The Determinants of Wages in Croatia: Evidence from Earnings Regressions

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Abstract

The paper explores the determinants of wages in Croatia by using individual record data from the Labor Force Survey for the second half of 2003. Both ordinary least squares and quantile regression estimates of the returns to education, experience and gender are presented. The paper also presents occupation and regional effects on remuneration differentials. Special attention is given to the public-private sector wage gap and its variation across the wage distribution. The study finds that the average public sector wage premium is around 9%. Relatively low-paid workers benefit more from working in the public sector than high-paid workers do. The premium decreases with the education level. Conditional wages of the employees in education sector show that they are the worst positioned among public sector industries. Variance decomposition reveals education and occupation as two major observable causes of wage differentials in Croatia.

Keywords: returns to education, public sector wage premium, quantile regression, Croatia
JEL Classification: J31, P23

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1 Introduction

This paper analyzes the structure of wages in Croatia in the early 2000s using both OLS and quantile regression techniques. It aims to assess the returns to various individual characteristics, as well as the effect of observed job and employer attributes upon wages. Within this background, the emphasis is given to the returns to education and the public-private sector wage gap.

The determinants of wages estimated by earnings regressions have been under examination in developed countries for a long time. In the last decade, empirical research on the topic has been accompanied with studies for transition countries (see e.g. Orazem and Vodopivec, 1995; Rutkowski, 2001; Skoufias, 2003). In the case of Croatia, a majority of earnings analyses has been performed by looking at *average* wages, their evolution in time and cross-section comparisons, without explicit estimation of wage regressions. For example, Nestić, Lovrinčević and Mikulić (2001) compare average wages in public administration and manufacturing industry in Croatia and observe higher average wages in public sector. They conclude that one of the reasons for that is higher education of employees in that sector, but they did not estimate the impact. The only formal estimation of earnings functions for Croatia was undertaken by Bisogno (2000), with the input data for 1998 and by the use of OLS technique.

Another strand of earnings analyses in Croatia was related to the public sector wages in the context of public administration reform and fiscal consolidation. World Bank (2002) reported that public sector wages in Croatia absorbed around 12% of GDP, much more than the average for the Central and Eastern European countries, and that this was more attributable to relatively high wages in public administration than to overstaffed public sector. One of the policy recommendations that followed was to contain public sector salaries. On the other side, unions claim that public sector employees are underpaid and that their relative position, compared to the private sector, has worsened recently. The main argument for the claim is found in the comparison of *average* wages in industry and pubic administration. The factors behind differences in the averages of private and public sector wages were completely left aside in this discussion.

This paper goes well beyond average wages for certain groups of employees. It uses individual record data from the Labor Force Survey as a base for wage regressions and is intended to provide a detailed description of the determinants of wages in Croatia. Moreover, quantile regression techniques employed in the study allow for exploring the

effect of each of the explanatory variables across the whole distribution, rather than just the effect upon the mean like in least squares estimates.

The paper is structured as follows. Section 2 presents the data sources and preliminary evidence on wage distribution in Croatia. Section 3 contains model specification. Section 4 comments on the major findings in wage equation estimate such as the effects of education, experience, gender, occupation, firm size and location. The impact of each of the explanatory variable on the dispersion of conditional wage distribution is estimated as well. Section 5 is devoted to the public-private sector wage gap. In addition to the gap estimated in general case, gap is also estimated at various education levels, for males and females separately, for different coverage of public sector and for several most common occupations. The return to education is presented in the Section 6. Section 7 provides the results of variance decomposition aimed at estimation of relative importance of the different factors explaining wage inequality. Section 8 offers concluding comments.

2 Data Description

The data employed in this study was obtained from *Labor Force Survey* (LFS) for the second half of 2003. The survey was carried out by the *Central Bureau of Statistics* (CBS) and administered to a random sample of Croatians living throughout the country. It covered 7,070 households and 19,529 resident individuals of all ages and employment status. For the purpose of this study, the sample was restricted to those over 15 years of age, who were in paid employment and were not self-employed. The latter is because entrepreneurial skills and capital invested in self-employment generate remuneration that cannot be separated from payment for work. Occasional and family workers were excluded also as their earnings exhibit an unclear link to human capital attributes. A total of 4,825 individuals were left in the sample. The survey collects information on usual monthly wages on the main job (net of contributions and taxes) and hours of work usually performed per week, thus making it possible to obtain hourly wage rates. Hourly wages were preferred so as to compensate for possible differences in wages stemming from variations in working hours. There is also abundant information on individual characteristics such as gender, age, actual work experience and education but also on employer and job characteristics, among which we use firm size, industry, ownership status, occupation and working conditions.

Table 1. **Summary statistics of wage distribution**

	No. of obs.	Mean wage per hour	Std. dev.	Median wage per hour	q0.9/q0.1	q0.75/q0.25
All	4825	21.26	11.25	18.75	2.80	1.77
Females	2211	20.00	10.03	18.13	2.82	2.00
Males	2614	22.32	12.09	20.00	2.89	1.73
Public sector	2182	23.86	9.70	22.50	2.50	1.58
Private sector	2643	19.11	11.98	15.63	2.96	1.75
Unfinished primary	84	15.67	7.25	13.75	2.33	1.56
Primary	632	15.92	7.86	14.88	2.19	1.50
Voc. secondary	1630	17.94	7.95	16.25	2.57	1.75
Gen. secondary	1501	20.84	8.81	20.00	2.40	1.60
2-year college	372	27.13	13.39	25.00	2.14	1.43
College graduate	563	32.96	13.83	30.00	2.63	1.50
Postgraduate	43	46.80	20.37	43.75	2.67	1.36

Data source: LFS 2003/II.

Table 1 presents summary statistics of wage distribution for sampled individuals while means and standard deviations of variables used in the study can be found in Table A1 in the Appendix. There are 46% of women in the sample, and around 45% of employees are working in the public sector. It has to be noted that public/private sector distinction here is based on the ownership status.[1] In that way, public sector is defined in a wide sense, enterprise included. About 15% of workers have got only primary school education or lower, while on the other hand, some college or postgraduate degree accounts for 21% of workers in the sample. Secondary education obviously prevails among Croatian workers.

The average wage for workers from the sample is a little over 20 kuna per hour. The wage rate is, on average, higher for men than for women, and higher for public sector employees as compared to private sector employees. As expected, the higher the educational level, the higher the average wage rate associated with it. It can be noted that all the averages considered here are unconditional means, meaning that none of the

[1] *Such a classification follows from the survey questionnaire, where surveyed individuals (employees) are asked to position themselves among those "working in state-owned enterprises, institutions and organizations", "working in enterprises undergoing the process of privatization", and "working for employers in the private sector". In this study, the first two categories (of which the second one is minor) are considered the public sector. Regardless of definition, relatively high portion of employment in the state-owned sector reminds once again on the disproportionate role of the Government in the economy, and to the need to give stronger role to the private sector as still-standing policy goal in Croatian transition to full-flaged market economy.*

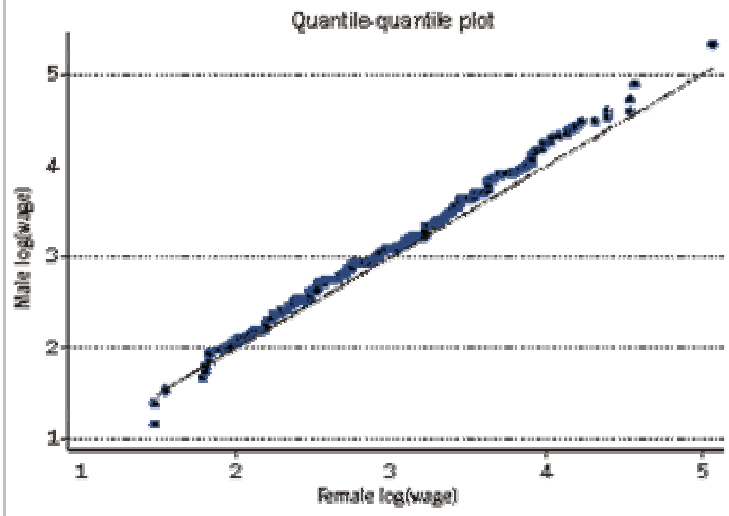
differences in the stock of human capital or job characteristics of selected groups were taken into account. The means are, however, sensitive to outliers. Therefore, median wages are also presented as well as selected quantile (percentile) ratios for specific groups. The median wage is lower than the mean wage for all groups, indicating that the distributions are skewed to the right. Quantile ratio 0.9/0.1 of 2.8 for the total sample seems rather low by the standards of industrialized countries, suggesting rather compressed distribution of hourly wages.[2] Also, this may indicate a problem of underreporting, presumably more pronounced at the upper tail of the distribution. It seems that there are no striking differences in 0.9/0.1 and 0.75/0.25 quantile ratios between wage distributions for males and females, or between wage distributions for workers with different educational attainment. However, public sector wages seem less dispersed than private sector wages.

