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Wage Differences between the Private and the Public  
Sector in Serbia: Some Evidence from Survey Data





# The wiiw Balkan Observatory

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Shortly after the end of the Kosovo war, the last of the Yugoslav dissolution wars, the Balkan Reconstruction Observatory was set up jointly by the Hellenic Observatory, the Centre for the Study of Global Governance, both institutes at the London School of Economics (LSE), and the Vienna Institute for International Economic Studies (wiiw). A brainstorming meeting on Reconstruction and Regional Co-operation in the Balkans was held in Vouliagmeni on 8-10 July 1999, covering the issues of security, democratisation, economic reconstruction and the role of civil society. It was attended by academics and policy makers from all the countries in the region, from a number of EU countries, from the European Commission, the USA and Russia. Based on ideas and discussions generated at this meeting, a policy paper on Balkan Reconstruction and European Integration was the product of a collaborative effort by the two LSE institutes and the wiiw. The paper was presented at a follow-up meeting on Reconstruction and Integration in Southeast Europe in Vienna on 12-13 November 1999, which focused on the economic aspects of the process of reconstruction in the Balkans. It is this policy paper that became the very first Working Paper of the wiiw Balkan Observatory Working Papers series. The Working Papers are published online at [www.balkan-observatory.net](http://www.balkan-observatory.net), the internet portal of the wiiw Balkan Observatory. It is a portal for research and communication in relation to economic developments in Southeast Europe maintained by the wiiw since 1999. Since 2000 it also serves as a forum for the Global Development Network Southeast Europe (GDN-SEE) project, which is based on an initiative by The World Bank with financial support from the Austrian Ministry of Finance and the Oesterreichische Nationalbank. The purpose of the GDN-SEE project is the creation of research networks throughout Southeast Europe in order to enhance the economic research capacity in Southeast Europe, to build new research capacities by mobilising young researchers, to promote knowledge transfer into the region, to facilitate networking between researchers within the region, and to assist in securing knowledge transfer from researchers to policy makers. The wiiw Balkan Observatory Working Papers series is one way to achieve these objectives.



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*This study has been developed in the framework of research networks initiated and monitored by wiiw under the premises of the GDN–SEE partnership.*

The Global Development Network, initiated by The World Bank, is a global network of research and policy institutes working together to address the problems of national and regional development. It promotes the generation of local knowledge in developing and transition countries and aims at building research capacities in the different regions.

The Vienna Institute for International Economic Studies is a GDN Partner Institute and acts as a hub for Southeast Europe. The GDN–wiiw partnership aims to support the enhancement of economic research capacity in Southeast Europe, to promote knowledge transfer to SEE, to facilitate networking among researchers within SEE and to assist in securing knowledge transfer from researchers to policy makers.

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**Wage Differences between the Private and the Public Sector in Serbia:  
Some Evidence from Survey Data**

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**Abstract:** In this paper is estimated the wage gap between the public and the private sector in Serbia, for women and men separately. The results show that, with advance of the transition, the public sector generates wage premium for those who work in that sector compared to the employed in the private sector. The public sector overpaid both men and women compared to their counterparts in the private sector, but the estimated wage premium for women is lower compared to the estimated wage premium for men (22.3 percent and 25.4 percent, respectively; both estimates are statistically significant). The only group of workers who are penalized for working in the public sector is comprised of women and men who have higher education. In order to estimate the sectoral wage gap by gender several regression models were used: the quantile regressions, the pooled OLS regression and the fixed-effects panel data model. The data that are used in the analysis are taken from the Serbian Living standard measurement surveys for 2003 and 2007.

**Key words:** transition, wage differences, public and private sectors, living standard measurement survey data.

*JEL classification:* J21, J31, J38, P2.

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## **I. Introduction**

Serbia experienced a significant increase of earnings in the first several years of economic transition. This acceleration in wages was not supported by the appropriate rise in productivity. The inflation was persistent, but the annual rates of inflation followed a slightly decreasing trend. At the same time, development of the labour market was unfavourable (World Bank 2002, 2004). The employment rates for both men and women decreased sharply, and this decrease affected women in a higher percentage than men. Almost  $\frac{1}{4}$  of women lost their jobs during that decade; significant part of these women belongs to the right side of the age distribution, most of them never found another job. Their obsolete skills and elderly age were the factors that pushed them out of the labour force. Over the years, particularly the female participation rates in Serbia continuously decreasing and they stood at below 60 percent by the end of 1990s (Krstić and Reilly 2000). The male participation rate also decreased, but it stood at over 70 percent.

The evolution of the Yugoslav women participation in paid work was favourable during the self-management. Petrin and Humphries (1980) covered the period after the Second World War and shown that women in Yugoslavia in childbearing age were increasingly active. According to the data presented in their article, the female labour market participation in the 20-34 age group increased from 50.8 percent in 1953 to 54.6 percent in 1971, while for the 35-49 age group this increase was even higher, i.e. from 34.9 percent to 60.2 percent. At the same time, the female labour market participation rate for the 15-19 age group decreased from 65.9 percent in 1953 to 38.2 percent in 1971 and it was explained by the rise in the female high school enrollment rates. It was the pool for future employment of women in the sectors of manufacture and services, but unfortunately most of them experienced all negative faces of the transition. The women's participation on the labour market in Serbia during the last decade of the 20th century followed a similar path as in the other Central and Eastern European and former Soviet Union countries (Brainerd 2000).

