | -0.0216 | -0.0239 | -0.0107 | -0.0079 | -0.0085 | -0.0137 | -0.0188 | -0.0230 | -0.0282 | -0.0314 |
| | [0.0023]*** | [0.0034]*** | [0.0026]*** | [0.0026]*** | [0.0026]*** | [0.0024]*** | [0.0030]*** | [0.0031]*** | [0.0035]*** | [0.0042]*** |
| Sex: female | -0.1559 | -0.0973 | -0.1131 | -0.1262 | -0.1395 | -0.1479 | -0.1585 | -0.1704 | -0.1896 | -0.2201 |
| | [0.0034]*** | [0.0047]*** | [0.0037]*** | [0.0037]*** | [0.0037]*** | [0.0035]*** | [0.0044]*** | [0.0045]*** | [0.0050]*** | [0.0061]*** |
| Constant | 1.3589 | 1.0599 | 1.1351 | 1.1903 | 1.2575 | 1.3330 | 1.4161 | 1.5016 | 1.6273 | 1.7845 |
| | [0.0088]*** | [0.0111]*** | [0.0089]*** | [0.0092]*** | [0.0094]*** | [0.0092]*** | [0.0117]*** | [0.0119]*** | [0.0135]*** | [0.0161]*** |
| Observations | 41449 | 41449 | 41449 | 41449 | 41449 | 41449 | 41449 | 41449 | 41449 | 41449 |
| R-squared | 0.53 | | | | | | | | | |
| | | | | | Specification 2 | | | | | |
| Min. years of education | 0.0204 | 0.0162 | 0.0174 | 0.0180 | 0.0184 | 0.0186 | 0.0192 | 0.0201 | 0.0212 | 0.0223 |
| | [0.0007]*** | [0.0008]*** | [0.0007]*** | [0.0007]*** | [0.0007]*** | [0.0006]*** | [0.0008]*** | [0.0008]*** | [0.0009]*** | [0.0014]*** |
| Vocational degree | -0.0101 | -0.0053 | -0.0080 | -0.0115 | -0.0093 | -0.0102 | -0.0122 | -0.0129 | -0.0216 | -0.0194 |
| | [0.0052]* | [0.0063] | [0.0057] | [0.0052]** | [0.0055]* | [0.0049]** | [0.0060]** | [0.0060]** | [0.0071]*** | [0.0108]* |
| Age:15-24 years old | -0.3000 | -0.1552 | -0.2030 | -0.2230 | -0.2443 | -0.2608 | -0.2894 | -0.3055 | -0.3453 | -0.3907 |
| | [0.0084]*** | [0.0101]*** | [0.0091]*** | [0.0083]*** | [0.0089]*** | [0.0079]*** | [0.0099]*** | [0.0099]*** | [0.0115]*** | [0.0179]*** |
| Age:25-34 years old | -0.1864 | -0.0900 | -0.1305 | -0.1423 | -0.1558 | -0.1659 | -0.1798 | -0.1881 | -0.2073 | -0.2141 |
| | [0.0069]*** | [0.0082]*** | [0.0075]*** | [0.0068]*** | [0.0073]*** | [0.0065]*** | [0.0081]*** | [0.0082]*** | [0.0095]*** | [0.0147]*** |
| Age:35-44 years old | -0.0629 | -0.0143 | -0.0406 | -0.0424 | -0.0519 | -0.0525 | -0.0591 | -0.0630 | -0.0685 | -0.0625 |
| | [0.0067]*** | [0.0080]* | [0.0072]*** | [0.0066]*** | [0.0071]*** | [0.0063]*** | [0.0078]*** | [0.0078]*** | [0.0091]*** | [0.0140]*** |
| Age:45-54 years old | -0.0163 | 0.0201 | -0.0010 | -0.0006 | -0.0065 | -0.0107 | -0.0193 | -0.0242 | -0.0260 | -0.0203 |
| | [0.0065]** | [0.0077]*** | [0.0070] | [0.0064] | [0.0068] | [0.0061]* | [0.0076]** | [0.0076]*** | [0.0089]*** | [0.0136] |
| Tenure in years | 0.0228 | 0.0295 | 0.0270 | 0.0250 | 0.0240 | 0.0227 | 0.0224 | 0.0213 | 0.0199 | 0.0174 |
| | [0.0006]*** | [0.0007]*** | [0.0006]*** | [0.0006]*** | [0.0006]*** | [0.0005]*** | [0.0007]*** | [0.0007]*** | [0.00086]*** | [0.0012]*** |
| Tenure squared/100 | -0.0184 | -0.0334 | -0.0239 | -0.0167 | -0.0149 | -0.0119 | -0.0124 | -0.0116 | -0.0113 | -0.0087 |
| | [0.0021]*** | [0.0025]*** | [0.0023]*** | [0.0021]*** | [0.0022]*** | [0.0019]*** | [0.0024]*** | [0.0024]*** | [0.0028]*** | [0.0044]** |
| Sex: female | -0.1242 | -0.0745 | -0.0803 | -0.0881 | -0.1020 | -0.1107 | -0.1229 | -0.1345 | -0.1536 | -0.1831 |
| | [0.0032]*** | [0.0040]*** | [0.0036]*** | [0.0032]*** | [0.0034]*** | [0.0030]*** | [0.0037]*** | [0.0037]*** | [0.0041]*** | [0.0066]*** |
| Constant | 1.7875 | 1.3543 | 1.4882 | 1.5625 | 1.6458 | 1.7302 | 1.8099 | 1.8759 | 2.1417 | 2.2502 |
| | [0.0332]*** | [0.0395]*** | [0.0358]*** | [0.0326]*** | [0.0348]*** | [0.0309]*** | [0.0386]*** | [0.0386]*** | [0.0448]*** | [0.0692]*** |
| Observations | 41449 | 41449 | 41449 | 41449 | 41449 | 41449 | 41449 | 41449 | 41449 | 41449 |
| R-squared | 0.63 | | | | | | | | | |

Notes: as in Table A1.