A more informative comparison of distributions can be provided by quantile-quantile plot. This kind of graph relates quantiles of the variable on the vertical axis to quantiles of the variable on the horizontal axis. A point at the symmetry line indicates that a quantile of one distribution has the same value as the corresponding quantile of the other distribution. Figure 1 contains two plots of wage distributions separated by gender and sector. The upper panel of the figure provides quantile-quantile plot of distributions of log hourly wages for male and female workers. Most of the observations are slightly above the diagonal line, implying that wages for male workers are a bit higher than wages for female workers for comparable quantiles of wage distributions. At lower to middle quantiles the difference is quite small, but when approaching higher quantiles, the male/female wage gap becomes larger. In other words, among higher-paid workers there is a larger relative discrepancy between male and female wages than among lower-paid workers. The lower panel of Figure 1 shows a quantile-quantile plot of log wage distributions for public and private sector workers. It can be seen that public sector wages are higher than private sector wages at lower and middle quantiles, while at higher quantiles private sector workers are generally paid more. This evidence illustrates the importance of investigating wages at different points of distribution.

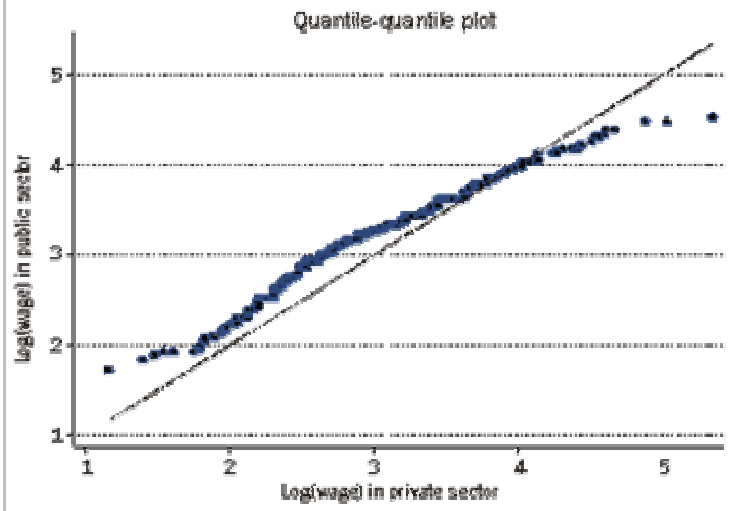
[2] *Gini coefficient of hourly wages calculated from our sample is 0.25, which is lower than in other transition countries, where it is around 0.30 as reported in Rutkowski (1991). Compressed wage distribution in Croatia is observed also in Rutkowski (2003).*

Figure 1. **Quantile-quantile plots of empirical distributions**

(a) Distributions of log wages for males and females



(b) Distributions of log wages for public and private sector workers



The observed (unconditional) wage differential between male and female or between public and private sector employees could be due to a difference in the stock of human capital, which further implies different productivity. As part of the preliminary evidence, Table 2 suggests that formal education could be an important factor in explaining sector-

based wage differences. Observed higher wages in the public sector may be due to the fact that public sector employees are better educated than their counterparts in the private sector, at least if judged by the share of post-secondary education. However, it seems that education differences could not help much in explaining gender-based wage differentials as employed women are generally better educated than employed men.

Table 2. **Educational attainment of employees by sector and gender (in %)**

	Private sector	State sector	Male	Female
Unfinished primary	1.8	1.7	2.3	1.1
Primary	13.6	12.5	12.9	13.3
Vocational secondary	41.8	24.1	42.8	23.2
General secondary	30.7	31.6	25.9	37.3
2-year college	4.7	11.4	6.3	9.4
College graduate	7.2	17.0	8.8	15.0
Post-graduate	0.2	1.7	1.0	0.8

Data source: LFS 2003/II.

3 Model Specification

The earnings functions used in this study follow the standard Mincer-type specification (Mincer, 1974), where the log wage rate is regressed to the set of variables representing individual characteristics of workers, but also job and company characteristics. In addition to the model estimated by OLS, the quantile regressions are run to enable further insight into the structure of wages.

Quantile regression techniques allow exploring the effect of each of the explanatory variables across the whole distribution, rather than just the effect upon the mean like in least squares estimates.[3] An estimation procedure in the quantile regression model can be viewed as the problem of minimizing a sum of absolute residuals.[4] To put it simply, the solution at different quantiles is found by asymmetrical weighting of absolute residuals.

[3] *The quantile regression model was originally introduced by Koenker and Bassett (1978). For the notion of quantile regressions, see Koenker and Hallock (2001), while for a more detailed exposition of recent advances in the technique see Bushinsky (1998).*

[4] *Quantile regression models are also known as least absolute value models (LAV or MAD) and L1-norm (from minimizing L1-norm of vector of deviations) models. Historically, the method of least absolute deviations was first proposed by renowned Croatian scientist Ruđer Bošković (aka Ruggero Giuseppe Boscovich) in his observations on the Earth's flattening in 1757, even before the least squares work of Gauss in 1809. For a brief exposition of Bošković' method see, for example, Teunissen (2000).*

For the estimation at lower quantiles, the higher weights are given to the negative residuals, and the opposite is done at upper quantiles. Unlike some other estimation procedures aimed to characterize different parts of distribution, here the estimation is performed using all available observations.

The quantile regression model is formulated as

$$\ln W_i = X_i'\beta_\theta + u_{\theta i}, \qquad \text{Quant}_\theta(\ln W_i \mid X_i) = X_i'\beta_\theta, \tag{1}$$

where ln W_i denote the log wage of worker i, X_i is a vector of explanatory variables, $X_{i1} \equiv 1$, and β_θ is a vector of coefficients. $\text{Quant}_\theta(\ln W \mid X)$ denotes θth conditional quantile of ln$W$, conditional on the regressor vector X. Partial derivative of the conditional quantile of ln$W$ with respect to regressor j, $\partial \text{Quant}_\theta(\ln W \mid X) / \partial x_j$ could be interpreted as the marginal change in the θth conditional quantile due to marginal change in the j th element of X. When X contains a set of distinct variables, than every one of these derivatives is given just by $\beta_{\theta j}$, measuring marginal change mentioned above. An interesting case would appear if the β_θ coefficients vary systematically across θ's, indicating that the marginal effect of particular explanatory variable is not uniform across different quantiles of the conditional distribution of ln$W$.

Quantile regressions are estimated at five points of the log (hourly) wage distribution; 0.10, 0.25, 0.50, 0.75 and 0.90 quantiles. In order to take into account a correlation among the various quantile regressions, the quantiles are estimated simultaneously, thus allowing a formal comparison of coefficients describing different quantiles. Estimations of standard errors are obtained via bootstrapping using 50 replications.[5]

Vector X used in the empirical estimation in this section includes variables representing education, experience, occupation, company size and region, and dummy variables for women, immigrants, non-regular working hours, rural area and public sector employees.