According to the official data, employment in the public sector in Serbia has had a rising trend over the second phase of the transition, engaging more than one third of the wage earners. More than 40 percent of the female wage earners are employed within the public sector, while 30 percent of

employed male have job in the public sector (according to the Labour force survey data for 2007). At the same time, both men and women participate in the private sector employment by similar percentages (the Labour force survey data for 2007 show that the private sector is employer for 53.9 (50.8) percent of the male wage earners (female wage earners), respectively), but the male employment in the private sector has developed faster compared to the female employment. Additionally, the percentage of women employed in the public sector raised by more than 8 percent, while the percentage of men employed in the same sector dropped by 8 percent. In the light of expected downsizing in public companies and current rationalization of the number of employees in the state administration, the public sector in Serbia has its limits regarding a further rise in employment.<sup>1</sup> On the other side, evidence for some other transitional countries shows that the private sector is less open for employment of women compared to men (Falaris 2004, Brainerd 2000, Adamchik and Bedi 2000), showing more inequality in the wage structure and workplace conditions. In addition, Milanovic (1999) concludes, analyzing several Central and Eastern European countries, that changes in the wage distribution during the economic transition were the main factor that increase the income inequality.

Having in mind that women in Serbia during the transition have experienced an unfavourable position compared to men (Lokshin and Jovanovic 2003, Krstić and Reilly 2000) and that privatization is not finished yet, further rise in women unemployment will significantly reduce the household incomes and have some additional negative social influences to the family composition. The reforms in the corporate sector in Serbia during the second decade of the transition are estimated by EBRD scores as unfavourable. During the years 2003-2007 that are observed in this article the slow improvement in privatization of the corporate sector was archived; the score of enterprise reforms moved from 2 to only 2.3 (EBRD 2010). Analysing privatization of developing countries over the

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<sup>1</sup> The Government of Serbia in 2009 introduced a Programme on rationalization of employees in the state administration, public agencies and organizations for compulsory social insurance that foreseen reduction of the current number of employees because of pressure to the public deficit growth. This measure was not implemented to the number of employees in public enterprises.

period 1990-2003, Kikeri and Kolo (2005) shown that privatization dropped off after 1997. Serbia with delayed transition has similarities with the other observed countries because privatization, after several disruptions during 1990s, became one of the policy priorities of the new government since 2001.

The public sector employment is of high importance for policy makers for at least two main reasons. Firstly, spending on earnings of employees in the public sector has a significant share in the overall government spending (according to the official data of the Serbian Ministry of finance in 2008 spending on wages of employees in the public sector is more than  $\frac{1}{4}$  of the total public expenditures); and secondly, the public sector is employer for more than 35 percent of the wage earners in Serbia (according to the Labour force survey data for 2007). When we consider earnings in the public and the private sector we should know that wage-setting decisions are different for these two sectors. On the one hand, the determination of earnings in the public sector is controlled by the regulation that puts limits on the wage bill through the budget constraints, while on the other hand wage setting in the private sector depends on productivity (both individual or by sectors of industry) and is more related to the business cycles. Public policy instruments that regulate wages of the public servants and other employees in the public sector have significant implications on both the private-public earnings inequality and on the wage differences between sectors. The main research task in this article is to thoroughly analyze a provision of employment for both men and women in the public and private sectors in Serbia and to estimate the existing differences in paid earnings in average and along the wage distribution, controlling for the sectoral choice, set of individual characteristics, workplace conditions, household related characteristics, etc.

In this article several estimation techniques are used in order to estimate the wage differences between the public and private sector employees, such as pooled OLS and quantile regressions separately for each observed year, and fixed-effects panel data model (pooled by years) allowing presence of the time dynamics. The data which are used come from the Living standard measurement survey for 2003 and 2007. Hence, the results of estimation of the sectoral pay gap, which will be presented in this article, will be rather descriptive, because the strategy of estimation of wage

differences between the sectors of employment and gender has to be further improved. The estimate of the sectoral wage differences was obtained in a simple way, including the sector dummy in the fixed-effects model. Angrist et al. (2006) have shown that under misspecification of the linear model for conditional quantiles the quantile regression (QR) approach minimizes the mean-squared error (MSE), similarly as the OLS estimation strategy does for the linear model with conditional means (Bargain and Melly 2008). Having in mind these empirical results, the presented estimates of conditional models could provide good basis for further improvements of the estimation strategy.

One of the first utilizations of the quantile regressions was presented by Poterba and Rueben (1994). Recently, the conditional quantile regressions were mainly used in analyzing cross-section data and such issues as the conditional wage distributions estimation and correction for selectivity bias (Heckman 1974, 1979). The main purpose of these articles was to investigate the gender wage differential in the economy of the U.S.A. (Blau and Kahn 1992), or, for instance, in the Spanish economy (Garcia et al. 2001), or to study female wage inequality in the U.S.A. along the age distribution (Buchinsky 1994, 2001), etc. Several articles have been focused on the experiences of transition countries (Adamchik and Bedi 2000, Newell and Reilly 2001, Falaris 2004) and in particular on the Serbian labour market (Krstić and Reilly 2000, Lokshin and Jovanovic 2003, Krstić et al. 2007, Ognjenović 2009). Not all of these studies utilize the conditional quantile regressions. Most of them use the mean regressions. The applied methodology for estimation of wage equations pays certain attention to the technical issues of correction for endogenous selection of the sector of employment and self-selectivity. Additionally, the utilization of panel data models in the analysis of sectoral or gender wage differences are rather uncommon for even developed or transitional countries.<sup>2</sup> Bargain and Melly (2008) examine sectoral wage gap in France by using fixed-effects approach that is further extended to the conditional quantiles. One of the reasons for restricted number of articles that deal with panel data is probably the unavailability of appropriate data sets and methodological issues.

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<sup>2</sup> There are several papers which are exceptions, for instance Bargain and Melly (2008), Pedersen et al. (1990), etc.

The article is organized in five sections. After a short introduction, the second section consists of description of the data used in the analysis of the sectoral pay gap. The estimation strategy that is applied to estimate the pay gap is elaborated in the third section. Then, in the fourth section, the obtained results of different estimators applied to the estimation of the wage equations are presented and explained. At the end of the article some general conclusions are summarized and proposals for further work are given.

