PUBLIC-PRIVATE SECTOR EARNINGS DIFFERENTIALS IN A TRANSITION ECONOMY

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ABSTRACT

The aim of this thesis is to analyse how economic transition affected earnings differentials in Eastern European economies. In particular, as the public sector was the sole employer in the pre-transition period, the analysis of public sector pay setting is crucial to understanding how privatisation affected the labour market during the transition.

The central idea of the first essay is to develop a theoretical model that explains the pay setting behaviour of the employer in the public sector. We argue that changes in wage differentials unrelated to productivity differentials may arise from changes in the degree of public sector market power during the transition.

The second essay estimates public-private sector pay differentials across the entire pay distribution in Serbia from 1995 until 2008 for men and women separately. It demonstrates the importance of a proper measurement of pay to account for differences in the structure of total remuneration between sectors. The economic transition is found adversely to affect public sector pay gap relative to private sector pay at the beginning but public sector wages increase faster than private sector wages in later stages. The essay adopts a number of statistical procedures including a quantile regression approach. The estimates show more negative or less positive (depending on the time interval) public-private sector earnings differentials among high earners than among low earners.

The third essay estimates public-private sector pay differentials across the entire pay distribution in Hungary from 1992 until 2003 for men and women separately. The results show an increasing public sector pay 'penalty' at all the percentiles of pay distribution during first years of transition and a decline later on. However, the pay differential is found to vary across the earnings distribution significantly. Particularly, the essay provides striking evidence of public sector pay compression during transition. Whereas the public-private sector pay gap for workers below the median was rather small, the gap was substantial for workers at and above the median over the whole period considered.

The three essays are preceded by an overview of the theoretical and empirical literature on public-private sector pay differentials in i) developed market economies and ii) transition economies of Eastern Europe.

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To My Parents

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Chapter 1

1 Introduction

Motivation

Does it pay to work in the public sector? Twenty years ago this question was unthinkable for workers in Eastern Europe for at least two reasons. First, because the public sector was the employer of almost the whole work force. Second because pay equality was one of the major social principles in pay determination. However, things have changed rapidly. Today the public and private sectors compete for workers. Wage differentials are one of the key variables in labour markets in transition economies.

The increasing pay inequality in transition economies has attracted numerous research attention. In this context, Keane and Prasad (2001) point to the importance of the reallocation of workers from a low wage public sector to a high wage private sector in driving up inequality. Newell and Socha (2007) talk about the 'wage inequality explosion'. They claim that sharp increases in hourly wage inequality in Poland after 1998 were similar in magnitude to the much-studied increase in British wage inequality during the 1980s (for example Machin (1996), Gosling, Machin and Meghir (2000)). Empirical evidence presented in Newell and Socha (2007) shows that these increases are associated with differences in pay-setting patterns between the public and private sector as well in the rapid increase in the demand for educated labour.

How can we explain these changes? Economic theory suggests that long term divergences between pay and productivity for similar workers could only arise due to market power (either of workers or employers), relative to the competitive outcome. We hypothesise that changing employer market power is one reason for the emergence of these changing differentials.

But whereas the private sector monopsony model derives from profit-maximising behaviour by an employer facing an upward sloping supply curve of labour, an alternative model is needed for a public sector employer with some degree of monopsony power. Such a model can arise from the public sector manager facing an exogenous budget constraint and an upward sloping supply curve of labour. Understanding this wage-employment relationship is important for analysis of the effects of restructuring the public sector on the labour market.

Leaving market power aside, Disney and Gosling (1998) point out that any change in the composition of the public sector driven by privatisation will affect relative wages even if the 'true' (i.e. holding all else constant) public sector pay gap does not change. Indeed, the public sector in transition economies has been restructured such that job composition in the public sector is comparable to developed market economies. This means a lower manual composition of workforce than before transition.

In the context of changing composition and changing market power, it seems natural to ask how does/did economic restructuring affect various groups of workers? Hence, this thesis examines trends in pay over the period of economic transition, looking both at wage inequality in general and at public-private sector wage differentials in different parts of the labour market.

However, a 'true' public sector pay gap is not easy to estimate. Simply comparing mean wages between public and private sectors may produce a biased estimate because workers may be self-selected. Although one can argue that worker self-selection at the start of large-scale privatisation in a transition economy is likely to be negligible at least because of limited worker mobility in the short run, it may be a more important factor during the later period (Brainerd, 2002). Ideally, one would need data tracking the same individuals over a given period. However, in many cases panel data is not available and the lack of strong instruments limits 'precise' estimates.

Moreover, a bias in the coefficient estimates may also arise from measurement error in ownership status given by workers' confusion or by ambiguous ownership status of their firms during the privatisation process itself (as discussed in Brainerd (2002) and Disney and Gosling (2003)). Measurement error in individual level data may also emerge from self-reported information on hours of work or simply because hours of work may not necessarily reflect productive efforts (as discussed by Bargain and Melly, 2007).

Researchers wishing to understand public sector pay determination face other problems. For example, one would like to control for non-wage job compensations (such as meal and transportation allowances, housing, medical services, vacations, day care, etc.) as well as social insurance, in particular pensions among public and private sector workers. Finally, in order to obtain accurate estimates of the public-private sector pay differential it is also important to allow for life-cycle effects due to differences in workers' age-wage profiles curvatures between sectors as showed by Disney, Emmerson and Tetlow (2009).

To summarise, care should be taken in interpreting empirical estimates of wage inequality, especially between public and private sector workers, for a variety of reasons: data limitations, measurement error, sampling bias, selection issues, omitted variables etc. Despite these reservations concerning simple pay comparisons, the purpose of the empirical essays in this thesis is to analyse changes in public-private sector pay differentials over the course of economic transition. The aim is to relate the empirical results to theoretical foundations developed in the first essay.