Education is defined by a set of seven dummy variables, describing the highest degree obtained.[6] A dummy takes the value 1 if a person holds a degree and 0 otherwise. In

[5] *In quantile regressions, the bootstrap standard errors could be preferable to those calculated analytically as suggested by Rogers (1992). In this study, estimation procedures are performed using STATA software package.*

[6] *Concerning educational attainments, an alternative was to use the number of years of formal education. However, preliminary runs including quadratic specification showed lower explanatory power of this variable.*

regressions, unfinished primary school dummy is omitted. Work experience is defined as the total years of actual employment, including experience with former employers. Occupation is represented by a set of dummy variables for each of the ten occupation categories defined according to standard (ISCO) classification. The omitted category is elementary occupation. There are four dummies for company size, defined with respect to the number of employees. The dummy for firms with the less than 10 employee is omitted in regressions[7]. The region variable consists of five dummies for territorial units defined according to a NUTS-2 proposal for Croatia that was made by a CBS-appointed task group in 2004 (not yet officially adopted). Each regional dummy takes the value 1 if an individual lives in the region and 0 otherwise. The dummy for Northern Croatia is the referent category. The dummy variable for living in a rural area takes the value 1 if an individual lives in a rural area and 0 otherwise. The dummy for immigrants takes the value 1 if someone has come from abroad to the current place of residence since 1991, the year when Croatia declared its independence and when war operations in the wider region began.[8] The dummy variable for non-regular working hours is defined in order to pick up the effect of bad working conditions and takes the value 1 in two cases: (i) if one always works nights, and (ii) if one sometimes works nights *and* sometimes on Saturdays *and* sometimes on Sundays.[9] In all other cases this dummy takes the value 0. The public sector dummy takes the value 1 if an individual works in state-owned institutions and enterprises, and 0 otherwise. A set of fourteen dummies for industry affiliation is

[7] *Oi and Idson (1999) find that the wage gap in large enterprises over small firms is rather large. They provide several theoretical explanations that might be also relevant for Croatia, from monitoring costs and efficiency wages to some productivity hypotheses. However, the aim of this variable in our study is not just to account for possibly different practices in the wage setting among companies of different size, but also to check for bias in underreporting. Anecdotal evidence suggests that the practice in small privately-owned firms is to pay a portion of the earning in a regular way, including taxes, and another portion in cash without proper documentation or tax obligations. In that case, one can imagine that an employee interviewed within LFS reports only a regular part of the earnings, for she might consider only this part of the earnings the "usual monthly wage on the main job".*

[8] *"Immigrant" is possibly not a fully correct term since most of individuals entering Croatia in post-1991 period are ethnic Croats having Croatian citizenship and arriving from neighboring countries, without need to go through any specific administrative procedure usually connected with immigration. This variable is chosen to account for some specific problems of adoption that can be reflected in wage differentials.*

[9] *This criterion might seem rather weak in describing "bad" working conditions, but only 16 percent of Croatian workers were exposed to such conditions. Apart from the always/sometimes/never distinction in working at nights and weekends, other indications of working conditions were not available in the Labor Force Survey.*

included in only one regression specification, aimed at exploring industry wage variations. Otherwise, the industry variable is not used.[10]

4 Wage Function Estimates

Table 3 presents the coefficients obtained in OLS and quantile regression estimates of wage function in Croatia. The overall explanatory power of the regressions seems satisfactory. Most of the coefficients are significant at a 5% level. A log-linear specification of the wage function allows us to treat the coefficient (if multiplied by 100) as a percentage change in conditional hourly wage that was due to marginal change in a corresponding regressor. Since explanatory variables are mostly defined as dummy variables, interpretation of the coefficients should be done relative to the omitted category. For instance, coefficients for general secondary education in the OLS estimate indicate that average wage for a worker who completed general secondary school is expected to be 21% higher than wage of a worker who did not finish primary school, all other characteristics being equal.

Some of the estimated coefficients are quite uniform over the whole range of distribution (i.e. similar at different quantiles of the conditional wage distribution) and consistent with the least squares result. However, some coefficients are largely different for various quantiles. The statistically significant difference in the coefficients at the lower and upper quantiles suggests that a corresponding variable is associated with an increase or a decrease in the *dispersion* (inequality) of conditional wages. Table 4 reports on the "coefficients" that are in fact the differences between the 0.9 and 0.1 quantile coefficients, and the 0.75 and 0.25 quantile coefficients. For a variable with significant and positive differences, its marginal effect increases as one moves along the distribution that further implies spreading out the conditional wage distribution, and vice versa. Interpretation of the results presented in Table 4 will be parallel to that referring to Table 3.

[10] *Although industry wage differentials might be substantial, inclusion of the industry variable to account for unobserved differences in ability is questioned by Krueger and Summers (1988). However, industry wage differentials in Croatia might be affected by ownership, since there are industries that are clearly dominated by state-ownership such as utilities, education, health care and public administration. Since this study is more interested in ownership effect and wants to have it distinguished from industry effect, variables for industry affiliation are not used in the analysis, unless otherwise stated.*

Table 3. **OLS and quantile regressions (dependent variable: log wage per hour)**

	OLS	Quantile				
		0.10	0.25	0.50	0.75	0.90
Constant	**2.361**	**1.929**	**2.169**	**2.332**	**2.546**	**2.761**
	(0.043)	**(0.073)**	**(0.046)**	**(0.047)**	**(0.053)**	**(0.120)**
Education (vs. unfin. primary)						
Primary	*0.067*	*0.101*	0.042	**0.085**	*0.084*	*0.109*
	(0.039)	*(0.062)*	(0.046)	**(0.043)**	*(0.045)*	*(0.116)*
Voc. secondary	**0.133**	**0.158**	**0.107**	**0.166**	**0.156**	**0.184**
	(0.039)	**(0.067)**	**(0.045)**	**(0.040)**	**(0.046)**	**(0.124)**
Gen. secondary	**0.215**	**0.232**	**0.218**	**0.242**	**0.225**	**0.257**
	(0.040)	**(0.068)**	**(0.047)**	**(0.041)**	**(0.048)**	**(0.122)**
2-year college	**0.334**	**0.351**	**0.312**	**0.355**	**0.372**	**0.390**
	(0.044)	**(0.076)**	**(0.046)**	**(0.045)**	**(0.058)**	**(0.123)**
College graduate	**0.463**	**0.403**	**0.405**	**0.471**	**0.562**	**0.608**
	(0.052)	**(0.081)**	**(0.057)**	**(0.047)**	**(0.065)**	**(0.139)**
Post-graduate	**0.690**	**0.552**	**0.624**	**0.658**	**0.816**	**0.816**
	(0.071)	**(0.121)**	**(0.076)**	**(0.078)**	**(0.111)**	**(0.153)**
Experiance	**0.012**	**0.015**	**0.014**	**0.011**	**0.014**	**0.010**
	(0.002)	**(0.003)**	**(0.002)**	**(0.002)**	**(0.002)**	**(0.003)**
Experiance sq. (/100)	**-0.019**	**-0.028**	**-0.025**	**-0.016**	**-0.024**	*-0.014*
	(0.005)	**(0.008)**	**(0.005)**	**(0.005)**	**(0.006)**	*(0.008)*
Female	**-0.153**	**-0.095**	**-0.126**	**-0.158**	**-0.180**	**-0.205**
	(0.010)	**(0.019)**	**(0.014)**	**(0.014)**	**(0.012)**	**(0.021)**
Immigrant	**-0.061**	-0.054	**-0.096**	**-0.095**	**-0.086**	0.007
	(0.030)	(0.043)	**(0.044)**	**(0.028)**	**(0.035)**	(0.063)
Occupation (vs. elementary)						
Plant&machine oper.	**0.063**	0.019	0.044	**0.069**	**0.095**	**0.079**
	(0.022)	(0.042)	(0.027)	**(0.021)**	**(0.027)**	**(0.037)**
Craftsman	**0.176**	**0.184**	**0.175**	**0.169**	**0.174**	**0.188**
	(0.022)	**(0.033)**	**(0.025)**	**(0.019)**	**(0.019)**	**(0.042)**
Farming	-0.004	0.062	0.024	-0.010	0.056	*0.094*
	(0.056)	(0.238)	(0.058)	(0.070)	(0.061)	*(0.057)*
Service&sales	**0.064**	*0.064*	**0.074**	**0.082**	**0.072**	**0.049**
	(0.021)	*(0.035)*	**(0.028)**	**(0.024)**	**(0.023)**	**(0.035)**
Clerk	**0.226**	**0.266**	**0.219**	**0.223**	**0.259**	**0.238**
	(0.021)	**(0.037)**	**(0.027)**	**(0.022)**	**(0.022)**	**(0.034)**
Technician	**0.343**	**0.352**	**0.369**	**0.349**	**0.324**	**0.313**
	(0.024)	**(0.045)**	**(0.026)**	**(0.024)**	**(0.028)**	**(0.041)**
Professional	**0.391**	**0.481**	**0.421**	**0.379**	**0.322**	**0.407**
	(0.041)	**(0.064)**	**(0.045)**	**(0.045)**	**(0.055)**	**(0.069)**
Management&adm.	**0.703**	**0.616**	**0.597**	**0.638**	**0.718**	**0.877**
	(0.062)	**(0.121)**	**(0.072)**	**(0.080)**	**(0.103)**	**(0.116)**
Military	**0.384**	**0.555**	**0.455**	**0.389**	**0.347**	**0.321**
	(0.048)	**(0.052)**	**(0.044)**	**(0.043)**	**(0.033)**	**(0.058)**
Non-regular hours	**0.080**	0.037	0.030	**0.085**	**0.113**	**0.140**
	(0.014)	(0.029)	(0.019)	**(0.016)**	**(0.017)**	**(0.027)**