## **II. Data**

The data used in this article come from the Living standard measurement survey (LSMS) conducted in 2003 and 2007.<sup>3</sup> Small number of the same households has been repeated by two (independent) surveys and hardly identified, so that the available data represent an unbalanced pseudo panel data set. By applying estimation strategy, the data will be treated as (pseudo) panel, pooled data set and separate data sets by years.

The World Bank's methodology was applied in designing the research and in the field work. Both surveys were implemented during May and/or June of the current year. Almost the same questionnaire (with small modifications in some of the questions) was applied in both surveys. The 2002 Census represented the sample frame for both years, with the census circles (more than 600) serving as primary sample units of the first stage. The module about the labour market in many aspects corresponds to the standards of the Labour force survey (LFS).<sup>4</sup> The 2003 survey was implemented by the SMMRI, an independent research institute, while the 2007 LSMS was managed and implemented by the National Statistical Office. The 2003 sample contains data for 5,188 individuals of the working

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<sup>3</sup> Similar survey was implemented in 2002 as well.

<sup>4</sup> The National Statistical Office runs the LFS as well. Since 2001, the questionnaire and samples have changed several times, due to the introduction of the ILO standards, so that the usage of panel data approach would be difficult for such a long period of time. The data obtained by this survey are used as some sort of benchmark for relative distributions of examined sub-samples.

age population (15-64 years old population)<sup>5</sup> or for 2,561 men and 2,627 women, respectively. By deleting zeros and missing observations, working sample of employees was reduced to 2,167 individuals or to 1,278 men and 889 women, respectively. The 2007 sample consists of the total number of 14,945 working age individuals. Broken by gender, the survey gathers information (about the employment status and households characteristics) for 7,185 men and for 7,760 women of working age in Serbia. On the other side, there were 4,066 and 2,991 employed men and women in the sample, respectively. After discarding zeros and missing data, the total number of observations for 2007 was 3,729 or 2,096 (1,633) men (women). The reported numbers of observations across genders and sectors provide enough room for utilization of the conditional quantile regressions in order to deeply analyze the wage distributions.

The data sets for both observed years are uniquely identified. The research units are all individuals who were employed with the private or public sector at the moment when the survey was conducted. Farmers, supporting members of the family, self-employed and owners of the companies are excluded from the analysis, so that only the wage earners are included in samples. The private sector includes those who are employed by private companies; while the public sector covers those who are employed by public enterprises, state and local governments' administration and for 2003 also social-sector employees, due to the fact that the questionnaire in the same question asks respondents about employment in public and socially-owned companies. From data set for 2007, employees who perform their job in socially-owned companies (it was a separate question) were excluded.

Average monthly wages from main job are used as dependent variable in the regression models after their transformation to relative measure and logs. It was decided to use the monthly wages because in Serbia wages are paid once per month. Total average monthly wages are the sum of nominal net monthly wages from main job plus all bonuses, compensation for sick leave, maternity leave, transportation, etc. To transform the nominal into the real wages the data are deflated by CPI

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<sup>5</sup> Retirement age for men and women in Serbia is lower compared to the upper boundary of 64 years of age and differs between genders. However, in order to save observations on employees, it was decided to leave all workers of the age 15-64 who were actively engaged in both the public and private sectors of employment.

using average-2003 index as a baseline year. Different indices were not used across regions to control for spatial varieties, due to the fact that there are no significant differences among CPIs for three macro-regions in Serbia (Belgrade, Central Serbia without Belgrade and Vojvodina). Moreover, the real monthly wages are divided by hours worked in that particular month, in order to create real hourly wage.

**[Insert Table 2]**

Wages in both nominal and real terms have been rising faster in the public than in the private sector, which is in line with data for the entire economy. The possible explanation could be found in the mechanism of wage setting (determination of the minimum wage and adjustment with the budget deficit). Wage setting, particularly in the public sector, is the result of tripartite bargaining of social partners, with dominant role of the government. Private sector wages in principle follow movement of wages in the public sector, while wages at the bottom tile of the earning distribution (representing significant proportion of employees) move upward very slowly. However, the trend of hours worked was opposite. Namely, the number of hours worked in the private sector recoded significantly higher increase in 2007 compared to the increase in the public sector.

The educational structure of employees in the two observed sectors is obviously different. The private sector hires workers of lower educational attainment, skilled blue collar workers and those who are engaged in manufacture and construction, as well as high-skilled employees who perform jobs in the sector of modern services, such as finance, insurance, trade and tourism, transportation, real estate, etc. Traditional services, such as health care and education, are mainly concentrated in the public sector. The educational structure of employees in the two observed sectors in 2003 was similar, mainly due to the fact that the public sector included workers who were employed with both the public sector and socially-owned companies. In the meantime, the majority of socially-owned enterprises have been privatized or closed down, so that the structure of manpower in these two sectors has significantly changed.

The variable *experience* represents total actual working experience reported by respondents. However, in order to save observations in the sample, some imputations have been done by creating

the new variable *potential experience*.<sup>6</sup> This variable represents a difference between age, years of schooling and the number of years before being enrolled into the primary education. In particular, in the 2003 sample a significant proportion of imputed observations were included (18.8 percent of the sample), while in 2007 only 4.1 percent of the values of variable *actual experience* were replaced by the potential experience. This imputation will probably have some influence on expected impact of experience on wages. Due to the perspective of the long-term unemployment and informal employment for some of individuals, the potential experience is usually greater than the actual experience. In 2003, the average actual experience was 17.7 years, while the potential experience was 22.5 years. In 2007, these numbers stood at 17.2 and 21.5 years, respectively.