1.2 Research Questions

This thesis aims to examine the effects of public sector restructuring on the wage and skill distributions during the economic transition in Eastern Europe by considering three research questions. Firstly, how can we model public sector pay and employment-setting behaviour during the three stages of economic restructuring: pre-transition, transition and post-transition? Secondly, is there evidence for lower pay inequality in the public than in the private sector as suggested by the public sector monopsony model? Could growing inequality during transition therefore simply reflect the weakening bargaining power of the public sector? Does the empirical evidence indicate that there was an average pay differential

between the public and private sector and, if so, how has this pay differential changed during the economic transition? Finally, does the empirical evidence indicate that there were pay differentials across the wage distribution and, if so, how have these pay differentials changed during the economic transition?

Examining the implications of changes in public sector pay-setting arrangements due to privatisation is a relatively new area of research in the economics literature. Rather few studies in developed OECD countries have analysed the effects of public sector restructuring on labour market outcomes such as changes in the relative wages and employment. Such studies as exist comprise Card (1986) for the US, Haskel and Szymanski (1993) and Disney and Gosling (2003) for the UK and Monteiro (2004) for Portugal. On the other hand, there is a growing (mainly empirical) literature that measures the effects of transition on public-private sector pay differentials.

This thesis makes a claim to originality in both a theoretical and empirical context. With respect to the theoretical contribution, this thesis models public sector wage determination and the effects of public sector restructuring on wage and skill distributions. With respect to the original empirical contribution, this thesis researches public-private sector earnings differentials in two transition economies, namely Serbia and Hungary.

The essay on public sector wage determination sets up a theoretical framework in which the public sector is modelled as an employer with some degree of monopsony power in setting wages and employment. In this environment, the public sector employs two types of workers: skilled and unskilled. With this environment it explains why pay compression associated with public sector wage determination may decline alongside the decline in public sector monopsony power over the course of the economic transition.

The essay on public-private sector pay differentials in Serbia presents new evidence of the public sector pay gap across the entire pay distribution. Moreover, the essay proposes a novel instrument constructed from an additional data source to correct for the measurement error in the public sector status. In this context, this is the first study that uses an instrumental variable procedures to estimate public sector pay effects by skill levels during large-scale privatisation in Serbia.

The essay on public-private sector pay differentials in Hungary presents evidence of striking public sector pay compression thoughout the period of transition. This has occured while Hungary has been considered as one of the most successful countries in transforming its economy from state socialism to market economy.

While acknowledging different ways of privatisation and public sector definitions in Serbia and Hungary the thesis does not attempt to compare them. The research findings in two empirical essays are obtained by using different sources of microdata. For Serbia individual level data is used from the Labour Force Survey (LFS) and the Living Standard Measurement Survey (LSMS). For Hungary employer-provided microdata sets are utilized from the Harmonised Hungarian Wage Survey (WS).

Although the empirical essays are self-contained and focus on two different countries with the use of different sources of microdata, a common story can be drawn from the results obtained. Both empirical essays find increasing average public sector pay penalties during the first years of transition which decline later on. Moreover, both essays find a significant public sector pay-inequality reducing effect. This means that the public sector pay distribution was more compressed than in the private sector. Although such comparison (and the rise in overall wage inequality accompanying privatisation) has often been treated as a political phenomenon, arising from a desire for greater equality under communist economies, the theoretical model in the first essay suggests a different interpretation.

1.3 Plan of Thesis

The thesis proceeds as follows: Chapter Two provides a theoretical and empirical literature overview on public-private sector wage differentials. Much of the debate as to whether the public sector workers are paid better or worse than their private sector counterparts is discussed based on empirical and theoretical evidence in developed market and transition economies. Furthermore, this chapter summarises the evidence on the public sector pay effect in developed market economies. The chapter ends with a broad summary of recent results from transition economies.

Chapter Three presents the public sector pay-employment theoretical framework. The chapter opens with the argument that differences in pay-setting arrangements across the public

sector and the emerging private sector during the process of economic transition may cause systematic trends in sector wage differentials. The argument is followed through three stages of economic restructuring: pre-transition, transition and post-transition, in the context of Eastern European economies. The hypothesis is that public sector market power is one reason for the emergence of sector pay differentials observed in empirical literature on transition economies. In the model provided by this chapter, public sector monopsony power arises from the public sector manager facing an exogenous budget constraint and upward sloping supply curve of labour with different elasticities for different types of workers. Some conclusions are then drawn for the ensuing analysis of public-private wage differentials, and wage dispersion, over the course of the economic transition in the next two chapters.

Chapter Four presents the first empirical essay. The public sector pay gap in Serbia is examined from 1995 to 2008 by using different sources of individual level data. The empirical analysis is based on annual as well as on pooled data estimates. The pooled estimates are obtained for the periods given by data convenience but which also correlate broadly to two different stages of economic transition. Conditional annual average estimates show that increasing public sector penalties during the 1990s come down to zero by 2003. From 2004, the average sector pay gap translates into a significant and increasing public sector premia for both men and women. The chapter argues that the change in sign of the estimated public sector pay gap is caused mainly by privatisation. Moreover, quantile regressions reveal a public sector pay equalising effect. This is further confirmed by differences in the returns to characteristics obtained by the decomposition of public-private sector earnings differential across the earnings distribution. At the final point of analysis, the chapter proposes an instrument to correct for potential measurement error bias in the public sector status. The changes in the proportions among industry branches in the public sector, argued to be caused mainly by privatisation, are constructed from an employer-provided data set and then used as an indicator of the public sector status. The chapter applies instrumental variable procedures on groups of workers according to their educational qualification and gender.