Table 3. (Continued)

	OLS	Quantile				
		0.10	0.25	0.50	0.75	0.90
Firm size (vs. <10 empl.)						
10-50 empl.	**0.069** **(0.015)**	**0.067** **(0.027)**	**0.061** **(0.017)**	**0.062** **(0.015)**	**0.049** **(0.017)**	0.023 (0.025)
50-200 empl.	**0.065** **(0.015)**	**0.081** **(0.027)**	**0.053** **(0.016)**	**0.043** **(0.014)**	*0.029* *(0.018)*	0.026 (0.021)
>=200 empl.	**0.101** **(0.016)**	**0.072** **(0.033)**	**0.075** **(0.015)**	**0.102** **(0.017)**	**0.092** **(0.016)**	**0.073** **(0.021)**
Region (vs. north)						
West	**0.069** **(0.018)**	0.045 (0.028)	**0.042** **(0.018)**	**0.057** **(0.018)**	**0.057** **(0.024)**	**0.066** **(0.027)**
Central	**0.070** **(0.015)**	0.032 (0.025)	**0.046** **(0.021)**	**0.083** **(0.016)**	**0.082** **(0.019)**	**0.083** **(0.027)**
East	**-0.038** **(0.017)**	**-0.086** **(0.025)**	**-0.072** **(0.020)**	*-0.032* *(0.017)*	-0.027 (0.022)	0.005 (0.026)
South	**0.046** **(0.017)**	0.014 (0.028)	0.016 (0.022)	**0.059** **(0.019)**	*0.040* *(0.022)*	0.048 (0.033)
Rural	**-0.041** **(0.010)**	**-0.038** **(0.019)**	**-0.029** **(0.012)**	**-0.030** **(0.011)**	**-0.046** **(0.012)**	*-0.033* *(0.019)*
Public	**0.086** **(0.011)**	**0.182** **(0.023)**	**0.164** **(0.014)**	**0.114** **(0.011)**	**0.053** **(0.013)**	-0.011 (0.016)
(R2) Pseudo R2	(0.466)	0.255	0.310	0.320	0.300	0.291

Notes: The numbers in parentheses are standard errors computed using bootstrap estimator. The standard errors for the least-squares estimates are computed using White method. Bold letters indicate significance at a 5%-level, whereas italics indicate significance at a 10%-level.

Having a regression specification shown in Table 3, the constant may be interpreted as the conditional quantile of the log wage distribution (or the conditional expectation of log wage in case of the OLS estimate) for a male employee with unfinished primary school and no experience, who is engaged in some elementary occupation, working in a private firm with less than 10 employees with regular working hours and living in an urban part of Northern Croatia. For example, the median of the conditional wage distribution for this group of employees is around 10 kuna per hour.[11]

[11] *Conditional distribution is the distribution of wages that would result in a sample of individuals who are all identical with respect to the observed attributes.*

Table 4. **Impact upon dispersion of conditional log wage distribution**

	0.90-0.10 Interquantile regression		0.75-0.25 Interquantile regression	
	Coef.	**Std. err.**	**Coef.**	**Std. err.**
Education (vs. unfin. primary)				
Primary	0.007	0.116	0.042	0.056
Vocational sec.	0.026	0.119	0.049	0.060
General sec.	0.026	0.124	0.006	0.062
2-year college	0.039	0.121	0.060	0.070
College graduate	0.206	0.142	**0.157**	**0.072**
Postgraduate	0.264	0.183	0.192	0.127
Experiance	-0.005	0.003	-0.001	0.002
Experience sq.(/100)	0.015	0.010	0.001	0.006
Female	**-0.110**	**0.025**	**-0.054**	**0.013**
Immigrant	0.060	0.084	0.010	0.045
Occupation (vs. elementary)				
Plant&machine operator	0.060	0.059	0.052	0.036
Craftsman	0.004	0.048	-0.002	0.026
Farming	0.032	0.225	0.032	0.070
Service&sales	-0.016	0.041	-0.002	0.030
Clerk	-0.028	0.043	0.040	0.036
Technician	-0.039	0.048	-0.045	0.036
Professional	-0.074	0.080	-0.099	0.060
Management&admin.	0.261	0.159	0.120	0.111
Military	**-0.233**	**0.068**	**-0.108**	**0.041**
Non-regular hours	**0.102**	**0.040**	**0.083**	**0.020**
Firm size (vs. <10 empl.)				
10-50 empl.	-0.044	0.041	-0.011	0.020
50-200 empl.	*-0.055*	*0.033*	-0.024	0.021
>=200 empl.	0.001	0.034	0.017	0.020
Region (vs. north)				
West	0.022	0.040	0.016	0.029
Central	0.051	0.031	0.036	0.024
East	**0.091**	**0.042**	0.045	0.026
South	0.034	0.041	0.024	0.025
Rural	0.005	0.022	-0.017	0.016
Public	**-0.193**	**0.028**	**-0.111**	**0.019**

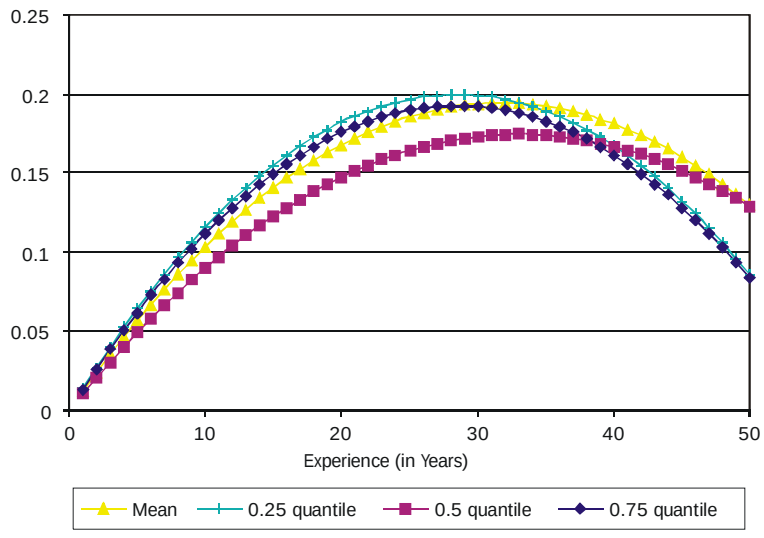
Note: Standard errors are computed using bootstrap estimator. Bold letters indicate significance at a 5%-level whereas italics indicate significance at a 10%-level.