During the observed period, the proportion of male employed with the public sector slowly decreased, while at the same time the percentage of those who accepted job in the private sector mildly increased. On the other side, those who performed job in the public sector preferred permanent employment, while in the private sector the number of contracts for flexible forms of employment considerably increased. Coverage of workers across macro regions did not change significantly between two observed years. In addition, it is obvious that the private sector employers preferred to engage younger unmarried workers, which means that costs of employment are very important for private employers (Adamchik and Bedi 2000).

Development of wages across sectors and gender has significantly changed over the observed period. The level of education became an important factor of stratification among workers.<sup>7</sup> These changes particularly affected female wages. In 2003, women of lower levels of education employed

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<sup>6</sup> O'Neill and Polachek (1993) provide empirical evidence about different outcomes in the returns to experience, particularly in the female earnings, depending on whether the experience was measured as actual or potential. Whenever possible it is suggested to use actual experience instead of potential one, due to the delay in employment after finishing the formal education.

<sup>7</sup> There are several articles which confirm that in advanced transitional countries the educational attainment became an important factor of remuneration in the conditions of changed ownership structure of the entire economy (Münich et al. 2005, Orazem and Vodopivec 1997).

with the public sector received lower wages than their counterparts in the private sector. Small difference occurred for post-secondary non-university and university education. In 2007, the public sector paid higher wages to women with secondary education than the private sector; at the same time higher level of education was rewarded more by the private sector employers. Contrary to this, different pattern is applicable for male workers. Men employed with the public sector are on average always paid more compared to their counterparts in the private sector.

**[Insert Table 3]**

### **III. Estimation strategy**

In order to analyze public sector wage premium or penalty by gender, two sets of econometric tools will be utilized. Firstly, pooled OLS (POLS) mean regression will be used in order to estimate the wage differences between sectors, i.e. the public sector wage gap, running two separate equations by gender. Then, standard quantile regression (QR) will be utilized for each year separately. This approach will enable the analysis of the public–private sector wage differences at various points of the conditional wage distribution by gender. Lastly, the fixed-effects panel regression will be performed with time-varying components. All in all, such approach will allow analysing static and dynamic public-private sector wage differences by gender.

Following standard theoretical approach, the wage equations could be put into the Mincer’s (1974) framework of the following linear expression:

$$\mathbf{W}_{i,j} = \alpha + \beta \mathbf{X}_{i,j} + \varepsilon_{i,j} \tag{1}$$

This equation is usually expressed in semi-logarithm form, where  $\mathbf{W}$  represents a measure of remuneration for performed job. In order to estimate the public-private wage gap the above equation will contain a dummy variable, indicating that an individual works with the public sector. The subscripts  $(i,j)$  describe individuals and observed groups, such as the sector of employment or gender. In the above equation, the term  $\beta\mathbf{X}$  represents a vector of explanatory variables and structural (slope) coefficients, while  $\varepsilon_{i,j}$  is assumed to be i.i.d. the error term. Furthermore, in the conditions of self-selectivity issues (Manski 1989, Heckman 1974, 1990) and endogenous choice of the sector of

employment, the usage of the OLS strategy of estimation will not produce estimates with the appropriate statistical properties. To obtain satisfied results of estimation of the public-private wage gap, the strategy of estimation needs to be further adjusted.

In the next step, following Koenker and Bassett (1978) and Buchinsky (2001, 1998), the wage equations will be expressed in the framework of the quantile regressions:

$$Q\theta (Y_{i,j}|X_{i,j}) = \alpha + [Q\theta (\epsilon_{i,j}) + \beta] X_{i,j} \quad (2)$$

where the term  $(Y_{i,j}|X_{i,j})$  represents the conditional wage regression,  $X$  set of explanatory variables,  $\beta$  vector of the slope parameters and the subscripts  $(i,j)$  represent individuals across pooled samples and the sector of employment or gender. The  $\theta$  may take different forms. The conditional wage distribution will be observed traditionally across the five quantiles: 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup> and 90<sup>th</sup> with the same set of variables included in each of the quantile equations. The interquantile range between the estimated quantiles will be observed too.

The fixed-effects linear panel data model is usually expressed in the following form:

$$Y_{it} = \alpha_i + \gamma Z_{it} + \epsilon_{it} \quad (3)$$

where subscripts  $(i,t)$  indicate the number of individuals across time units. Parameter  $\alpha$  represents individual fixed effects, while  $\gamma Z$  is a vector of slope parameters of the set of exogenous variables, and  $\epsilon$  is an error term. The fixed-effects estimator will be applied as traditional POLS on time-demeaned panel data and as traditional fixed-effects with time dummies. Similar approach was applied by Bargain and Melly (2008). By introducing the simple linear transformation of the fixed-effects panel data model, they show that the interaction terms of the public sector dummy and year dummies are identified for all years. They further extended the approach of the fixed-effects estimation to the quantile regressions following the estimator provided by Koenker (2004).

#### **IV. Results**

The Table 5 shows results of estimation of the sector pay gap by gender and years. The results indicate outputs of different estimation strategies that were utilized in order to estimate the public-private sector wage differences. The estimated coefficients represent public sector wage premium or

penalty, depending on the sign of the slope parameter. All estimated wage equations include the same set of covariates. Besides the dummy for the public sector (if it is not otherwise indicated), the models contain set of educational dummies, in order to provide different returns to education, depending on the educational level, and to cover non-linearity. In addition, the model includes actual experience, squared of actual experience, aggregated dummies for industry (*agriculture*=agriculture, forestry and fishing, *industry*=mining, manufacturing, electricity, gas and water supply, construction, *modern services*=trade, hotels, transportation, finance, real estate, and *other services* uncovered by previous variable, see Table 1), type of contract indicating permanent employment, marital status, type of settlement and macro regions. Reference categories for dummy variables through all the estimated equations include primary school or less, employment in agriculture, forestry and fishing, and region of central Serbia without Belgrade. The occupational dummies are excluded from the wage equations because of suspicion to their simultaneous endogeneity, but those variables are included in the reduced form of the hours worked equation. Following empirical approaches of Dustmann and van Soest (1998) and Garcíá et al. (2001) an auxiliary regression of hours worked was estimated by OLS (dependent variable is actual monthly hours worked in the main job). Instead of nominal variable of hours worked the estimated residuals from the reduced form were included in the further estimation, in order to allow endogenous nature of hours worked. In addition, the auxiliary regressions<sup>8</sup> include age (given in years) as an instrument that is excluded from the wage equations (see Table 4).