Table A3: OLS and quantile estimation results, Sample: males, Year: 1995

| | OLS | Quantile estimations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | Specification 1 | | | | | | | | |
| Min. years of education | 0.0316 | 0.0230 | 0.0244 | 0.0257 | 0.0278 | 0.0296 | 0.0316 | 0.0340 | 0.0352 | 0.0382 |
| | [0.0005]*** | [0.0006]*** | [0.0006]*** | [0.0006]*** | [0.0006]*** | [0.0006]*** | [0.0007]*** | [0.00086]*** | [0.0010]*** | [0.0012]*** |
| Vocational degree | 0.0652 | 0.0825 | 0.0848 | 0.0766 | 0.0804 | 0.0810 | 0.0720 | 0.0558 | 0.0421 | 0.0298 |
| | [0.0066]*** | [0.0080]*** | [0.0085]*** | [0.0078]*** | [0.0077]*** | [0.0078]*** | [0.0087]*** | [0.0100]*** | [0.0114]*** | [0.0133]** |
| Age:15-24 years old | -0.3391 | -0.1738 | -0.2154 | -0.2436 | -0.2806 | -0.3150 | -0.3567 | -0.4006 | -0.4440 | -0.5306 |
| | [0.0117]*** | [0.0142]*** | [0.0150]*** | [0.0138]*** | [0.0137]*** | [0.0140]*** | [0.0155]*** | [0.0179]*** | [0.0207]*** | [0.0242]*** |
| Age:25-34 years old | -0.1529 | -0.0807 | -0.0929 | -0.1119 | -0.1311 | -0.1506 | -0.1646 | -0.1844 | -0.1921 | -0.2194 |
| | [0.0078]*** | [0.0093]*** | [0.0099]*** | [0.0091]*** | [0.0091]*** | [0.0093]*** | [0.0103]*** | [0.0120]*** | [0.0139]*** | [0.0163]*** |
| Age:35-44 years old | -0.0056 | 0.0351 | 0.0321 | 0.0257 | 0.0044 | -0.0066 | -0.0147 | -0.0256 | -0.0247 | -0.0331 |
| | [0.0072] | [0.0088]*** | [0.0093]*** | [0.0085]*** | [0.0084] | [0.0086] | [0.0095] | [0.0109]** | [0.0127]* | [0.0148]** |
| Age:45-54 years old | 0.0531 | 0.0599 | 0.0669 | 0.0672 | 0.0547 | 0.0511 | 0.0507 | 0.0468 | 0.0494 | 0.0459 |
| | [0.0070]*** | [0.0086]*** | [0.0091]*** | [0.0083]*** | [0.0082]*** | [0.0084]*** | [0.0092]*** | [0.0106]*** | [0.0122]*** | [0.0142]*** |
| Tenure in years | 0.0265 | 0.0317 | 0.0311 | 0.0302 | 0.0307 | 0.0299 | 0.0282 | 0.0267 | 0.0232 | 0.0173 |
| | [0.0008]*** | [0.0011]*** | [0.0011]*** | [0.0010]*** | [0.0010]*** | [0.0010]*** | [0.0011]*** | [0.0013]*** | [0.0015]*** | [0.0017]*** |
| Tenure squared/100 | -0.0307 | -0.0417 | -0.0374 | -0.0357 | -0.0379 | -0.0369 | -0.0332 | -0.0315 | -0.0249 | -0.0147 |
| | [0.0029]*** | [0.0038]*** | [0.0039]*** | [0.0035]*** | [0.0034]*** | [0.0035]*** | [0.0038]*** | [0.0044]*** | [0.0051]*** | [0.0059]** |
| Constant | 1.4696 | 1.1286 | 1.2191 | 1.2989 | 1.3634 | 1.4348 | 1.5100 | 1.5952 | 1.7211 | 1.9077 |
| | [0.0091]*** | [0.0104]*** | [0.0114]*** | [0.0107]*** | [0.0107]*** | [0.0109]*** | [0.0120]*** | [0.01387]*** | [0.0157]*** | [0.0179]*** |
| Observations | 25994 | 25994 | 25994 | 25994 | 25994 | 25994 | 25994 | 25994 | 25994 | 25994 |