Chapter Five presents the second empirical essay. The public sector pay gap in Hungary is examined from 1992 to 2003 by using large cross-sections from employer-provided microdata. Conditional annual average estimates show that both men and women in

the public sector have fared statistically significantly worse than their private sector counterparts during 1990s, but this penalty declined to almost zero in 2003. Again, quantile regression results verify that the public sector pay distribution was more compressed than in the private sector. The same is further reinforced by differences in the returns to characteristics obtained by the decomposition of public-private sector earnings differential across the earnings distribution. Finally, the estimates for each group defined according to highest educational qualification reveal that public sector compresses the pay in two dimensions: by reducing between-group inequality and by reducing within-group inequality. Both features are particularly pronounced among high-skilled workers.

Chapter Six concludes the thesis with an evaluation of the findings and the main arguments of each essay, together with comments on the prospects for future research.

Chapter 2

2 Literature Review

2.1 Introduction

Why should pay differ between the public and private sectors in any systematic way? This chapter attempts to provide some explanations provided by the theoretical and empirical literature. The arguments imply that even as the public and private sectors compete in the labour market, wage-setting arrangements as well as workers' measured and unmeasured characteristics in each sector usually differ significantly.

However, although the vast empirical literature provides sophisticated ways to control for heterogeneity in relative pay (especially by skill level), the number of theoretical studies which have attempted to compare wage-settings across sectors is rather limited. In particular, most of the theoretical studies model the attributes of labour demand in the public sector. These models will be briefly summarised in the first part of the chapter. In addition, this chapter reviews related theoretical models from transition economies. In this context, special attention is given to a single model that explains public-private sector pay differentials and accounts for heterogenous labour across the sectors.

The second part of the chapter surveys the public sector pay effects obtained by empirical studies over the period of last two decades in developed market economies. The final part of the chapter summarises the empirical findings from transitional economies in Eastern Europe.

2.2 Theoretical Literature Review

What makes the public sector workers so different? There is an ongoing debate as to whether public sector workers are paid better or worse than their private sector counterparts. This section summarises some of the arguments. The arguments are organised into two sub-sections. The first sub-section presents the ideas as to why public-private pay differentials might exist. This aims to motivate the theoretical review in the subsequent sub-section.

2.2.1 Why there may be a Difference in Pay between the Public and Private Sectors?

Public sector workers differ in measured and unmeasured abilities from their private sector counterparts. For example, they are found in developed countries in recent years to be on average better educated, older and more risk averse than private sector workers.

Also, the composition of jobs in public and private sectors differs. Industry branches such as public administration, the police and army, health care and education traditionally reside in the public sector. Consequently, these days the majority of jobs in the public sector in OECD countries are clerical while usually a very small fraction of jobs is manual, especially since privatisation in the 1980s and 1990s. In addition, public sector establishments are on average larger than the average private sector firm.

In this context a significant part of the raw public-private sector pay differential may be just a statistical artifact arising from the different skills and nature of jobs mentioned above. However, most studies empirically confirm the existence of sector pay differentials for some groups of workers even after controlling for workers and jobs characteristics. For example, Katz and Krueger (1991) find that the public sector is likely to provide rents to less educated employees while experiencing difficulty in recruiting skilled professionals. In general, comprehensive surveys of estimates of public-private wage differentials by Ehrenberg and Schwarz (1986), Bender (1998) and Gregory and Borland (1999) find average public sector premia for women, for less skilled workers, minorities and veterans.

In this context, the rational for a public sector 'pay effect' may be related to political factors through the role of government as a "good" employer as suggested in Gregory (1990). He argues that the empirical finding on public sector pay compression is because the government overpays unskilled workers and underpays skilled workers for egalitarian reasons.

In a closely related vein, Gunderson (1979) argues that the basic difference between the public and private sectors with respect to the wage determination process is that the private sector is profit-constrained while the public sector is constrained by the public budget. He lists political forces that influence public sector wages indirectly through institutional setting such as: rights to organise and bargain, the use of comparability in setting pay scales, civil service regulations and wage criteria, wage-price guidelines, intergovernmental transfers and decisions to restrain the growth of the public sector.

Considering the politics of wage setting, Fogel and Lewin (1974) point out that the public sector demand curve is derived from the voter expressed demand for government services and through bargaining between government and unions rather than through the marginal revenue product curve. Gregory (1990) also mentions the bargaining power of public sector unions as a source of upward bias in wages.

However, Disney (2009) suggests that whereas the rationale for the existence of a union wage differential is straightforward, treating public sector wage bargaining as equivalent to a 'mark-up' on the competitive wage is over-simplistic. Disney (2009) argues that the public sector as a unitary employer with potential monopsonistic power has a capacity to countervail the monopolistic power of public sector unions. The existence of potential monopsony power in the public sector is supported by Fogel and Lewin (1974)'s and by Boal and Ramson (1997)'s survey of evidence on monopsony effect for specific occupations such as nursing and teaching, where a worker seeks employment in a relatively small geographic region or has few outside options.

The lack of an outside employment option as a rationale for monopsony power has been particularly manifested in countries under central planning. For example, workers across Eastern Europe were not able to self-select between public and private sectors simply because the public sector was explicitly the sole employer and the scope for worker migration was extremely limited.