### **[Insert Table 3]**

Results of POLS indicate that both men and women were paid more in the public sector compared to the private sector counterparts, but remuneration that men received was higher than premium for women. When four different OLS wage equations are estimated across years and gender, there exist some differences between men and women. In 2003, men employed with the public sector were overpaid, while women employed with the same sector were underpaid. The results obtained for 2007 show certain convergence in the public sector premium between men and women. The possible

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<sup>8</sup> Several auxiliary regressions were estimated depending on the subset of data that were utilized in the wage equations estimation.

explanation that could be found in the literature is that the public sector attracts educated women, who, beside high wages, enjoy some other benefits, such as job security, flexible working hours, and other workers' rights guaranteed by the labour code (Adamchik and Bedi 2000, Falaris 2004, Melly 2005, Bargain and Melly 2008). At the same time, the wage premium for men decreased, because one part of those who previously worked in socially-owned firms left previous job and probably entered the private sector or became inactive (retirement and similar). The estimated causalities and the public-private wage differences should be interpreted with caution, but in general they describe trends in the public sector premium by gender.

Results obtained by estimating conditional quantiles of the wage distribution, applied to the pooled sample, show low and insignificant public sector wage premiums for women at the bottom (10<sup>th</sup> quantile) and upper tiles (90<sup>th</sup> quantile) of the conditional wage distribution. On the opposite, the public sector wage premiums for men at the two observed tiles of the conditional distribution are positive and statistically significant. However, low qualified male workers in the public sector have higher remuneration in comparison with their counterparts in the private sector. General conclusion is that the pay gap is higher at the bottom tiles of conditional distributions for both men and women (statistically insignificant premium), meaning that low-skilled worker in the public sector has better perspective than in the private sector. Quantile differences in the public sector premium point out to the diminishing pay gap between the genders. The estimated differences between quantiles are not statistically different.

Separate analyses of trends in differences between public and private sector wages pointed out to crucial changes that appeared between sectors. QR estimates of the conditional quantiles show significant changes along the scale of remuneration of the wage earners in the private sector. The wage premium for employees in the public sector in 2007 follows different path in comparison to the path of those who worked in the same sector in 2003. At the 10<sup>th</sup> quantile the public wage premium estimated on the 2007 data is high and statistically significant for both genders, while at the 90<sup>th</sup> quantile the public sector penalizes those who work in that sector. Significance of these estimates is not confirmed at the conventional levels of confidence, but it means that the private sector tries to attract highly

skilled workers by providing higher remuneration. The empirical results for developed economies show that similar pattern of behaviour can cause problems with future recruitment of qualified workers in the public sector (Pedersen et al. 1990, Dustmann and van Soest 1998, Depalo and Giordano 2010).

Also, similar pattern of behaviour in the public wage premium by gender is obtained by utilizing the fixed-effects strategy of estimation. The same set of covariates is used in the fixed-effects panel data models as in the POLS and QR. Two models are separately estimated by gender. The estimate of the public sector wage gap represents premium (penalty) for certain groups of individuals and makes it possible to follow this gap by years. The obtained results confirm that the public sector overpaid both men and women, but the estimated wage premium for women is lower compared to the estimated wage premium for men. The average worker employed in the public sector in 2003 was underpaid compared to his or her counterparts in the private sector, while in 2007 those who performed their job in the public sector were paid better. Even if the reported results represent descriptive measure of the public sector pay gap, it is obvious that the pattern of wage differences between these two sectors changed significantly. For the entire economy reported results are important, because the public sector wages put pressure on the wage bill, while the growth of wages in the private sector is slow and diminishing. The manner in which wage setting is conducted for the two sectors may have further impacts to the level of public deficit and budget, but on the opposite sides, one on the expenditure and the other on the revenue side.

**[Insert Table 6]**

## **V. Conclusion**

This article deals with the estimation of the wage differences between the public and private sectors in Serbia over the 5-year period of the second phase of the transition to a market economy. The data used in performing this task come from the Living standard measurement survey which was conducted two times over the observed period, in 2003 and again in 2007. Beside, the same survey firstly was implemented in 2002, but the 2002 data are not included in this analysis. The data set at hand allowed using the conditional mean and the quantile regression approach in the empirical analysis.

Several estimation strategies were used in order to estimate wage differences between the two observed sectors. Firstly, two independent data sets are observed, broken down by year. Then, the pooled data are examined, allowing further creation of the unbalanced pseudo panel data set for the observed years. In regard to this the appropriate estimation techniques are applied. Secondly, for independent years, the standard OLS and conditional quantile regressions (Koenker and Bassett 1978) are used. Then, for the pooled two-year data set, the POLS and conditional quantile regressions at the broader set of observations are applied. Incorporation of the time dynamics was important for the analysis of time-varying differences, so that the previous approach was extended to the usage of the standard linear fixed-effects panel data model. Incorporation of the sectoral choice and belonged wage differences was solved by introduction of the sectoral dummy variable into the wage equation as it was already done in several empirical studies (Pedersen et al. 1990, Bargain and Melly 2008).