| R-squared | 0.40 | | | | | | | | | |
| | | Specification 2 | | | | | | | | |
| Min. years of education | 0.0166 | 0.0127 | 0.0131 | 0.0148 | 0.0158 | 0.0152 | 0.0158 | 0.0159 | 0.0175 | 0.0189 |
| | [0.0007]*** | [0.0008]*** | [0.0008]*** | [0.0007]*** | [0.0008]*** | [0.0008]*** | [0.0007]*** | [0.0008]*** | [0.0010]*** | [0.0014]*** |
| Vocational degree | 0.0614 | 0.0521 | 0.0549 | 0.0635 | 0.0668 | 0.0640 | 0.0668 | 0.0626 | 0.0633 | 0.0560 |
| | [0.0063]*** | [0.0077]*** | [0.0076]*** | [0.0063]*** | [0.0073]*** | [0.0070]*** | [0.0069]*** | [0.0074]*** | [0.0093]*** | [0.0127]*** |
| Age:15-24 years old | -0.2713 | -0.1503 | -0.1824 | -0.2004 | -0.2185 | -0.2355 | -0.2704 | -0.3059 | -0.3418 | -0.4120 |
| | [0.0105]*** | [0.0127]*** | [0.0128]*** | [0.0106]*** | [0.0122]*** | [0.0117]*** | [0.0116]*** | [0.0125]*** | [0.0158]*** | [0.0216]*** |
| Age:25-34 years old | -0.1287 | -0.0875 | -0.0877 | -0.1017 | -0.1052 | -0.1109 | -0.1264 | -0.1359 | -0.1475 | -0.1770 |
| | [0.0070]*** | [0.0082]*** | [0.0084]*** | [0.0070]*** | [0.0081]*** | [0.0078]*** | [0.0078]*** | [0.0084]*** | [0.0106]*** | [0.0145]*** |
| Age:35-44 years old | -0.0016 | 0.0215 | 0.0188 | 0.0134 | 0.0075 | 0.0060 | 0.0032 | -0.0016 | -0.0101 | -0.0240 |
| | [0.0065] | [0.0078]*** | [0.0078]** | [0.0065]** | [0.0075] | [0.0072] | [0.0071] | [0.0077] | [0.0096] | [0.0131]* |
| Age:45-54 years old | 0.0452 | 0.0569 | 0.0576 | 0.0488 | 0.0477 | 0.0488 | 0.0466 | 0.0412 | 0.0332 | 0.0354 |
| | [0.0063]*** | [0.0077]*** | [0.0077]*** | [0.0063]*** | [0.0073]*** | [0.0070]*** | [0.0069]*** | [0.0074]*** | [0.0092]*** | [0.0126]*** |
| Tenure in years | 0.0224 | 0.0237 | 0.0249 | 0.0247 | 0.0251 | 0.0244 | 0.0239 | 0.0218 | 0.0192 | 0.0152 |
| | [0.0008]*** | [0.0010]*** | [0.0010]*** | [0.0008]*** | [0.0009]*** | [0.0009]*** | [0.0009]*** | [0.0009]*** | [0.0012]*** | [0.0016]*** |
| Tenure squared/100 | -0.0233 | -0.0240 | -0.0264 | -0.0252 | -0.0264 | -0.0252 | -0.0253 | -0.0208 | -0.0169 | -0.0123 |
| | [0.0026]*** | [0.0033]*** | [0.0033]*** | [0.0027]*** | [0.0031]*** | [0.0029]*** | [0.0029]*** | [0.0031]*** | [0.0039]*** | [0.0054]** |
| Constant | 1.6815 | 1.3497 | 1.3808 | 1.4119 | 1.5052 | 1.5677 | 1.7074 | 1.8968 | 2.0053 | 2.1575 |
| | [0.0582]*** | [0.0697]*** | [0.0696]*** | [0.0576]*** | [0.0663]*** | [0.0635]*** | [0.0626]*** | [0.0674]*** | [0.0842]*** | [0.1157]*** |
| Observations | 25882 | 25882 | 25882 | 25882 | 25882 | 25882 | 25882 | 25882 | 25882 | 25882 |
| R-squared | 0.53 | | | | | | | | | |