Moreover, using models of 'vocation' developed elsewhere in the literature, Disney (2009) explains why recruitment to the public sector may be relatively insensitive to fluctuations in public-private sector pay differentials of developed market economies. This rigidity can also be linked to Manning (2003)'s idea of 'dynamic monopsony' where

employers have market power observed through the wage dispersion of identical workers. This market power appears due to the fact that workers do not quit immediately when their wage is lower than an outside wage. Manning (2003) argues that this disparity, in relation to public sector workers, may simply arise from limited information on outside options in the standard dynamic search model.

Considering different incentive designs in the public and private sectors Tirole (1994) points out that low powered individual incentives in the public sector may be due to the lack of appropriate comparisons, heterogeneity of tastes of principals and career concerns about prospects of re-election or promotion. In this context, Disney, Emmerson and Tetlow (2009) discuss the backloading of pay as one incentive mechanism. Using total lifetime remuneration of a worker employed in the public sector relative to the private sector they find that the pay of private sector workers in the highest educational group peaks earlier. They also find less evidence of declining wages for older public sector workers in the middle educational group and women. This is in accordance with 'backloading' of pay being an incentive mechanism in the public sector where 'spot' market productivity cannot be measured.

In their view of pay compression, Postel-Vinay and Turon (2007) suggest that the public and private sector differ not only in the mean income but also in terms of income and job mobility. They find less income mobility and less incidence of employment disruption in the public sector and show that the observed relative income compression in the public sector may be just due to a lower variance of the transitory component of income.

Overall, therefore, the theoretical arguments indicate that the magnitude and sign of the public sector pay effect in market economies is inconclusive. On the other hand, the literature from transitional economies mainly suggests reasons why private sector pay may be higher than the public sector pay.

Brainerd (2002) argues that workers may demand a wage premium for work in the private sector if they perceive that job security is lower in the private than in the public sector. Next, the private sector may have to pay a higher wage simply to attract workers from public sector jobs (Brainerd, 2002). Indeed, the evidence that the private sector hired almost exclusively from the public sector rather than drawing from the pool of unemployed (which has been perceived as a sign of lower ability) is broadly documented by the empirical

literature on transition economies (Boeri (1998), Flanagan (1995), Rutkowski (1995), Večernik (1993), Allison and Ringold (1996)).

Complementing these arguments a literature proposes that the private sector may pay more to induce harder work in new jobs ('efficiency wage') or to compensate for fewer non-wage benefits (Jurajda and Terrell (2001), Brainerd (2002)). Finally, private sector pay may be higher if a regulated public sector and an unregulated private sector co-exist (Disney, 2007).

The next sub-section briefly reviews some theoretical models that provide a conceptual framework for public sector wage-setting.

2.2.2 Theoretical Models of Public Sector Wage Determination

What is public sector wage-setting like? Although the issue of the sector pay gap has been intensively empirically explored, there have been fewer attempts to provide a conceptual framework for its analysis. Indeed Bender (1998) points out that Holmlund (1993) is the only purely theoretical paper on the sectoral wage differential. A model which allows for heterogeneity in the workforce and a variation of labour supply responses is laid down by Boeri (1998).

Importantly, none of the literature attempted to provide a careful formal theoretical model to explain greater pay compression in the public than in the private sector as a result of pay determination. This thesis attempts to fulfill this gap in the literature.

The sub-section takes a broader view by breaking the literature down into groups of models that attempt to provide a framework for public sector pay determination. It is followed by sub-section on models from transition economies. The focus is placed on a model set out by Boeri (1998) because it complements a model that will be developed in the next chapter. So, the Boeri (1998) model is discussed in more detail in the next section.

In the theoretical literature, the first group of models investigates the demand for labour and pay determination in the public sector with the latter as a social welfare maximiser. Ehrenberg (1973), Ashenfelter and Ehrenberg (1973) and Ehrenberg and Schwarz (1986) analyse the effects of tax revenues on ability to pay and the effects of unions on pay and labour demand determination in the public sector. These theoretical models ignore the labour

supply side. For example, Ehrenberg (1973) considers a single decision making unit which is assumed to choose the total per capita level of services. The employment demand function is obtained by maximising the utility function subject to the constraint that the total employment budget is exhausted. This model assumes an infinitely elastic supply of labour.

Recent social welfare models analyse how managers, workers and investors respond to various incentives (Tirole (1994), Hart, Shleifer and Vishny (1997), Rodrik (1997)). This group of models includes adverse selection, moral hazard and incomplete contracting models to obtain optimal public sector performance. In this context, Albano and Leaver (2005) explore recruitment and retention consequences of rigidities in public sector pay.

The second group of models is concerned with the personal objectives of politicians and bureaucrats. The models build upon the argument of bureaucracy ineffectiveness owning to the fact that resources are obtained through 'budget allocation' instead of market performance (Niskanen (1975), Tullock (1965)). In these models bureaucrats manipulate the decision making process to obtain a desired pay and employment combination. This leads to oversupply of goods and organisational growth. Budget maximisation models are usually used to explain the behaviour of public sector unions bargaining for higher wages and employment.

In a third group of models, the demand for labour in the public sector, besides producing public sector output, is utilised for 'vote-producing activities' (Reder, (1975), Courant, Gramlich and Rubinfeld (1979), Freeman (1987)). A special treatment of some groups of voters or political favouritism and increased hiring by the government that runs office are considered to explain public sector earnings' premia or excessive employment.

In a particular theoretical model of Borjas (1980), the existence of wage differentials among similar workers between different administration units within the public sector is explained by the government choosing optimal values of wage and employment, subject to an exogenously given budget, in such a way as to maximise political support. Hence, pay differentials are linked to a number and organisation of constituents and organisation of the bureaucracy. Supply constraints on the government's behaviour are not considered.