The effect of education on wages increases with education level. At the 0.5 (median) quantile, wage for a worker who completed primary school was 8.5% higher than for someone who did not complete primary school, while for a worker with a post-graduate degree the difference over unfinished primary school is around 65%, other things being equal. The effect of education is a bit stronger in median regression estimates than in OLS estimates of the mean effect, except for the postgraduate education. Completed primary education does not necessarily ensure an increase in wages when compared to unfinished primary school, since a positive value of the coefficient is not significant at

the usual 5% levels (except at the medium of conditional wage distribution). It seems that the Croatian economy values unfinished and finished primary school roughly the same, and what makes a difference in the quest for higher wages is secondary and higher education. It also appears that general secondary education could provide higher wages than vocational secondary education.

The pattern of the education effect across different quantiles of conditional wage distribution is not very clear, although the effect seems stronger at higher quantiles. The results of formal testing for difference between coefficients presented in Table 4 suggest that education beyond primary school is not associated with higher dispersion of wages in a statistically significant way. The only exception is college education that significantly affects the 0.75-0.25 quantile spread of conditional wage distribution, as compared to the distribution for unfinished primary school. One interesting policy implication could be depicted here. An increase in the education level of the Croatian labor force that might be achieved in the future would not necessarily lead to a greater wage inequality.

Figure 2. **Effect of experience**



The impact of experience on wages was assessed by means of coefficients for both a linear and a quadratic term of the years of experience. The cumulative effect of the two experience variables estimated at different points of the conditional wage distribution is depicted in Figure 2. The pattern of the effect is concave, increasing for less experienced workers, peaking at experience of around 30 years and decreasing thereafter. An employee with actual work experience of 30 years can expect, on average, almost 20% higher wages than a new entrant. However, the return to any additional year of experience after working for more than 30 years is negative. The experience-wage profiles at the various quantiles are not distinct in any particular order.

The Croatian labor market allows some disparity between wages for males and females, particularly at the right tail of the distribution, as revealed by the coefficients on dummy variable for female shown in Table 3. At the 0.1 quantile of the conditional wage distribution, employed women earn about 10% less than men, but at the 0.9 quantile the difference is higher and their wage is 20% lower. In other words, in high-paid jobs, women are relatively more disadvantaged then in low-paid jobs. On average, women earn some 15% less than men with the same observed characteristics. It can be noted that disclosed gender wage gap in Croatia is substantial, but comparable to many other countries.[12]

Workers who moved to Croatia after 1991 are faced with certain wage penalty, as compared to workers residing in the country for a longer period. The effect is estimated to be significant only at the central part of conditional wage distribution. At the lower and upper tails of the conditional distribution, the difference in wages between native and non-native workers was not statistically significant. However, on average (estimated by OLS), immigrants can expect to earn some 6% less than other comparable workers do.

Occupation of the worker is an important factor in wage determination. Having controlled for other observed characteristics shown in Table 3, it can be seen that all other occupations yield higher wages than elementary occupations (except farming), especially management and administration related jobs. No systematic behavior of the occupation effects can be revealed for different quantiles at which regressions are estimated.

[12] *Machado and Mata (2001) report on resembling (in level, but also in pattern across wage distribution) gender wage differential in Portugal in mid 1990s, just as Garcia, Hernandez and Nicolas (2001) for Spain. Rutkowski (2001) finds gender-based differential in transition countries in the late 1990s in a range of 20-30%. Orazem and Vodopivec (1995) estimated the gap in Slovenia at around 10% in the early 1990s.*

Working at night and on weekends can produce higher wages, as revealed by the coefficient for non-regular working hours dummy. The effect is much more relevant at the upper tail of the conditional wage distribution. For example, the wage premium for non-regular working hours at the 0.9 quantile of the conditional distribution is 14%, much higher than at the median. Relatively low-paid workers hardly can benefit from unpleasant timing of work, since the positive effect on wage is rather low, and it is not statistically significant at usual levels.[13]

Larger companies tend to pay more to workers with the same characteristics. The average hourly wage for a worker in a company with more than 200 employees can be some 10% higher than for someone with the same attributes working in a firm with up to 10 employees. The effect of the company size does not appear to exert a clear pattern along the conditional wage distribution.

The regional-based differences in wages in Croatia are notable. Otherwise comparable worker in Central Croatia can earn some 10% more than a worker in Eastern Croatia. Such a difference is not very sensitive to the choice of the quantile at which we estimate regression. Moreover, a worker's residence in a rural area is usually associated with lower wages.

The marginal effect of regressors on the dispersion of conditional wage distributions shown in Table 4 is informative for further elaboration. Similar to education, it can be seen that occupation, company size and region generally exhibit no significant differences in the marginal effects at the upper and lower tail of the distribution. It appears that these variables exert only a pure location shift effect on the conditional wage distribution. For this effect, the quantile regression results are mostly compatible with the OLS results. However, the effects of gender, ownership and irregular working hours are not constant across the conditional distribution of log wages. For these three variables, quantile regression results do a good job representing a whole range of effects along the wage distribution. For example, the conditional wage distribution for women is less dispersed than that for men, implying that the gender pay gap should be significantly different at higher quantiles than at lower quantiles. Non-regular working hours spread out the conditional wage distribution meaning that their effect on wages is stronger for highly paid jobs. State ownership tends to compress the wage spread.

[13] *It can be noted here that an additional job holding was not proved to be significant determinant of wages in main job. This might suggest that acceptance of a low-paid regular job was not motivated by an additional job holding.*

5 Public-Private Sector Wage Gap

The regression coefficients for the public sector dummy variable shown in Table 3 describe the wage premium related to work in state-owned institutions and enterprises, as compared to work in private sector. A positive value implies wage premium for working in public sector, while a negative one depicts existence of wage penalty. It can be seen that the public sector wage premium varies with the quantile of conditional wage distribution; it is substantial at the lower tail but it gradually ceased out as we move along the distribution. That premium is statistically insignificant at the higher tail. For example, at the 0.10 quantile, a public sector worker is estimated to be paid about 18% percent more than a worker with the same attributes but working in the private sector. At the 0.75 quantile, a public sector wage premium is around 5%, while at the 0.9 quantile we find negative premium (penalty), but not statistically significant at usual levels. In other words, relatively low-paid workers benefit more from working in the public sector than high-paid workers do.

The OLS estimate suggests that a worker in the public sector can expect some 9% higher hourly wage than a worker with the same characteristics in the private sector. Presumably high underreporting of wages in private sector may challenge this finding. However, the estimated model controls for the company size, so it might account for underreporting in small, predominantly private firms. The problem of relatively high wages that are underreported remains and it is probably more pronounced for private sector wages. However, there are several factors working in favor of observed public sector premium. First, the choice of the hourly wage as a dependent variable takes into account longer working hours of private sector workers.[14] The most usual comparison of wages in Croatia is made for wages on a monthly level, thereby overlooking working hours as an important factor for wage determination. Second, unions are more pervasive in the public sector, and this could be putting upward pressure on wages. Third, high unemployment in Croatia allows private sector employers to find workers they need even when they offer poor wages. Fourth, for state-owned sector there is political pressure to behave as a "good" employer providing relatively high wages, especially because the cost-cutting market pressures are mostly lacking.

[14] *The data from our sample shows that an average public sector worker is engaged 40.7 hours per week, while for a private sector worker the average is 42.3 hours.*

The public/private sector wage gap observed in Table 3 is estimated in a model specification that constrains the gap to be the same, regardless of education level. It is interesting to employ the alternative specification that allows the coefficients to change across the various education levels. This is done by interacting the set of educational dummies with the indicator variable for the public sector and by including these interactive dummies in the previous specification.[15] Table 5 presents resulting coefficients for interactive variables that are to be interpreted as public sector wage premiums by education level.