Notes: as in Table A1.

Table A4: OLS and quantile estimation results, Sample: males, Year: 2002

| | OLS | Quantile estimations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | | | | Specification 1 | | | | | |
| Min. years of education | 0.0490 | 0.0345 | 0.0383 | 0.0417 | 0.0452 | 0.0464 | 0.0491 | 0.0515 | 0.0539 | 0.0579 |
| | [0.0007]*** | [0.0008]*** | [0.0007]*** | [0.0007]*** | [0.0007]*** | [0.0007]*** | [0.0009]*** | [0.0009]*** | [0.0010]*** | [0.0014]*** |
| Vocational degree | -0.0527 | -0.0172 | -0.0349 | -0.0449 | -0.0572 | -0.0529 | -0.0568 | -0.0591 | -0.0712 | -0.0845 |
| | [0.0067]*** | [0.0086]** | [0.0080]*** | [0.0078]*** | [0.0076]*** | [0.0076]*** | [0.0089]*** | [0.0086]*** | [0.0091]*** | [0.0126]*** |
| Age:15-24 years old | -0.3965 | -0.1837 | -0.2237 | -0.2564 | -0.3091 | -0.3652 | -0.4267 | -0.4783 | -0.5557 | -0.6599 |
| | [0.0122]*** | [0.0153]*** | [0.0142]*** | [0.0140]*** | [0.0137]*** | [0.0138]*** | [0.0162]*** | [0.0157]*** | [0.0167]*** | [0.0233]*** |
| Age:25-34 years old | -0.2453 | -0.1201 | -0.1441 | -0.1597 | -0.1977 | -0.2337 | -0.2754 | -0.2944 | -0.3305 | -0.3756 |
| | [0.0095]*** | [0.0117]*** | [0.0109]*** | [0.0108]*** | [0.0106]*** | [0.0106]*** | [0.0125]*** | [0.0126]*** | [0.0130]*** | [0.0182]*** |
| Age:35-44 years old | -0.0740 | -0.0286 | -0.0267 | -0.0215 | -0.0419 | -0.0649 | -0.0829 | -0.0894 | -0.1168 | -0.1405 |
| | [0.0091]*** | [0.0113]** | [0.0105]** | [0.0104]** | [0.0102]*** | [0.0102]*** | [0.0120]*** | [0.0116]*** | [0.0123]*** | [0.0172]*** |
| Age:45-54 years old | -0.0045 | 0.0497 | 0.0472 | 0.0431 | 0.0245 | 0.0038 | -0.0144 | -0.0280 | -0.0518 | -0.0641 |
| | [0.0087] | [0.0109]*** | [0.0101]*** | [0.0100]*** | [0.0097]** | [0.0097] | [0.0114] | [0.0110]** | [0.0117]*** | [0.0163]*** |
| Tenure in years | 0.0285 | 0.0314 | 0.0311 | 0.0311 | 0.0315 | 0.0310 | 0.0299 | 0.0293 | 0.0274 | 0.0225 |
| | [0.0008]*** | [0.0011]*** | [0.0010]*** | [0.0010]*** | [0.0009]*** | [0.0009]*** | [0.0011]*** | [0.0010]*** | [0.0011]*** | [0.0016]*** |
| Tenure squared/100 | -0.0193 | -0.0199 | -0.0127 | -0.0113 | -0.0147 | -0.0177 | -0.0205 | -0.0242 | -0.0263 | -0.0243 |
| | [0.0029]*** | [0.0040]*** | [0.0036]*** | [0.0034]*** | [0.0033]*** | [0.0033]*** | [0.0038]*** | [0.0037]*** | [0.0039]*** | [0.0055]*** |
| Constant | 1.3888 | 1.0507 | 1.1330 | 1.1909 | 1.2608 | 1.3579 | 1.4513 | 1.5417 | 1.6788 | 1.8715 |
| | [0.0109]*** | [0.0130]*** | [0.0123]*** | [0.0123]*** | [0.0121]*** | [0.0123]*** | [0.0145]*** | [0.0139]*** | [0.0147]*** | [0.0203]*** |