A final group of models examines the role of public sector trades unions. A bargaining model developed by Leslie (1985) analyses the effect of cash limits on pay settlements in the public sector. In this model, a cash limit defined as the fixed amount of money available for

the public sector wage bill and known to unions before negotiation, thereby presents a budget constraint with a unit constant elasticity.

Public-private sector wage differentials emerge from the bargaining process between sector-specific monopoly unions in the model set by Holmlund (1993). In this model, a government with utilitarian preferences decides about public sector employment and the tax rate on wages. A public sector pay premium arises from non-cooperative union wage setting. This causes two types of externalities. First, in the form of higher taxes for private sector workers. Second, in the form of lower public consumption for all workers in the economy because a wage increase reduces public sector employment. Under cooperative union wage setting the public sector pay premium disappears.

Haskel and Szymanski (1993) use the right-to-manage bargaining approach to develop the first theoretical framework on the impact of privatisation on wages. In this model privatisation causes lower wages due to decline in union bargaining power and the firm's product market power. However, Haskel and Sanchis (1995) show that wages may increase as a result of privatisation if the degree of workers' effort is included in the bargaining process.

2.2.3 Models on Wage Determination in a Transition Economy

(i) Bargaining Models

Extending the analysis of the effects of wage determination in transition economies, there is a a large strand of theoretical literature that has evaluated the impact of transition - in the form of privatisation - on firm's decisions and on aggregate welfare (Shleifer and Vishny (1994), Boycko, Shleifer, and Vishny (1995), Blanchard (1997), Roland and Sekkat (2000), Šuvaković and Radosavljević (2007)).

Brainerd (2002) uses the framework developed by Shleifer and Visny (1994) according to which state-owned firms maximise a weighted average of profits and personal benefits to the politician or manager of the firm. On the other side, workers maximise a utility function that depends on the wage, the probability of employment in the firm and the wage in alternative employment. In the bargaining process between managers and workers the firm chooses employment given wages. In the context of Russian workers, Brainerd (2002) points

out that this explains why workers accepted low wages in exchange for relatively high levels of employment (a similar argument is highlighted by Blanchard, 1997). The generalized Nash bargaining solution of the right-to-manage model in Brainerd (2002) shows an ambiguous impact of privatisation on wages: the wage is related positively to the outside wage and worker bargaining power and profits ("insider privatisation") and negatively to greater emphasis on profits by managers or politicians ("outsider privatisation").

Commander and Tolstopiatenko (1998) and Aghion and Commander (1999) develop partial equilibrium models of transition considering institutional factors that influenced state-owned firm restructuring. These models incorporate job-to-job movements from the public to private sector as a result of restructuring of state-owned firms rather than as a result of workers' choice. A public sector firm is assumed to be governed by a zero profit condition subject to the wage bill so that wages are set to equal the average product. A public sector firm is assumed to be less efficient than a profit-maximising private firm, where wages are set equal to the marginal product. In these models only the private sector hires workers, either from unemployment or from public sector firms. Hence, workers reallocate from a low wage public sector to a high wage private sector. The public sector firms either face closure or restructuring. In the wage-setting the restructured firm becomes equivalent to a private sector firm. Therefore, the restructuring implies decline in employment resulting in an increase in marginal product for remaining workers. These models do not detail the supply side of the labour market.

Likewise, in Commander (1998) and Köllő (1998) while private firms act as profit-maximisers, public sector firms make their wage and employment decisions on the zero iso-profit curve with wages set equal to the average product. Basu, Estrin and Svejnar (2004) start from the common argument that in a communist system, planners kept wages low and sought to maintain full employment (as in Blanchard and Kremer, 1997). Thus the efficient point for a centrally planned system is the one in which workers are paid the minimum acceptable wage and planners appropriate the maximum profit. Furthermore, the authors argue that prior to the transition, the system had been partially reformed as a result of pressure from workers and managers. Hence, as in Commander (1998) and Köllő (1998) their model uses the McDonald-Solow bargaining framework between planners, managers and workers. A set of final and

intermediate wage-employment outcomes is derived depending on the preferences and relative power of these three parties.

However, Boeri and Terrell (2002) find that unions (as well as minimum wages and employment protection) have had only a modest influence on the labour market in transition economies. They argue that labour reallocation between the public and private sectors in transition can only be explained by adopting a theoretical perspective that allows for heterogeneity in the workforce and a variation of labour supply responses. The remaining part of the section is therefore devoted to the main implications of a model that considers different types of labour, since labour heterogeneity will loom large in the next chapter of the thesis.

(ii) A Worker Reallocation Model

A model that focuses on the importance of labour supply of heterogenous workers in the reallocation between public and private sectors and hence on the sectoral pay gap over the period of economic transition is laid out by Boeri (1998). The model explains why private employers paid the premium for hiring public sector workers at the beginning of the transition, rather than hiring unemployed workers who were ready to work at the lower end of the wage distribution.

Boeri (1998) considers two types of workers: low and high productivity workers. In the model, public sector managers cannot disentangle high from low productivity workers and hence are assumed to pay all workers the same average wage. However, private employers can measure the productivity of each new worker being hired and consequently, offer wages equal to productivity.

In this model, at the launch of the economic transition the total labour force is employed in the public sector. The start of transition involves free entry of private firms. The model assumes that separation rates in public and private enterprises are comparable, whereas significant asymmetries between the two sectors are present on the hiring side. For the reason that the public sector can at best offer an average wage and because an average wage is increased only by hiring high-productivity workers, the public sector is unable to attract (and retain) high-productivity workers, and hence no hiring takes place in the public sector. On the other hand, the model assumes a fixed setup cost for creating new jobs and screening

applicants as a result of which there are a limited number of jobs that can be offered during each period by the private sector.