Table 5. **Public sector wage premia by educational attainment**

	OLS	Quantile				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Unfin. primary	0.061	0.140	**0.205**	*0.158*	0.010	-0.340
	(0.070)	(0.124)	**(0.075)**	*(0.082)*	(0.081)	(0.238)
Primary	**0.106**	**0.097**	**0.139**	**0.161**	**0.099**	0.030
	(0.028)	**(0.038)**	**(0.034)**	**(0.032)**	**(0.032)**	(0.053)
Voc. secondary	**0.085**	**0.129**	**0.142**	**0.126**	**0.087**	0.029
	(0.018)	**(0.044)**	**(0.026)**	**(0.022)**	**(0.022)**	(0.030)
Gen. secondary	**0.097**	**0.219**	**0.193**	**0.109**	**0.056**	-0.038
	(0.017)	**(0.042)**	**(0.025)**	**(0.023)**	**(0.021)**	(0.025)
2-year college	**0.084**	**0.366**	**0.232**	**0.113**	-0.052	**-0.146**
	(0.041)	**(0.060)**	**(0.047)**	**(0.047)**	(0.061)	**(0.079)**
College graduate	*0.057*	**0.280**	**0.161**	-0.013	-0.055	0.007
	(0.034)	**(0.067)**	**(0.047)**	(0.048)	(0.045)	(0.068)
Post-graduate	-0.219	0.296	-0.148	-0.317	**-0.339**	-0.181
	(0.183)	(0.468)	(0.403)	(0.204)	**(0.159)**	(0.142)

Notes: The numbers in parentheses are standard errors computed using bootstrap estimator. The standard errors for the least-squares estimates are computed using White-Huber method. Bold letters indicate significance at a 5%-level, whereas italics indicate significance at a 10%-level.

The quantile regression results suggest two findings. First, the level of premium is sensitive to the choice of the quanile at all education levels. With only a few exemptions, there is a much higher premium associated with working in the public sector at low than at high quantiles. In other words, the premium is higher for low-paid workers than for high-paid workers at all education levels. Higher educated public sector workers are often faced with a negative premium (penalty), especially those at high quantiles. This further implies that the conditional wage distribution for public sector workers is more compressed than for private sector workers, and this seems to be valid for every

[15] *This approach is applied by Poterba and Rueben (1994).*

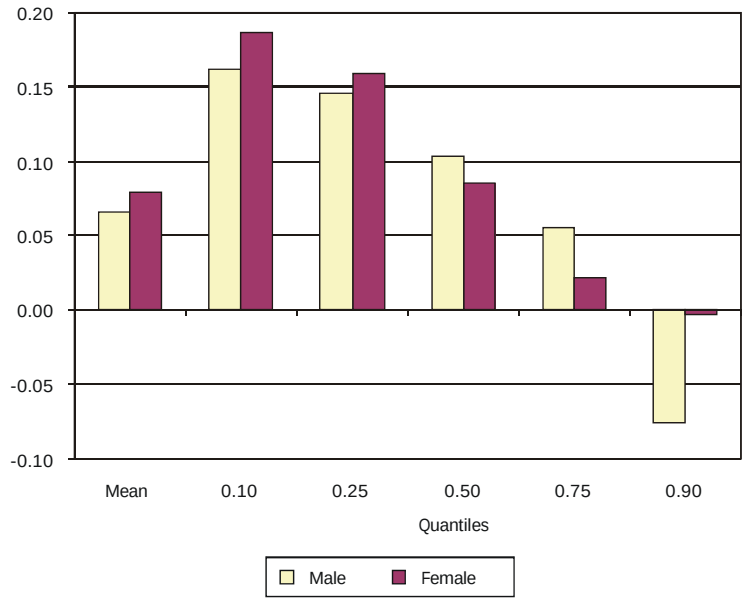
education level. However, results for unfinished primary school and postgraduate education exhibit certain problems with the statistical significance that is related to the small sample. Second, the public sector wage premium is substantial at a lower to middle level of education and it turned negative (penalty) at college and post-graduate education, as suggested by the estimation at the middle of the distribution (0.50 quantile). The OLS estimate mostly confirms the second finding, but with still positive public sector wage premium for college graduates.

Labor market situation in Croatia can explain observed pattern of the premium. There is rather high unemployment among workers who obtained primary and secondary education that allows private sector employers to set wages for these workers well below public sector ones. For relatively scarce highly educated workers, however, private sector employers need to ensure higher wages than public sector to attract them to move in.

Gender-based differences in the public sector wage premium are also explored. Separate wage equations for males and females were run with the interest in the coefficients for public sector dummy evaluated at various points of the conditional wage distribution. Figure 3 shows the result. On average (OLS estimate) the public sector wage premium is higher for a female worker than for a male worker. For both, males and females, the premium diminishes as we move along the distribution and it became negative at the upper tail. For low-paid jobs, i.e. at the lower quantile, the premium is a bit higher for females than males.[16] At the 0.90 quantile, males employed in the public sector are faced with substantially lower wages than otherwise comparable males employed in the private sector. For high-paid female workers, such a wage gap between sectors is statistically insignificant.

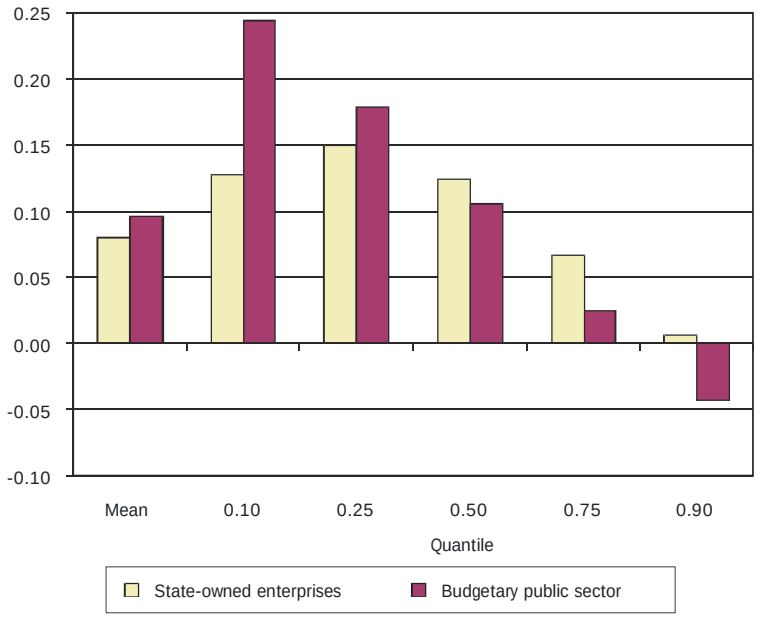
[16] *The similar finding is documented in Mueller (1998), and Disney and Gosling (1998).*

Figure 3. **Public-private sector wage gap by gender**



Our definition of the public sector as state-owned institutions and enterprises may be challenged with the alternative in the quest for the difference in wage determination between state-owned enterprises and state-owned institutions. Since the Labor Force Survey does not allow direct distinction between the two parts of the wider public sector, a combination of employer's ownership status and the industry is employed. State-owned employers in public administration, education and health care are considered "budgetary public sector", and state-owned employers in other industries are considered "state-owned enterprises". The first term is chosen since the central government budget in Croatia in fact provides for wages of employees in public education, public health care and, of course, public administration. The wage function is re-estimated by using the same set of explanatory variables as previously but two public sector dummies, for budgetary public sector and for state-owned enterprises. The estimated coefficients for these dummies can be interpreted as the wage premium over the private sector. The result is presented in Figure 4.

Figure 4. **Public-private sector wage gap**



On average, the budgetary public sector pays higher wage premium over the private sector than state-owned enterprises do. A worker in the budgetary public sector can expect an hourly wage of almost 10% over the wage of a worker with the same observable characteristics but working in the private sector. However, there is a difference in the premium at various points of the conditional wage distribution. Budgetary public sector pays rather high premium at the lower tail of the distribution, and a negative one at the upper tail. In other words, in the budgetary public sector, low-paid workers are relatively better off compared to high-paid workers. For state-owned enterprises, the variation in premium along the distribution is smaller than for the budgetary public sector. At the 0.9 quantile, there is no statistically significant difference in conditional wages between workers in state-owned enterprises and workers in the private sector. State-owned enterprises managed to keep track in wages with the private sector for high-paid workers, and even to provide the premium for low- and middle- paid workers.