| Observations | 25964 | 25964 | 25964 | 25964 | 25964 | 25964 | 25964 | 25964 | 25964 | 25964 |
| R-squared | 0.52 | | | | | | | | | |
| | | | | | Specification 2 | | | | | |
| Min. years of education | 0.0208 | 0.0165 | 0.0168 | 0.0183 | 0.0184 | 0.0191 | 0.0195 | 0.0209 | 0.0217 | 0.0223 |
| | [0.0008]*** | [0.0011]*** | [0.0009]*** | [0.0009]*** | [0.0009]*** | [0.0010]*** | [0.0009]*** | [0.0010]*** | [0.0012]*** | [0.0015]*** |
| Vocational degree | -0.0124 | -0.0123 | -0.0146 | -0.0116 | -0.0128 | -0.0095 | -0.0104 | -0.0184 | -0.0239 | -0.0202 |
| | [0.0063]** | [0.0082] | [0.0067]** | [0.0067]* | [0.0069]* | [0.0073] | [0.0067] | [0.0074]** | [0.0092]*** | [0.0116]* |
| Age:15-24 years old | -0.3346 | -0.1822 | -0.2342 | -0.2486 | -0.2839 | -0.3012 | -0.3179 | -0.3507 | -0.3895 | -0.4229 |
| | [0.0110]*** | [0.0142]*** | [0.0115]*** | [0.0117]*** | [0.0120]*** | [0.0128]*** | [0.0118]*** | [0.0130]*** | [0.0163]*** | [0.0208]*** |
| Age:25-34 years old | -0.2141 | -0.1111 | -0.1552 | -0.1634 | -0.1860 | -0.2022 | -0.2115 | -0.2249 | -0.2441 | -0.2434 |
| | [0.0085]*** | [0.0108]*** | [0.0088]*** | [0.0090]*** | [0.0092]*** | [0.0099]*** | [0.0091]*** | [0.0101]*** | [0.0126]*** | [0.0162]*** |
| Age:35-44 years old | -0.0685 | -0.0254 | -0.0470 | -0.0473 | -0.0578 | -0.0618 | -0.0637 | -0.0718 | -0.0760 | -0.0621 |
| | [0.0081]*** | [0.0105]** | [0.0085]*** | [0.0087]*** | [0.0089]*** | [0.0095]*** | [0.0087]*** | [0.0096]*** | [0.0120]*** | [0.0152]*** |
| Age:45-54 years old | -0.0165 | 0.0215 | 0.0004 | 0.0052 | -0.0048 | -0.0129 | -0.0202 | -0.0241 | -0.0289 | -0.0189 |
| | [0.0077]** | [0.0099]** | [0.0081] | [0.0082] | [0.0084] | [0.0090] | [0.0083]** | [0.0091]*** | [0.0114]** | [0.0144] |
| Tenure in years | 0.0216 | 0.0282 | 0.0267 | 0.0255 | 0.0242 | 0.0232 | 0.0227 | 0.0211 | 0.0192 | 0.0162 |
| | [0.0007]*** | [0.0010]*** | [0.0008]*** | [0.0008]*** | [0.0008]*** | [0.0009]*** | [0.0008]*** | [0.0009]*** | [0.0011]*** | [0.0014]*** |
| Tenure squared/100 | -0.0165 | -0.0281 | -0.0239 | -0.0210 | -0.0191 | -0.0170 | -0.0165 | -0.0143 | -0.0109 | -0.0074 |
| | [0.0026]*** | [0.0034]*** | [0.0028]*** | [0.0028]*** | [0.0028]*** | [0.0030]*** | [0.0028]*** | [0.0031]*** | [0.0039]*** | [0.0049] |
| Constant | 1.8026 | 1.3386 | 1.4204 | 1.5307 | 1.6210 | 1.8157 | 1.8786 | 1.9067 | 2.2022 | 2.2230 |
| | [0.0490]*** | [0.0578]*** | [0.0495]*** | [0.0512]*** | [0.0528]*** | [0.0565]*** | [0.0520]*** | [0.0567]*** | [0.0658]*** | [0.0828]*** |
| Observations | 25964 | 25964 | 25964 | 25964 | 25964 | 25964 | 25964 | 25964 | 25964 | 25964 |
| R-squared | 0.62 | | | | | | | | | |

Notes: as in Table A1.