The model considers three possible pay options for the private sector. The choice by private employers of which wage-job combination to offer will depend on the expected surplus resulting from the new hires. First, if the private sector offers pay higher than the average pay paid by the public sector, it can hire all the high-productivity workers (either in the public sector or unemployed). Under this strategy productivity and wage differentials are increasing between the public and private sectors over time, meaning that high productivity workers would be better off in the private sector while low productivity workers would be better off staying in the public sector. Second, if the private sector offers pay lower than the average but higher than the productivity of low-productivity worker, it can hire only high-productivity workers from the unemployment pool. Third, if the private sector offers a pay lower than the productivity of a low-productivity worker it can hire unemployed workers of both low and high-productivity type. The choice between pay offers will depend on initial endowments of high-productivity workers and public sector lay-off rate.

2.3 Literature Review of Empirical Studies

The empirical literature attempting to measure the public-private sector pay differential offers various econometric techniques. The methods may be grouped into macro and micro econometric techniques. Macroeconometric studies use time-series data with the weights given by the time varying proportions of workers in the public and private sectors. Microeconometric studies use cross-section and panel data to control for a range of worker and job characteristics across public and private sectors in a standard human capital wage regression.

A common microeconometric estimation approach pools data across workers in both sectors in the 'single equation' model. The single equation includes a public sector dummy variable taking the value one if an individual works in the public sector and zero otherwise. In the case when this model is estimated by the ordinary least squares (OLS) the differences in rates of payment between public and private sector are limited to an intercept shift whereas the returns to characteristics are constrained to be equal across sectors. This model is given by:

$$\ln w_i = \alpha + \beta' x_i + \gamma P_i + \varepsilon_i \qquad \text{for } i = 1,...,N \qquad (2.1)$$

where $\ln w_i$ is the log of real hourly earnings for the ith individual which is explained by x_i set of observed worker and job characteristics with the sector-specific parameter vector β, $\hat{\gamma}$ is the 'average' estimate of the public sector pay gap equivalent to an intercept shift and ε_i is an error term uncorrelated with x_i.

An alternative approach named 'double equation' model estimates earnings equations for the public and private sector samples separately and therefore allows different intercepts and returns to characteristics across sectors:

Private sector: $$\ln w_i^{NP} = \alpha^{NP} + \beta'^{NP} x_i + \varepsilon_i^{NP} \qquad (2.2)$$

Public sector: $$\ln w^{P}{}_i = \alpha^{P} + \beta'^{P} x_i + \varepsilon_i^{P} \qquad (2.3)$$

where NP and P denote non-public (i.e. private) and public sectors respectively.

Studies using this method usually decompose the sector pay gap into the 'explained' part (due to differences in observed characteristics) and 'unexplained' part (due to differences in returns to characteristics). Following Oaxaca (1973) a decomposition model can be written as:

$$\ln \bar{w}^{P} - \ln \bar{w}^{NP} = (\bar{x}^{P} - \bar{x}^{NP})\hat{\beta}^{NP} + [\ (\alpha^{P} - \alpha^{NP}) + \bar{x}^{P}(\hat{\beta}^{P} - \hat{\beta}^{NP})\ ] \qquad (2.4)$$

where the first bracket represents the effect of differences in characteristics and the second bracket represents the effect of differences in coefficients (could be interpreted as public sector earnings premium or penalty).

However, simply comparing mean wages between public and private sector workers may produce biased estimates, largely because of selection issues. In this context, a specific identification issue plays a key role. In policy evaluation terms this relates to a missing data problem: we are not able to observe the earnings of public sector workers had they been employed in the same capacity in the private sector and *vice versa.*

Hence, an instrumental variable procedures are usually used to correct for non-random sector selection. The non-random sector selection can be explained starting from the model:

$$\ln w_i = \alpha + \beta' x_i + \gamma_1 P_i + \gamma_2 y_i + \upsilon_i \qquad (2.5)$$

where sectoral attachment P_i might be systematically related to unobserved factor y_i such that $\hat{y}_i = \hat{\rho}_0 + \hat{\rho}_1 \hat{P}_i$ and γ_2 is an unknown parameter. Therefore: $E(\hat{\gamma}_1) = \gamma_1 + \gamma_2 \hat{\rho}_1$ which implies that the so called omitted variable bias in $\hat{\gamma}_1$ is $E(\hat{\gamma}_1) - \gamma_1 = \gamma_2 \hat{\rho}_1$ (Woldridge, 2003). The $\hat{\gamma}_1$ will be unbiased only if $\gamma_2 = 0$ or if $\hat{\rho}_1 = 0$ whereas in other cases the size and direction of the bias will be determined by the sizes and signs of γ_2 and $\hat{\rho}_1$. Hence, estimating (2.1) is not proper if $E(\varepsilon_i \mid P_i = 1) \neq E(\varepsilon_i \mid P_i = 0)$ implying that $\varepsilon_i = \gamma_2 y_i + \upsilon_i$.

Instrumental variable methods require plausible instruments that identify the worker's sector choice but which are uncorrelated with earnings. This can be written as:

$$P_i = \delta' z_i + v_i \quad \text{and} \quad E(\varepsilon_i \mid z_i) = 0 \tag{2.6}$$

where z_i are characteristics (i.e. instruments) that indicate sectoral attachment P_i but are uncorrelated with earnings and δ is the parameter vector. The (2.6) is typically used in the first stage of a Heckman selection model (Heckman, 1979) or assuming $\hat{\beta} = \hat{\beta}^P = \hat{\beta}^{NP}$ in (2.1) in a linear probability model in the first step of a two stage least squares instrumental variable procedure. However, such instruments are difficult to find and often rely on functional form assumptions rather than theory (see Dustmann and Van Soest (1998) and Disney and Gosling (2003)).