Following this, the main conclusions can be drawn from the analysis of wage differences between the public and private sectors in Serbia observed by years and gender. The results obtained by running QR separately for two years pointed out to significant changes in wage differences that occurred over the observed period. The public sector wage premium in 2007 by quantiles followed different path compared to 2003. Namely, at the bottom tail of the wage distribution (first decile) the wage premium for public sector employees in 2007 was positive and statistically significant for both men and women, while the estimated wage premium at the highest tile of the wage distribution (ninth decile) showed some sort of penalizing of those who worked in the public sector (because of wage ceiling) compared to the wage earners in the private sector. Thereto, men employed in the public sector whose wages belong to the left tile of the wage distribution (recipients of the lowest salaries) are in a better position than women employed in the same sector and men employed in the private sector. On the other side, women employed in the public sector who receive the highest salaries are in a more unfavourable position than men employed in the same sector and women employed in the private sector.

The public sector wage premium estimated by the fixed-effects panel data model for 2007 confirm the fact that the public sector overpaid men and women compared to their counterparts in the

private sector, but the margin estimated for women was lower compared with that estimated for men (22.3 percent and 25.4 percent, respectively; both estimates are statistically significant). This situation substantially changed compared to 2003 when the estimated wage difference for both men and women employed in the public sector were negative (-6.95 percent and -23.3 percent, respectively; the estimates are statistically significant). Hence, the average worker employed in the public sector in 2003 was paid less than worker with similar characteristics employed in the private sector, while in 2007 several changes occurred that resulted in the improvement of earning power of employees in the public sector so that the average worker employed in the public sector was in a better position that he or she would have been if they were employed in the private sector. In summary, the estimates obtained by using several techniques of estimation confirm that the public sector pay gap became positive over the years generating the premium for those who work in that sector. The only group of workers who are penalized for working in the public sector is comprised of women and men who have higher education.

It is obvious that the position of both men and women in the labour market in Serbia has significantly deteriorated during the economic transition to a market economy. A lot of jobs have been lost due to the economic restructuring and privatization and small number of the new jobs has been created. In the conditions of absence of job creation in the private sector, the public sector has taken a role of the employment generator. The fact that the public sector offers wage premium, with advance of the transition, is probably result of unobserved factors such as working conditions, job security, and other non-wage aspects of employment and for shure of different educational attainment of required manpower in these two sectors. The public sector wage policy has to be adjusted in the light of presence of the wage gap (a public sector wage advantage), particularly in terms of the price setting for publicly provided services (increase efficiency) and increase of the wage bill (permanent pressure on fiscal deficit).

The results presented in this article are rather descriptive and could provide some description of the trends in development of the sectoral wage differences among the wage earners in Serbia, in particular observed by gender. Some further development of the research strategy would be additional

improvement of the estimation strategy by introduction the instrumental variable estimator or fixed-effects for conditional quantile regressions (Koenker 2004, Bargain and Melly 2008).

## Literature

Adamchik, V.A. and Bedi, A.S. (2000). Wage differentials between the public and the private sectors: Evidence from an economy in transition. *Labour Economics*, 7, 203-224.

Angrist, J., Chernoyhukov, V. and Fernández-Val, I. (2006). Quantile regression under misspecification, with an application to the U.S. wage structure. *Econometrica*, 74 (2), 539-563.

Bargain, O. and Melly, B. (2008). Public sector pay gap in France: New evidence using panel data. IZA Discussion Paper 3427, April 2008.

Blau, F. and Kahn, L. (1992). The gender earnings gap: Learning from international comparisons. *American Economic Review (P&P)*, 82, 533-538.

Brainerd, E. (2000). Women in transition: Changes in gender wage differentials in Eastern Europe and the Former Soviet Union. *Industrial and Labour Relations Review*, 54, 138-162.

Buchinsky, M. (1994). Changes in the U.S. wage structure 1963-1987: An application of quantile regression. *Econometrica*, 62 (2), 405-458.

Buchinsky, M. (2001). Quantile regression with sample selection: estimating women's return to education in the U.S. *Empirical Economics*, 26, 87-113.

Depalo, D. and Giordano, R. (2010). The public pay gap in Italy. Mimeo, Bank of Italy, version March 15, 2010.

Dustmann, C. and van Soest, A. (1998). Public and private sector wages of male workers in Germany. *European Economic Review*, 42, 1417-1441.

EBRD (2010). *Transition report 2010: recovery and reform*. EBRD: London.

Falaris, M.E. (2004). Public and private sector wages in Bulgaria. *Journal of Comparative Economics*, 32, 56-72.

García, J., Hernández, J. P. and López-Nicolás, A. (2001). How wide is the gap? An investigation of gender wage differences using quintile regression. *Empirical Economics*, 26, 149-167.

Heckman, J.J. (1974). Shadow prices, market wages, and labor supply. *Econometrica*, 42, 679-694.

Heckman, J.J. (1979). Sample selection bias as a specification error. *Econometrica*, 47, 153-161.

Heckman, J.J. (1990). Varieties of selection bias. *American Economic Review*, 80, 313-318.

Kikeri, S. and Kolo, A.F. (2005). Privatization: trends and recent developments. World Bank Policy Research Working Paper 3765, November 2005.

Koenker, R. (2004). Quintile regression for longitudinal data. *Journal of Multivariate Analysis*, 91, 74-89.

Koenker, R. and Bassett, G. (1978). Regression quantiles. *Econometrica*, 46, 33-50.

Krstić, G. and Reilly, B. (2000). The gender pay gap in the Federal Republic of Yugoslavia. *Ekonomika*, 33, 191-213.

Krstić, G., Litchfield, J. and Reilly, B. (2007). An anatomy of male labour market earnings inequality in Serbia 1996-2003. *Economic Systems*, 31, 97-114.

Lokshin, M. and Jovanovic, B. (2003). Wage differentials and state-private sector employment choice in Yugoslavia. *Economics of Transition*, 11, 463-491.