Table A5: OLS and quantile estimation results, Sample: females, Year: 1995

| | OLS | Quantile estimations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | Specification 1 | | | | | | | | |
| Min. years of education | 0.0360 | 0.0161 | 0.0204 | 0.0242 | 0.0273 | 0.0320 | 0.0346 | 0.0376 | 0.0428 | 0.0501 |
| | [0.0007]*** | [0.0008]*** | [0.0005]*** | [0.0006]*** | [0.0008]*** | [0.0008]*** | [0.0009]*** | [0.0010]*** | [0.0011]*** | [0.0019]*** |
| Vocational degree | 0.1027 | 0.0942 | 0.0878 | 0.1216 | 0.1121 | 0.1057 | 0.1181 | 0.1096 | 0.0870 | 0.0808 |
| | [0.0210]*** | [0.0236]*** | [0.0166]*** | [0.0189]*** | [0.0225]*** | [0.0242]*** | [0.0256]*** | [0.0278]*** | [0.0286]*** | [0.0470]* |
| Age:15-24 years old | -0.1971 | -0.0843 | -0.1041 | -0.1259 | -0.1594 | -0.1830 | -0.1780 | -0.2000 | -0.2187 | -0.3010 |
| | [0.0143]*** | [0.0161]*** | [0.0115]*** | [0.0128]*** | [0.0154]*** | [0.0166]*** | [0.0177]*** | [0.0193]*** | [0.0202]*** | [0.0335]*** |
| Age:25-34 years old | -0.0580 | -0.0140 | -0.0131 | -0.0216 | -0.0297 | -0.0449 | -0.0355 | -0.0491 | -0.0545 | -0.0949 |
| | [0.01278]*** | [0.0142] | [0.0102] | [0.0114]* | [0.0137]** | [0.0147]*** | [0.0157]** | [0.0171]*** | [0.0178]*** | [0.0295]*** |
| Age:35-44 years old | 0.0526 | 0.0525 | 0.0676 | 0.0737 | 0.0660 | 0.0609 | 0.0739 | 0.0673 | 0.0661 | 0.0259 |
| | [0.0122]*** | [0.0138]*** | [0.0099]*** | [0.0110]*** | [0.0132]*** | [0.0142]*** | [0.0150]*** | [0.0163]*** | [0.0169]*** | [0.0278] |
| Age:45-54 years old | 0.0562 | 0.0373 | 0.0582 | 0.0668 | 0.0589 | 0.0660 | 0.0710 | 0.0637 | 0.0673 | 0.0380 |
| | [0.0125]*** | [0.0142]*** | [0.0101]*** | [0.0113]*** | [0.0135]*** | [0.0145]*** | [0.0154]*** | [0.0166]*** | [0.0172]*** | [0.0282] |
| Tenure in years | 0.0245 | 0.0236 | 0.0243 | 0.0255 | 0.0244 | 0.0246 | 0.0247 | 0.0257 | 0.0256 | 0.0221 |
| | [0.0011]*** | [0.0012]*** | [0.0009]*** | [0.0010]*** | [0.0012]*** | [0.0013]*** | [0.0013]*** | [0.0015]*** | [0.0015]*** | [0.0024]*** |
| Tenure squared/100 | -0.0149 | -0.0217 | -0.0143 | -0.0142 | -0.0079 | -0.0070 | -0.0066 | -0.0116 | -0.0173 | -0.0134 |
| | [0.0044]*** | [0.0051]*** | [0.0036]*** | [0.0040]*** | [0.0048]* | [0.0051] | [0.0054] | [0.0058]** | [0.0059]*** | [0.0095] |
| Constant | 1.1761 | 1.1117 | 1.1169 | 1.1260 | 1.1588 | 1.1708 | 1.1913 | 1.2325 | 1.2706 | 1.3881 |
| | [0.0136]*** | [0.0147]*** | [0.0105]*** | [0.0118]*** | [0.0144]*** | [0.0157]*** | [0.0169]*** | [0.0184]*** | [0.0191]*** | [0.0308]*** |
| Observations | 12077 | 12077 | 12077 | 12077 | 12077 | 12077 | 12077 | 12077 | 12077 | 12077 |
| R-squared | 0.43 | | | | | | | | | |
| | | Specification 2 | | | | | | | | |
| Min. years of education | 0.0151 | 0.0089 | 0.0093 | 0.0103 | 0.0112 | 0.0125 | 0.0138 | 0.0148 | 0.0159 | 0.0183 |
| | [0.0010]*** | [0.0012]*** | [0.0011]*** | [0.0012]*** | [0.0009]*** | [0.0011]*** | [0.0011]*** | [0.0013]*** | [0.0016]*** | [0.0019]*** |
| Vocational degree | 0.0681 | 0.0295 | 0.0226 | 0.0518 | 0.0624 | 0.0771 | 0.0876 | 0.0896 | 0.0586 | 0.0962 |
| | [0.0186]*** | [0.0212] | [0.0211] | [0.0220]** | [0.0175]*** | [0.0214]*** | [0.0204]*** | [0.0242]*** | [0.0288]** | [0.0353]*** |
| Age:15-24 years old | -0.1493 | -0.0914 | -0.0913 | -0.1116 | -0.1193 | -0.1295 | -0.1337 | -0.1382 | -0.1490 | -0.2126 |
| | [0.0127]*** | [0.0145]*** | [0.0145]*** | [0.0150]*** | [0.0120]*** | [0.0147]*** | [0.0142]*** | [0.0169]*** | [0.0201]*** | [0.0251]*** |
| Age:25-34 years old | -0.0405 | -0.0077 | -0.0056 | -0.0143 | -0.0202 | -0.0293 | -0.0360 | -0.0388 | -0.0406 | -0.0748 |
| | [0.0113]*** | [0.0129] | [0.0128] | [0.0133] | [0.0107]* | [0.0131]** | [0.0126]*** | [0.0149]*** | [0.0178]** | [0.0219]*** |
| Age:35-44 years old | 0.0524 | 0.0648 | 0.0667 | 0.0568 | 0.0561 | 0.0544 | 0.0503 | 0.0479 | 0.0486 | 0.0133 |
| | [0.0108]*** | [0.0124]*** | [0.0124]*** | [0.0129]*** | [0.0103]*** | [0.0125]*** | [0.0120]*** | [0.0142]*** | [0.0168]*** | [0.0204] |
| Age:45-54 years old | 0.0480 | 0.0430 | 0.0520 | 0.0482 | 0.0511 | 0.0471 | 0.0405 | 0.0464 | 0.0468 | 0.0183 |
| | [0.0110]*** | [0.0127]*** | [0.0127]*** | [0.0132]*** | [0.0105]*** | [0.0127]*** | [0.0122]*** | [0.0144]*** | [0.0170]*** | [0.0206] |
| Tenure in years | 0.0188 | 0.0239 | 0.0212 | 0.0195 | 0.0191 | 0.0182 | 0.0176 | 0.0172 | 0.0152 | 0.0121 |
| | [0.0010]*** | [0.0011]*** | [0.0011]*** | [0.0012]*** | [0.0009]*** | [0.0011]*** | [0.0011]*** | [0.0013]*** | [0.0015]*** | [0.0019]*** |
| Tenure squared/100 | -0.0063 | -0.0323 | -0.0162 | -0.0060 | -0.0056 | -0.0009 | 0.0023 | 0.0025 | 0.0118 | 0.0165 |
| | [0.0040] | [0.0045]*** | [0.0044]*** | [0.0047] | [0.0037] | [0.0046] | [0.0043] | [0.0051] | [0.0060]** | [0.0074]** |
| Constant | 1.4723 | 1.3263 | 1.3571 | 1.3595 | 1.4001 | 1.4654 | 1.5310 | 1.5905 | 1.6070 | 1.7782 |
| | [0.0390]*** | [0.0424]*** | [0.0446]*** | [0.0458]*** | [0.0369]*** | [0.0447]*** | [0.0427]*** | [0.0499]*** | [0.0600]*** | [0.0697]*** |
| Observations | 12019 | 12019 | 12019 | 12019 | 12019 | 12019 | 12019 | 12019 | 12019 | 12019 |
| R-squared | 0.57 | | | | | | | | | |