Preferably, researchers use 'fixed effects' methods applied to panel data in order to net out individual unobserved characteristics y_i. The model by which we can track each individual i over time t can be written as:

$$\ln w_{it} = \beta' x_{it} + \gamma P_{it} + y_i + \varepsilon_{it} \qquad \text{for } i = 1,...,N \text{ and } t = 1,...,T \tag{2.7}$$

The unobserved effect, fixed over time, y_i, disappears by estimating the following model by pooled OLS:

$$\ln(w_{it} - \overline{w}_i) = \beta'(x_{it} - \overline{x}_i) + \gamma(P_{it} - \overline{P}_i) + (\varepsilon_{it} - \overline{\varepsilon}_i) \tag{2.8}$$

Therefore, 'fixed effect' (i.e. 'within-group') estimator $\hat{\gamma}$ is obtained avoiding the problem of adequate instruments. Nevertheless, the empirical evidence based on 'fixed effects' methods is rare due to a lack of panel data.

Finally, all approaches mentioned can be used to obtain estimates not only at the conditional mean but across the whole earnings distribution. This is done by using quantile regression methods where ϑ^{th} is the regression quantile, $0 < \vartheta < 1$, computed as in Koenker and Basset (1978):

$$\min_{\beta \in R^k} \left\{ \sum_{i:\ln w_i \geq \beta'_\vartheta x_i + \gamma_\vartheta P_i} \vartheta \left| \ln w_i - \beta'_\vartheta x_i - \gamma_\vartheta P_i \right| + \sum_{i:\ln w_i < \beta'_\vartheta x_i + \gamma_\vartheta P_i} (1-\vartheta) \left| \ln w_i - \beta'_\vartheta x_i - \gamma_\vartheta P_i \right| \right\} \quad (2.9)$$

The next section reviews public sector pay gap estimates reported by the studies that utilised different estimation methods. As a point of reference, the first part of the next section briefly summarises the main empirical results from developed market economies. The subsequent part presents a review of empirical studies from transition economies.

2.3.1 Main Empirical Results from Studies in Developed Countries

Selected empirical literature on public-private sector pay differentials in developed market economies is summarised in Table 2.1. The reviewed studies relate to research that was conducted over the last twenty years.

Elliot and Duffus (1996) used time series techniques to reveal that the relative pay of public sector non-manual workers in UK declined in the period after 1980 until 1991 and 1992. On the other side, they find that manual workers fared better in the public than in the private sector. Similarly, Katz and Krueger (1991) find that a sharp rise in skill differentials in the 1980s in the US was mainly a private sector phenomenon. This study documents that education differentials and wage inequality barely increased in the government sector.

Both of these studies used time series models to focus on specific groups of similarly qualified workers. Since these models are sensitive to issues of worker and job heterogeneity other studies reviewed here used microeconometric methods.

Table 2.1: Summary of the selected empirical literature on public-private sector pay gap in developed market economies over the last two decades

Study	Data source	Years covered	Methodology	Results
UK				
Rees and Shah (1995)	General Household Survey	1983, 1985, 1987	Decomposition at the mean	Public sector premium annual: 10%, 9.8%, 11.4% for men and 26.3%, 22.3%, 25.9% for women. Men differ more in characteristics (endowments) and women in returns (coefficients).
Elliott and Duffus (1996)	New Earnings Surveys	1970-1992	Time series technique	Public sector hourly premium declined by 5-20% over the period for nonmanual and manual occupations but increased by 15% in education occupations.
Blackaby, Murphy, O'Leary (1999)	Quarterly Labour Force Survey	Autumn 1993 – Summer 1995	Decile Decomposition	Public sector hourly pay gap falls from 1.5% (3.3%) at the 10th percentile and -1.9% (0.1%) at the 90th percentile for men (women).
Disney, Goodman, Gosling, Trinder (1998)	New Earnings Survey	1979-1994	OLS	Public sector pay premium after controlling for occupation: 8% (16%) in early 1980's and 0% (8%) in early 1990's for men (women).
	General Household Survey (GSH) and British Household Panel Survey (BHPS)	1983 GSH and 1991-1995 BHPS	Quantile regression	Public sector weekly pay gap for men in 1983: +8% at 10th and +4% at 90th percentile; 1991-95: +10% at 10th and -5% at 90th percentile.
Disney and Gosling (1998)	General Household Survey (GSH) and British Household Panel Survey (BHPS)	1983 GSH and 1991-1995 BHPS	Quantile regression	Public sector weekly pay premia/penalties differ across educational levels. Pay compression effect largest for graduates: men in 1983 25% at 10th and 0% at 90th percentile; in 1991-95 at 25th percentile and above significant public sector penalty; women in 1983 0% across distribution; in 1991-95 premia at the lower end and penalty at the top end of earnings distribution.
		1991-1995 BHPS	OLS	0% (13.7%); 9.1% (21.2%); 8.9% (26.4%); -9.4% (6.6%) for men (women) with no qualification; O level or below; at least one A level; Degree or above.
		1991-1995 BHPS	Fixed effects	6% (17.7%); 4.6% (7.8%); -6.4% (17.3%); 13.2% (16.6%) for men (women) with no qualification; O level or below; at least one A level; Degree or above.
Bender (2003)	Social Change and Economic Life Initiative (SCELI)	1986	Decomposition at the mean and deciles	Average hourly pay differential: 8.6% (23.6%) for men (women). Without adjustment: 4.9% (11.5%) at 10th percentile -0.3% (5.6%) at 50th percentile and 8.9% (17.1%) at 90th percentile for men (women). Adjustment for differences in mean differences: 3.2% (0.1%) at 10th percentile, -2% (-5.8%) at 50th percentile and 7.2% (5.7%) at 90th percentile for men (women).
			Decomposition at the mean and deciles controlling for sector selection	Instruments: worker attitudes towards unionisation and whether father worked in the public sector when the respondent was age 14. Average hourly pay differential: 14.5% (41.2%) for men (women). Without adjustment: 13.4% (34.1%) at 10th percentile 7.3% (28.9%) at the 50th percentile and 18.5% (32.8%) at 90th percentile for men (women). Adjustment for differences in mean differences: 2.2% (1.9%) at 10th percentile -4% (-3.3%) at 50th percentile and 7.2% (0.6%) at 90th percentile for men (women).