Table 6. **Industry effects**

	OLS		Median regression	
	Coef.	**Std. err.**	**Coef.**	**Std. err.**
Industry (vs. agriculture)				
Mining	0.044	0.052	-0.044	0.075
Manufacturing	0.013	0.029	-0.037	0.047
Utilities	**0.158**	**0.033**	**0.128**	**0.044**
Construction	**0.116**	**0.033**	0.075	0.047
Retail&wholesale	0.012	0.030	-0.021	0.045
Hotels&restaurants	0.049	0.034	-0.005	0.054
Transport&comm.	**0.182**	**0.032**	**0.152**	**0.046**
Fin. intermediation	**0.267**	**0.038**	**0.238**	**0.049**
Real estate	0.045	0.039	0.003	0.051
Public admin.	**0.174**	**0.030**	**0.117**	**0.046**
Education	*0.054*	*0.030*	0.020	0.044
Health	**0.132**	**0.031**	*0.078*	*0.047*
Community services	**0.088**	**0.039**	0.054	0.049

Notes: Variables controlled for in the regressions are education, experience, gender, occupation, region, firm size, non-regular working hours, and gender. The standard errors for the least-squares estimates are computed using White-Huber method, while for median regression they are computed using the bootstrap method. Bold letters indicate significance at a 5%-level, whereas italics indicate significance at a 10%-level.

The interest in the public sector wage premium is sometimes more specific and directed towards differences among wages in public administration, education and health care. Therefore, we estimate a wage function that includes a set of industry dummies along with other explanatory variables such as education, experience, occupation, firm size, region and other factors, but excludes the public sector dummy. In that way we cannot explicitly estimate a public sector wage premium, but rather an industry-related premium. However, public administration, education and health care are industries dominated by state-owned institutions, meaning that any industry-related premium in these sectors can be interpreted, at least partially, as the public sector wage premium of a particular industry.

The coefficients for industry variables and associated standard errors estimated in OLS and median regressions are presented in Table 6. The results of other quantile regressions are not shown since they are similar to median regression. The omitted industry was agriculture, meaning that coefficients are to be interpreted in relation to it. The ordering of the industry-related wage differentials is of particular interest. The OLS estimate reveals that, after controlling for education, experience, occupation and other factors, the best-paid workers are occupied in the financial industry. Other “premium” industries are transport and communications, public administration, utilities and health care.

Interestingly, in the Croatian economy all these industries, besides financial one, can be considered "public". While public administration and health care are directly dependent on the government budget, transport and utilities are industries dominated by state-owned enterprises in the field of public transport, postal service, energy, water and gas distribution. Obviously, employees of these state-dominated industries have higher wages than employees with comparable characteristics working in agriculture, manufacturing industry and retail trade. Comparable wages of employees in education show that they are the worst positioned among public sector industries. The same conclusion can be drawn from median regression results.

Table 7. **Occupation-specific public sector wage premia**

	No. of obs.		Premium
	Private	Public	
Elementary occ.	229	222	**0.086** **(0.034)**
Service&sales	578	224	**0.201** **(0.030)**
Clerk	321	359	**0.137** **(0.022)**
Technician	333	513	-0.038 (0.030)
Professional	139	345	-0.005 (0.037)

Notes: Public sector wage premium was obtained as the coefficient on public sector dummy in earnings regression, estimated by OLS for each occupation separately. Variables controlled for in the regressions are education, experience, experience squared, region, firm size, non-regular working hours, and gender. Robust standard errors are reported in parentheses. Bold letters indicate significance at a 5%-level.

An additional illustration of the public-private sector wage gap can be made with respect to occupations. To address this issue, we estimate wage equations separately for several occupations that are common in both the public and the private sector. The coefficient for the public sector dummy variable in each regression can be treated as a public sector wage premium. The resulting coefficients estimated by OLS and presented in Table 7 show that the public sector wage premium is most pronounced in medium-skill occupations. For a worker in services and sales, the wage premium for the public sector is around 20 percent. For clerks, the premium is about 14 percent. However, for high-skill occupations such technicians and professionals, the difference between public and private sector wages is statistically insignificant.

6 Returns to Education

The discussion that follows shifts the focus on education. Marginal effects of education on conditional wages that are discussed above should be interpreted in relation to the omitted education level i.e. unfinished primary school. However, one may wish to assess the effect of education between adjacent levels. For example, what is the effect on wages of the general secondary school graduation, as compared to holding a primary school degree. Having results from Table 3, one should calculate the difference in the marginal effects (i.e. coefficients) between two adjacent education levels. The mentioned example gives an effect of 15.7% in median regression, depicting an increase in the conditional wage at the median due to general secondary school graduation. This effect is sometimes called return to education. However, the most common interpretation of the return on education is in terms of the wage effect of one additional year of education. Therefore, calculation of the returns of education at different levels of education should be done by dividing the increase in the marginal effect of education between two adjacent education levels by the length of schooling between those levels. For example, the return to general secondary education at the θth quantile is defined as

$$R^{ed}_{\theta,GenSec} = \frac{\beta_{\theta,GenSec} - \beta_{\theta,Prim}}{s_{GenSec} - s_{Prim}} \tag{2}$$

where $\beta_{\theta,\ GenSec}$ and $\beta_{\theta,\ Prim}$ are the coefficients on general secondary education and primary education estimated for the θth quantile regression, and s_{GenSec} and s_{Prim} are years of schooling usually needed to complete general secondary and primary education. Analogous calculation can be performed for other education levels. As "usual" schooling time for accomplishing primary, vocational secondary, general secondary, 2-year college, college and postgraduate education we took 8, 11, 12, 14, 16, and 18.5 years, respectively. These figures are close to actual averages calculated from the sample.

Table 8 presents estimated returns on education. As can be seen, a return to additional year of education increases with the education level. This conclusion is robust to the choice of quantiles and holds also for the least squares estimate.[17] This finding can be a motivation for private investment in human capital in Croatia, since it obviously pays off more and more as one raises the education level.

[17] *There are only two deviations from the observed pattern, one at the 0.1 quantile for graduate education and the other at the 0.9 quantile for post-graduate education.*

Table 8. **Returns to education by level (as per year, relative to the previous level)**

	OLS	Quantile				
		0.10	0.25	0.50	0.75	0.90
Voc. secondary (relative to the primary)	0.022	0.019	0.022	0.027	0.024	0.025
Gen. secondary (relative to the primary)	0.037	0.033	0.044	0.039	0.035	0.037
2-year college (rel. to the gen. secondary)	0.059	0.060	0.047	0.057	0.074	0.066
College graduate (rel. to the 2-year college)	0.065	0.026	0.046	0.058	0.095	0.109
Post-graduate (rel. to the coll. graduate)	0.091	0.060	0.088	0.075	0.102	0.083

Note: Return to education is calculated as the increase in the marginal effect of education between two adjacent education levels divided by years of schooling usually performed between that levels. The result is based on regressions presented in Table 3. Further description is provided in the text.

Psacharopoulos (1994) in his work on returns to education criticized the inclusion of too many variables in the earnings function, other than human capital variables, especially the estimation of earnings functions within occupations that results in artificial downward bias in the returns to education. Following this objection, Table 9 reports the return on education derived from the same earnings regressions as before, but without occupation dummies. It is not surprising that resulting returns on education are now higher because education and occupation are often closely related, for education provides the qualifications for more skill-demanding and higher-paying occupations. An additional year of schooling in post-secondary education (2-year college, college graduates and post-graduates) can increase wages by about 10 percent, as estimated by OLS.[18] Similar results are obtained by median regression estimates. Results for other quantiles are not shown since they are not significantly different from the median regression. A distinct difference in returns to education is seen between general secondary, and vocation secondary education in favor of the former. In addition to the observed effect, general secondary school degree in the Croatian education system allows one to continue education at higher schools, while vocational education does not. Evidently, general secondary education pays off more than vocation secondary education.