Notes: as in Table A1.

Table A6: OLS and quantile estimation results, Sample: females, Year: 2002

| | OLS | Quantile estimations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | Specification 1 | | | | | | | | |
| Min. years of education | 0.0497 | 0.0307 | 0.0341 | 0.0380 | 0.0430 | 0.0455 | 0.0504 | 0.0517 | 0.0549 | 0.0606 |
| | [0.0009]*** | [0.0009]*** | [0.0008]*** | [0.00071]*** | [0.0009]*** | [0.0011]*** | [0.0011]*** | [0.0012]*** | [0.0015]*** | [0.0017]*** |
| Vocational degree | -0.0225 | 0.0121 | -0.0148 | -0.0314 | -0.0346 | -0.0300 | -0.0348 | -0.0401 | -0.0353 | 0.0061 |
| | [0.0111]** | [0.0133] | [0.0113] | [0.00991]*** | [0.0113]*** | [0.0131]** | [0.0138]** | [0.0134]*** | [0.0167]** | [0.0185] |
| Age:15-24 years old | -0.2834 | -0.1571 | -0.1660 | -0.1977 | -0.2599 | -0.2895 | -0.3239 | -0.3359 | -0.3476 | -0.4266 |
| | [0.0161]*** | [0.0193]*** | [0.0167]*** | [0.01421]*** | [0.0164]*** | [0.0189]*** | [0.0200]*** | [0.0195]*** | [0.0245]*** | [0.0273]*** |
| Age:25-34 years old | -0.1613 | -0.0804 | -0.0894 | -0.1108 | -0.1516 | -0.1592 | -0.1935 | -0.1920 | -0.1921 | -0.2282 |
| | [0.0145]*** | [0.0175]*** | [0.0147]*** | [0.0129]*** | [0.0148]*** | [0.0171]*** | [0.0180]*** | [0.0176]*** | [0.0220]*** | [0.0243]*** |
| Age:35-44 years old | -0.0507 | -0.0151 | -0.0123 | -0.0150 | -0.0362 | -0.0360 | -0.0650 | -0.0622 | -0.0631 | -0.0995 |
| | [0.0142]*** | [0.0171] | [0.0144] | [0.0126] | [0.0144]** | [0.0167]** | [0.0175]*** | [0.0171]*** | [0.0213]*** | [0.0235]*** |
| Age:45-54 years old | -0.0148 | 0.0078 | 0.0149 | 0.0156 | -0.0140 | -0.0149 | -0.0381 | -0.0281 | -0.0141 | -0.0419 |
| | [0.01448] | [0.0172] | [0.0146] | [0.0128] | [0.0147] | [0.0170] | [0.0178]** | [0.0173] | [0.0217] | [0.0239]* |
| Tenure in years | 0.0313 | 0.0328 | 0.0302 | 0.0286 | 0.0281 | 0.0283 | 0.0288 | 0.0296 | 0.0281 | 0.0267 |
| | [0.0010]*** | [0.0012]*** | [0.0011]*** | [0.0009]*** | [0.0011]*** | [0.0012]*** | [0.0013]*** | [0.0012]*** | [0.0015]*** | [0.0017]*** |
| Tenure squared/100 | -0.0251 | -0.0406 | -0.0247 | -0.0112 | -0.0029 | -0.0023 | -0.0042 | -0.0112 | -0.0114 | -0.0171 |
| | [0.0043]*** | [0.0053]*** | [0.00461]*** | [0.0040]*** | [0.0045] | [0.0051] | [0.0052] | [0.0051]** | [0.0064]* | [0.0073]** |
| Constant | 1.1660 | 0.9943 | 1.0553 | 1.0959 | 1.1374 | 1.1821 | 1.2264 | 1.2936 | 1.3615 | 1.4854 |
| | [0.0155]*** | [0.0174]*** | [0.01481]*** | [0.0132]*** | [0.0155]*** | [0.0182]*** | [0.0195]*** | [0.0192]*** | [0.0242]*** | [0.0267]*** |
| Observations | 15485 | 15485 | 15485 | 15485 | 15485 | 15485 | 15485 | 15485 | 15485 | 15485 |
| R-squared | 0.45 | | | | | | | | | |
| | | Specification 2 | | | | | | | | |
| Min. years of education | 0.0176 | 0.0129 | 0.0144 | 0.0138 | 0.0142 | 0.0146 | 0.0156 | 0.0164 | 0.0180 | 0.0197 |
| | [0.0011]*** | [0.0014]*** | [0.0011]*** | [0.0010]*** | [0.0010]*** | [0.0009]*** | [0.0011]*** | [0.0013]*** | [0.0015]*** | [0.0021]*** |
| Vocational degree | -0.0109 | 0.0097 | -0.0022 | -0.0041 | -0.0166 | -0.0198 | -0.0153 | -0.0204 | -0.0154 | -0.0090 |
| | [0.0097] | [0.0123] | [0.0094] | [0.0090] | [0.0087]* | [0.0082]** | [0.0100] | [0.0118]* | [0.0125] | [0.0181] |
| Age:15-24 years old | -0.2420 | -0.1265 | -0.1400 | -0.1728 | -0.1896 | -0.1957 | -0.2226 | -0.2569 | -0.2787 | -0.3359 |
| | [0.0140]*** | [0.0180]*** | [0.0136]*** | [0.0131]*** | [0.0126]*** | [0.0119]*** | [0.0146]*** | [0.0173]*** | [0.0187]*** | [0.0270]*** |
| Age:25-34 years old | -0.1348 | -0.0605 | -0.0742 | -0.0982 | -0.1081 | -0.1062 | -0.1200 | -0.1445 | -0.1479 | -0.1683 |
| | [0.0126]*** | [0.0162]*** | [0.0121]*** | [0.0117]*** | [0.0113]*** | [0.0106]*** | [0.0131]*** | [0.0155]*** | [0.0167]*** | [0.0239]*** |
| Age:35-44 years old | -0.0432 | 0.0082 | -0.0011 | -0.0196 | -0.0302 | -0.0279 | -0.0346 | -0.0534 | -0.0480 | -0.0545 |
| | [0.0122]*** | [0.0158] | [0.0119] | [0.0114]* | [0.0110]*** | [0.0103]*** | [0.0127]*** | [0.0150]*** | [0.0161]*** | [0.0229]** |
| Age:45-54 years old | -0.0135 | 0.0182 | 0.0115 | -0.0029 | -0.0160 | -0.0044 | -0.0108 | -0.0275 | -0.0183 | -0.0229 |
| | [0.0124] | [0.0159] | [0.0120] | [0.0115] | [0.0112] | [0.0105] | [0.0129] | [0.0152]* | [0.0163] | [0.0232] |
| Tenure in years | 0.0251 | 0.0325 | 0.0284 | 0.0248 | 0.0236 | 0.0233 | 0.0224 | 0.0208 | 0.0191 | 0.0171 |
| | [0.0009]*** | [0.0012]*** | [0.0009]*** | [0.0009]*** | [0.0008]*** | [0.0008]*** | [0.0009]*** | [0.0011]*** | [0.0012]*** | [0.0017]*** |
| Tenure squared/100 | -0.0263 | -0.0526 | -0.0351 | -0.0208 | -0.0154 | -0.0134 | -0.0106 | -0.0062 | -0.0043 | -0.0034 |
| | [0.0038]*** | [0.0047]*** | [0.0036]*** | [0.0035]*** | [0.0034]*** | [0.0032]*** | [0.0039]*** | [0.0046] | [0.0049] | [0.0072] |
| Constant | 1.6458 | 1.3300 | 1.4183 | 1.5260 | 1.5788 | 1.5813 | 1.6084 | 1.7160 | 1.9706 | 2.0660 |
| | [0.0436]*** | [0.0546]*** | [0.0415]*** | [0.0399]*** | [0.0390]*** | [0.0367]*** | [0.0451]*** | [0.0525]*** | [0.0560]*** | [0.0807]*** |
| Observations | 15485 | 15485 | 15485 | 15485 | 15485 | 15485 | 15485 | 15485 | 15485 | 15485 |
| R-squared | 0.6 | | | | | | | | | |