Manski, C. (1989). Anatomy of selection problem. *Journal of Human Resources*, 24, 343-360.

Melly, B. (2005). Public-private sector wage differentials in Germany: Evidence from quantile regression. *Empirical Economics*, 30, 505-520.

Milanovic, B. (1999). Explaining the increase in inequality during transition. *Economics of Transition*, 7, 299-341.

Mincer, J. (1974). *Schooling, experience, and earnings*. Columbia University Press (for the National Bureau of Economic Research), New York U.S.A.

Münich, D., Svejnar J. and Terrell, K. (2005). Returns to human capital under the communist wage grid and during the transition to a market economy. *The Review of Economic and Statistics*, 87 (1), 100-123.

Newell, A. and Reilly, B. (2001). The gender pay gap in the transition from communism: Some empirical evidence. *Economic Systems*, 25, 287-304.

O'Neill, J. and Polachek, S. (1993). Why the gender gap in wages narrowed in the 1980s. *Journal of Labour Economics*, 11, 205-228.

Ognjenovic, K. (2009). Quantile regression analysis of female earnings in the private and public sectors in Serbia: Some evidence from survey data, Mimeo, Belgrade.

Orazem, P.F. and Vodopivec, M. (1997). Value of human capital in transition to market: Evidence from Slovenia. *European Economic Review*, 41, 893-903.

Pedersen, P.J., Schmidt-Sørensen J.B., Smith N. and Westergård-Nilsen N. (1990). Wage differentials between the public and private sectors. *Journal of Public Economics*, 41, 125-145.

Petrin, T. and Humphries, J. (1980). Women in the self-managed economy of Yugoslavia. *Economic Analysis and Workers' Management*, 14 (1), 69-91.

Poterba, J. and Rueben, K. (1994). The distribution of public sector wage premia: New evidence using quantile regressions. NBER Working Paper 4734.

World Bank (2004). *Serbia and Montenegro: An agenda for economic growth and employment*. Report No. 29258-YU. The World Bank: Washington D.C.

World Bank (2002). *Transition the first ten years: analysis and lessons for Eastern Europe and the Former Soviet Union*. The World Bank: Washington D.C.

## Annex

**Table 1: Explanation of variables used**

Code	Description
wage	Hourly earnings
log(wage)	Log of hourly earnings
public	Dummy, 1 if employed in public sector, 0 if in private sector
hours	Hours worked during the observed period (month)
edu_level	Dummy variables on education levels:
edu_level 1	Dummy, 1 if completed primary and less, 0 otherwise
edu_level 2	Dummy, 1 if completed vocational education, 0 otherwise
edu_level 3	Dummy, 1 if completed general secondary education, 0 otherwise
edu_level 4	Dummy, 1 if completed gymnasium, 0 otherwise
edu_level 5	Dummy, 1 if completed postsecondary non-university education, 0 otherwise
edu_level 6	Dummy, 1 if completed university and more, 0 otherwise
skills	Dummy variables on skill levels:
managerial	Dummy, 1 if managerial, 0 otherwise
senior_profess	Dummy, 1 if senior professionals, 0 otherwise
high_skilled	Dummy, 1 if high skilled workers, 0 otherwise
low_inter_skilled	Dummy, 1 if lower and intermediate white collar workers, 0 otherwise
skilled	Dummy, 1 if skilled workers in services and craft, 0 otherwise
un_semi_skilled	Dummy, 1 if unskilled and semi-skilled workers, 0 otherwise
contract	Dummy, 1 if fixed-term contract, 0 otherwise
experience	Actual experience
exp_sq/100	Actual experience squared/100
age	Age in years
age_sq/100	Age in years squared/100
settlement	Dummy, 1 if urban, 0 otherwise
married	Dummy, 1 if married, 0 otherwise
region	Dummy variables on macro regions:
reg_Belgrade	Dummy, 1 if living in Belgrade, 0 otherwise
reg_Central	Dummy, 1 if living in Central Serbia, 0 otherwise
reg_Vojvodina	Dummy, 1 if living in Vojvodina, 0 otherwise
industries	Dummy variables on industries:
agriculture	Dummy, 1 if in agriculture, fishing, 0 otherwise
industry	Dummy, 1 if in mining, manufacture, electricity, construction, 0 otherwise
service	Dummy, 1 if in trade, hotels, transport, finance, real estate, 0 otherwise
other	Dummy, 1 if all other industry codes according NACE, 0 otherwise

**Table 2: Descriptive statistics by sector of employment and years**

Variable	Public		Private	
	2003	2007	2003	2007
wage <sup>a</sup>	10,881	24,418	11,001	19,000
log(wage)	4.10 (0.75)	4.54 (0.71)	4.14 (0.63)	4.23 (0.79)
hours <sup>b</sup>	162.11 (65.73)	164.82 (40.18)	165.81 (59.42)	174.4 (59.77)
edu_level 1	0.21	0.11	0.12	0.19
edu_level 2	0.29	0.13	0.25	0.23
edu_level 3	0.34	0.41	0.35	0.43
edu_level 4	0.04	0.04	0.03	0.04
edu_level 5	0.07	0.11	0.10	0.06
edu_level 6	0.06	0.20	0.15	0.06
managerial	0.12	0.03	0.01	0.02
senior_profess	0.02	0.16	0.13	0.04
high_skilled	0.17	0.35	0.30	0.25
low_inter_skilled	0.09	0.11	0.32	0.05
skilled	0.32	0.21	0.08	0.44
un_semi_skilled	0.27	0.14	0.15	0.20
male	0.62	0.53	0.56	0.59
contract	0.51	0.92	0.94	0.74
experience <sup>c</sup>	16.13 (11.58)	19.61 (10.21)	18.97 (10.03)	15.14 (10.54)
exp_sq/100	3.94 (4.93)	4.89 (4.03)	4.60 (3.99)	3.40 (3.90)
age	38.63 (11.25)	43.04 (9.92)	42.94 (9.66)	37.99 (10.81)
age_sq/100	16.18 (9.04)	19.51 (8.30)	19.37 (8.09)	15.60 (8.51)
settlement	0.62	0.66	0.67	0.54
married	0.68	0.75	0.78	0.65
reg_Belgrade	0.17	0.23	0.17	0.17
reg_Central	0.58	0.58	0.60	0.54
reg_Vojvodina	0.27	0.19	0.23	0.29
agriculture	0.11	0.03	0.03	0.09
industry	0.21	0.26	0.39	0.44
service	0.40	0.18	0.17	0.41
other	0.27	0.53	0.41	0.06
N	1,043	1,720	1,124	2,009