[18] *Observed effect is close to the average of the European and Middle East countries, and the average of upper middle income countries, as reported by Psacharopoulos (1994).*

Table 9. **Returns to education by level – alternative specification (as per year, relative to the previous level)**

	Overall		Private sector		State sector	
	OLS	**Median**	**OLS**	**Median**	**OLS**	**Median**
Voc. secondary (relative to the primary)	0.043	0.052	0.040	0.046	0.045	0.056
Gen. secondary (relative to the primary)	0.075	0.083	0.068	0.068	0.080	0.086
2-year college (rel. to the gen. secondary)	0.109	0.111	0.103	0.114	0.111	0.113
College graduate (rel. to the 2-year college)	0.103	0.081	0.126	0.144	0.090	0.069
Post-graduate (rel. to the coll. graduate)	0.101	0.092	0.216	0.178	0.086	0.086

Note: See Table 8, except that here results are based on regressions without occupation dummies as regressors.

Returns to education calculated for public and private sector separately reveal a distinct valuation of education by these two sectors. Graduate and post-graduate education is substantially more valued in the private sector, while secondary education pays off more if engaged in the public sector.[19] In the private sector, the return to additional year of schooling increases with the education level, while in the public sector education beyond a 2-year college decreases the yearly return. However, if we take into account completed college education (a 4-year college) and assess the return relative to the general secondary education, the return to college graduation is higher than return to secondary education, even in the public sector[20].

7 Accounting for Wage Differentials

The relative importance of the different set of variables in explaining wage variations can be estimated by the variance decomposition technique. Starting with the estimates of wage function, and following Fields (2003), the log-variance of wage is decomposed as

$$s_j(\ln W) = \frac{\mathrm{cov}[\beta_j X_j, \ln W]}{\sigma^2(\ln W)} = \frac{\beta_j * \sigma(X_j) * \mathrm{cor}[X_j, \ln W]}{\sigma(\ln W)} \quad (3)$$

[19] *Šošić (2004) reports on the average return to education in Croatia of 10.5% in 2001, which was lower in the public sector.*

[20] *The public sector return to additional year of schooling in college education, relative to the general secondary education is around 10% in OLS estimation, and around 9% in median regression.*

where $s_j(\ln W)$ denotes the share of the log-variance that is attributable to the j'th explanatory factor. Note that $R^2(\ln W)$ is the fraction of the log variance that is explained by all the X's taken together. The fraction of the explained variance that is attributable to the j'th factor can be calculated as $s_j(\ln W)/R^2(\ln W)$. The log variance decomposition is applicable only at the conditional mean, i.e. the least squares estimate.

Table 10. **Contribution of selected factors to log-wage inequality**

	Equation 1 (incl. occupation) contribution as a percentage of:		Equation 2 (excl. occupation) contribution as a percentage of:	
	Total variance	**Explained variance**	**Total variance**	**Explained variance**
Education	15.2	32.6	27.2	65.5
Experience	3.0	6.4	3.8	9.1
Gender	2.0	4.4	2.3	5.5
Ownership	2.9	6.3	3.5	8.5
Location	2.4	5.2	2.6	6.4
Occupation	18.8	40.4	-	-
Firm size	1.5	3.3	1.5	3.7
Other	0.6	1.3	0.6	1.4
Total explained (=R2)	46.6	100.0	41.6	100.0
Unexplained	53.4	-	58.4	-
Total	100.0	-	100.0	-

As can be seen from the first two columns of Table 10, education and occupation are prevailing factors explaining the differences in log hourly wages. The difference in education levels explains around 15% of wage variations, representing 1/3 of the inequality explained by the wage regression that includes occupation regressors. Occupation differences account for 19% of the total variance in wages and 40% of the explained variance. Other measurable factors are less important in explaining wage differentials. Expirience, gender, ownership, location, and company size account each for less than 3% of the total variance of hourly wages.

A strong influence of occupations on wage inequality can be questioned by the objection that education is often a prerequisite for high paid occupations and therefore an ultimate source of observed inequality. The second wage equation that is estimated without occupation variables and used for the variance decomposition, shows a much stronger contribution of education. It seems that the contribution of occupation is now almost entirely attributed to education, since minor changes occurred in other observable

factors. Therefore, it can be concluded that education is the key factor in explaining wage variations in Croatia.

A comparison of these results to the variance decomposition of wage inequality in Bulgaria, Hungary, Macedonia and Poland in mid 1990s (Rutkowski, 2001) reveals that education in Croatia is a stronger contributor than elsewhere, but close to the result for Hungary. The wage gap between public and private sector in Croatia is responsible for a much higher portion of variance in wages than in above transition countries. The log variance decomposition for Croatia in 1998 (Bisogno, 2000) produced broadly consistent results with these in Table 10.

8 Concluding Remarks

This paper offers a detailed description of the conditional wage distribution in Croatia in 2003. The results of wage regressions point that wages are increasing with the education level, that there is a certain wage gap between males and females and that unpleasant work hours can increase wages of high paid workers, but not of those at the bottom part of the distribution. It appears also that larger firms provide higher wages and that there are notable regional differences in wages of otherwise comparable workers. However, the most striking findings are related to the public/private sector wage gap.

The analysis shows substantial public sector wage premium paid to the majority of its employees. The existent premium is robust to the definition of public sector used: public administration, state-owned enterprises, budgetary public sector, and wider enterprise-included public sector. The premium over private sector is highest for low-paid, low- to medium-skilled and female employees. It diminishes for highly educated males, especially those at the higher tail of the wage distribution. If looked by industries, it seems that education is the least privileged part of the public sector. Wages paid for workers in budgetary public sector are of special policy interest due to regular wage negotiations between the Government and unions, the fiscal implications of the wage agreements and the reform in the public administration system. In that respect, evidences from this study may be important for some policy decisions. A differentiated policy treatment might be needed for various groups within public sector if aimed to achieve more equitable returns to education and other worker's attributes across public sector, and between the public and private sector. The compressed wage structure in public

sector, especially at the upper end of the distribution might be released as to increase incentives for work and prevent migration of senior administration to private sector.

Further improvement of the study could be directed towards accounting for sample selection problem and analyzing in more details some specific elements of wage differentials (for example, returns to education, gender wage gap or wage discrimination in general). Adding the time dimension to the study should be the natural next step in the analysis.

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Appendix

Table A1. **Means and standard deviation of variables**

Variable	**Mean**	**Std. dev.**
Net monthly wage (in kunas)	3508	1905
Wage per hour (in kunas)	21.26	11.25
Log wage per hour	2.95	0.44
Education&other individual characteristics		
Unfinished primary	0.02	0.13
Primary	0.13	0.34
Vocational sec.	0.34	0.47
General sec.	0.31	0.46
2-year college	0.08	0.27
College graduate	0.12	0.32
Postgraduate	0.01	0.09
Years of schooling	11.83	2.49
Experience	16.88	10.56
Age	39.16	10.64
Immigrant	0.03	0.18
Female	0.46	0.50
Employer characteristics (size&sector)		
<10 empl.	0.19	0.39
10-50 empl.	0.25	0.44
50-200 empl.	0.25	0.43
>=200 empl.	0.31	0.46
Agriculture	0.03	0.18
Mining	0.01	0.09
Manufacturing	0.23	0.42
Utilities	0.03	0.16
Construction	0.09	0.29
Retail&wholesale	0.15	0.35
Hotels&restaurants	0.06	0.23
Transport&comm.	0.08	0.27
Fin. intermedietion	0.02	0.15
Real estate	0.04	0.20
Public admin.	0.08	0.27
Education	0.07	0.26
Health	0.07	0.26
Community services	0.04	0.19
Public sector	0.45	0.50
Job characteristics (occupation&conditions)		
Elementary occupation	0.09	0.29
Plant&machine operator	0.13	0.34
Craftsman	0.16	0.37
Farming	0.01	0.09
Service&sales	0.17	0.37
Clerk	0.14	0.35
Technician	0.18	0.38
Professional	0.10	0.30
Management&admin.	0.01	0.12
Military	0.01	0.09
Non-regular hours	0.16	0.37
Region		
North	0.15	0.36
West	0.13	0.34
Central	0.36	0.48
East	0.17	0.37
South	0.19	0.39
Rural	0.39	0.49

Note: Means of indicator variables (such as educational attainment, firm size, sector of activity, occupation, region etc.) should be considered as proportions of total.
Data source: LFS 2003/II.