Notes: as in Table A1.

Table A7: Breakdown of observed wage changed by decile

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | All | | | | |
| Observed pay change (in logs) | -0.021 | -0.014 | -0.008 | -0.008 | 0.007 | 0.048 | 0.100 | 0.147 | 0.195 |
| Composition effects of: | | | | | | | | | |
| worker characteristics | -0.049 | -0.056 | -0.062 | -0.068 | -0.083 | -0.059 | -0.063 | -0.035 | 0.031 |
| job characteristics | -0.033 | -0.012 | -0.017 | -0.026 | -0.010 | 0.007 | 0.062 | 0.094 | 0.115 |
| Price effects of: | | | | | | | | | |
| constant | -0.001 | 0.044 | 0.092 | 0.154 | 0.127 | 0.126 | 0.095 | 0.278 | 0.177 |
| worker characteristics | 0.036 | 0.011 | -0.002 | -0.018 | -0.034 | -0.028 | -0.020 | -0.014 | 0.006 |
| job characteristics | 0.000 | -0.014 | -0.039 | -0.072 | -0.025 | -0.015 | 0.020 | -0.180 | -0.094 |
| Residual effects | 0.026 | 0.012 | 0.020 | 0.021 | 0.031 | 0.017 | 0.005 | 0.003 | -0.039 |
| | | | | | Males | | | | |
| Observed pay change (in logs) | -0.046 | -0.041 | -0.030 | -0.013 | 0.027 | 0.084 | 0.124 | 0.174 | 0.211 |
| Composition effects of: | | | | | | | | | |
| worker characteristics | -0.068 | -0.072 | -0.073 | -0.057 | -0.081 | -0.041 | -0.023 | 0.027 | 0.064 |
| job characteristics | -0.039 | -0.020 | -0.018 | -0.010 | 0.001 | 0.076 | 0.077 | 0.112 | 0.118 |
| Price effects of: | | | | | | | | | |
| constant | -0.011 | 0.040 | 0.119 | 0.116 | 0.248 | 0.171 | 0.010 | 0.197 | 0.066 |
| worker characteristics | 0.023 | -0.016 | -0.012 | -0.041 | -0.032 | -0.032 | -0.016 | -0.005 | 0.017 |
| job characteristics | 0.024 | 0.010 | -0.055 | -0.021 | -0.157 | -0.095 | 0.068 | -0.141 | -0.049 |
| Residual effects | 0.025 | 0.017 | 0.009 | 0.000 | 0.048 | 0.005 | 0.008 | -0.015 | -0.004 |
| | | | | | Females | | | | |
| Observed pay change (in logs) | 0.001 | 0.021 | 0.037 | 0.043 | 0.060 | 0.074 | 0.109 | 0.163 | 0.213 |
| Composition effects of: | | | | | | | | | |
| worker characteristics | -0.042 | -0.037 | -0.035 | -0.041 | -0.045 | -0.031 | -0.028 | 0.007 | 0.036 |
| job characteristics | -0.024 | -0.014 | -0.008 | -0.013 | 0.002 | 0.016 | 0.013 | 0.061 | 0.084 |
| Price effects of: | | | | | | | | | |
| constant | 0.004 | 0.061 | 0.166 | 0.179 | 0.116 | 0.077 | 0.125 | 0.364 | 0.288 |
| worker characteristics | 0.023 | 0.016 | -0.015 | -0.026 | -0.020 | -0.029 | -0.055 | -0.052 | -0.032 |
| job characteristics | -0.004 | -0.024 | -0.085 | -0.070 | -0.007 | 0.048 | 0.042 | -0.195 | -0.125 |
| Residual effects | 0.044 | 0.019 | 0.013 | 0.014 | 0.014 | -0.008 | 0.011 | -0.022 | -0.038 |

Figure A1: Bootstrapped employee characteristics by sex and year

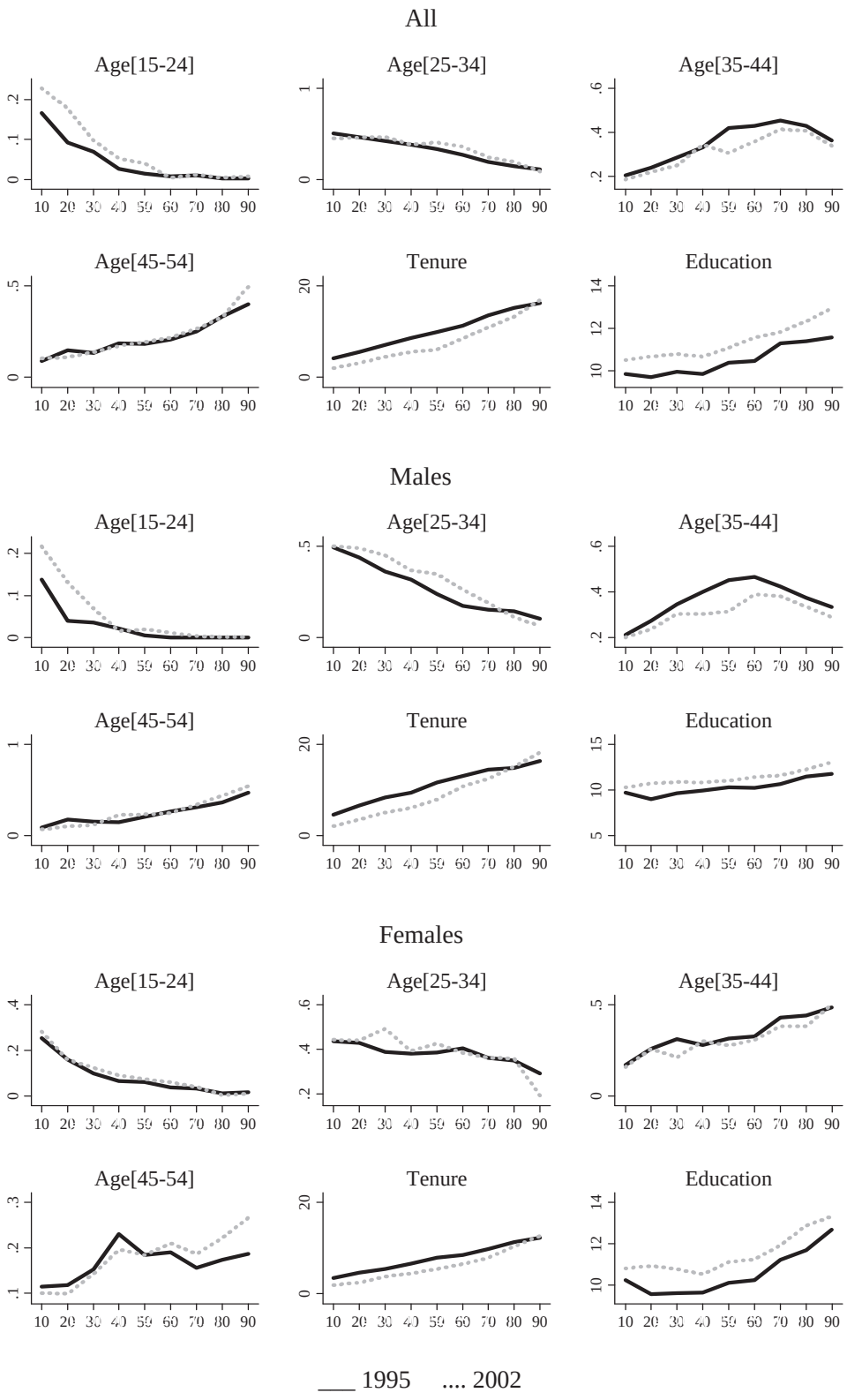

Figure A2: Changes in the estimated returns to employee characteristics over 1995-02