**Notes:** Standard deviations of continuous variables are given in parentheses. <sup>a</sup> Nominal net monthly wages (remuneration for main job plus all bonuses, compensation for sick leave, maternity leave, transportation, etc.) are given in Serbian dinars. Real hourly wages are obtained as monthly wages divided by monthly working hours deflated by CPI (avearge-2003=100). <sup>b</sup> Actual working hours for a month that preceded the reporting period when the survey was conducted. <sup>c</sup> This variable represents actual working experience reported by an individual. For unreported data an imputation of potential experience is made following standard approach, i.e. age minus education (in years) minus no. of years before enrolment into the primary school.

**Table 3: Relative difference of wages in the private sector by level of education, gender and years (public sector=100)**

Educational level	2003		2007	
	Male	Female	Male	Female
Primary and less	94,6	139,8	89,0	81,6
3-year vocational	77,9	114,8	93,9	91,4
4-year secondary general	84,4	111,1	89,4	81,7
4-year gymnasium	79,5	122,9	99,7	80,7
Post-secondary non-university	107,9	110,6	86,9	104,2
University and more	77,8	101,3	93,4	119,4

**Notes:** Nominal net monthly wages (remuneration for main job plus all bonuses, compensation for sick leave, maternity leave, transportation, etc.) are given in Serbian dinars.

**Table 4: Pooled OLS auxiliary regression of the hours worked variable**

Variable	Male		Female	
	Coeff.	t-stat.	Coeff.	t-stat.
const	155.31	27.44	129.86	20.76
contract	19.23	7.31	24.94	9.63
age	-0.45	-4.28	-0.31	-3.13
married	7.81	3.03	5.59	2.56
reg_belgrade	-0.12	-0.04	1.74	0.61
reg_central	0.46	0.19	3.18	1.37
settlement	1.38	0.64	2.25	1.04
industry	9.79	2.27	13.97	2.81
service	10.49	2.27	16.46	3.25
other	-1.54	-0.33	5.02	1.03
managerial	25.39	4.68	20.92	3.28
senior_profess	3.20	4.79	4.78	1.21
high_skilled	6.43	1.99	6.57	2.07
low_inter_skilled	12.88	3.08	5.92	1.67
skilled	5.52	1.71	14.27	4.39
N	3374		2522	

**Notes:** Variable *hours worked* is reported by respondents as nonzero actual hours worked from main job in the month before the survey was conducted. (The data for overtime work are not available from the survey.)

**Table 5: POLS and QR estimates of the public sector premium (penalty) by gender**

	Mean		Median		q(90)		q(75)		q(10)		90-10		75-25		50-10	
	Coeff.	t-stat.														
Male																
POLS	0.130	5.04	0.128	6.84	0.084	1.72	0.178	6.88	0.130	3.13	-0.046	-0.83	0.027	0.83	-0.002	-0.07
Separate regressions by years																
2003	0.157	3.52	0.072	1.61	0.305	3.01	0.271	3.91	0.091	0.93	0.213	1.69	0.200	2.95	-0.019	-0.26
2007	0.128	3.24	0.115	4.09	-0.017	-0.29	0.077	2.00	0.150	3.01	-0.167	-2.13	-0.119	-2.73	-0.035	-0.70
Female																
POLS	0.048	1.79	0.112	4.36	0.044	0.79	0.098	3.21	0.052	1.22	-0.008	-0.13	0.034	1.14	0.059	1.36
Separate regressions by years																
2003	-0.118	-2.38	-0.131	-2.94	0.013	0.14	-0.070	-1.49	-0.213	-1.74	0.227	1.53	0.036	0.46	0.082	1.09
2007	0.085	2.03	0.147	3.58	-0.091	-1.30	0.077	2.05	0.128	2.25	-0.220	-2.43	-0.117	-2.34	0.018	0.34

**Notes:** Set of variables in the estimated models includes: residuals from reduced form of hours worked instead of actual hours worked, dummy variable indicating sector of employment, type of contact, industry dummies, experience, experience squared, dummy marital status, educational dummies, type of settlement and regional dummies. Estimated coefficients represent public sector wage premium (+) or penalty (-). Standard errors of QR estimates are bootstrapped on 100 replications.

**Table 6: Fixed-effects estimates of the public sector premium (penalty) by gender**

	Men		Women	
	Coeff.	t-stat.	Coeff.	t-stat.
Pooled fixed-effects	0.127	4.94	0.048	1.79
By years <sup>a</sup>				
2003	-0.072	-2.13	-0.265	-7.04
2007	0.226	7.61	0.201	6.48

**Notes:** Set of variables in the estimated models includes: residuals from reduced form of hours worked instead of actual hours worked, dummy variable indicating sector of employment, type of contact, industry dummies, experience, experience squared, dummy marital status, educational dummies, type of settlement and regional dummies. Estimated coefficients represent public sector wage premium (+) or penalty (-).  
<sup>a</sup> Estimates of the public sector wage premium (penalty) represent interaction of the public sector employment dummy and year dummies.