Disney and Gosling (2003)	British Household Panel Survey (BHPS) New Earnings Survey (NES)	1991-1999	OLS Fixed effects Instrumental variable procedure	Hourly pay differential: All workers: 5% men; 17.2% women. Graduates: -7% men; 2% women. No education: 0% men, 14.3% women. Hourly pay differential: All workers: 0% men; 9.2% women. Graduates: 16% men; 20% women. No education: 0% men, 10.7% women. Measurement error instrument: proportion of each occupation in the public sector. Instrument for endogenity of job moves: occupation in t-1 period. Measurement error and endogenous change biases are of the opposite direction. For men measurement error and endogeneity cancel out so first differences showed no statistically significant public sector effect. For women the measurement error is less crucial and therefore there is a premium.
Yu, Van Kerm, Zhang (2005)	British Household Panel Survey (BHPS)	1991-2001	Bayesian quantile regression	Public sector hourly pay gap for men at 10th, 50th, 90th percentile, respectively: 1991: 6.05%, 4.34%, -3.02% 1995: 13.19%, 10.74%, -6.24% 1999: 7.07%, 2.49%, -10.68% 2001: 13.18%, -1.21%, -11.66%.
Postel-Vinay and Turon (2007)	British Household Panel Survey (BHPS)	1996-2003	A model of income and employment dynamics	The average public monthly total income premium in terms of present discounted sum of future incomes would be positive (although small) if individuals remain all their working life in either sector. The public premium in lifetime values is zero for highly employable individuals when job mobility is taken into account. Greater variance of private sector incomes due to the transitory component of income.
Disney and Gosling (2008)	New Earnings Survey (NES) / Annual Survey of Hours and Earnings (ASHE) panel data	1975-2006	Fixed person effects by using a two step estimator. First stage: 'within groups' model without the public sector status. Second stage estimates the public sector wage effect. Comparison of nurses and those who have ever been nurses	Long run public-private hourly pay differential is not large (i.e. close to zero). Statistically significant public sector penalty for men in 20 out of 32 years and premium for women in 18 out of 32 years of data. Capturing a pay-work quality trade-off predicted wage differentials relatively stable over the period.
US				
Moulton (1990)	Current Population Survey (CPS)	1988 September to December	Double equation technique	Public sector hourly premium declines when detailed occupation variables are included: blue collar 8.6%, clerical 4.1%, administration 0%.
Katz and Krueger (1991)	Current Population Survey (CPS)	May 1973, 1975 and full year 1979, 1983, 1988	Double equation technique by examining different subsamples (by sector, education,	Public sector hourly wages more compressed. Public sector premium highest for women and less educated.

		(outgoing rotation groups)	experience and gender)	
Moore and Raisian (1991)	Panel Study of Income Dynamics (PSID) and Current Population Survey (CPS)	PSID: 1970-79; CPS May: 1979 and 1983	OLS Decomposition at the mean Fixed effects	Government hourly wage differential PSID: 0%, CPS: 3.7%. Government hourly wage differential PSID: 3.99%, CPS: 2.63%. PSID: 2.14%.
Jacobsen (1992)	1% Census Sample	1980	OLS	Federal government hourly premium for men: 9% (white), 12% (non white) and women 16% (white), 18% (non white).
Choudhury (1994)	Current Population Survey (CPS)	March 1991	Heckman corrected wage equation for sector and sample selection	Public sector hourly premium: 19% men and 26% women. Sector selection important for public and employment selection for private sector.
Poterba and Rueben (1994)	Current Population Survey (CPS)	1979-1992	OLS Quantile regression	Public sector hourly pay gap (state and local government relative to private sector) in: 1979: -9.8% (+3.08%); 1991: -2.4% (+3.6%) for men (women). 1979: 0% at 10th and -18.3% at 90th 1991: +7.6% (+9.2%) at 10th and -8.1% (-4.3%) at 90th for men (women).
Australia				
Birch (2006)	Australian Bureau of Statistics' Household Sample File	2001	OLS Quantile regression	Public sector hourly pay premium for men 9.3% 20.9% at 10th, 8.5% at 50th and -5.4% at 90th percentile.
Canada				
Mueller (1998)	Labour Market Activity Survey (LMAS)	1990	Quantile regression Decile Decomposition	Public sector hourly pay gap: 2.1% (11.8%) -3.4% (2.4%) for men (women) at 10th and 90th percentiles respectively. Differences due to returns to characteristics: 9.8% (22.1%) -5% (-7%) for men (women) at 10th and 90th percentiles respectively.
France, Italy, UK				
Lucifora and Meurs (2004)	British Labour Force Survey (GBLS), Bank of Italy's Survey of Household Income and Wealth (SHIW) and French Labour Force Survey (FREE).	1998	Quantile regression Decile Decomposition	Public sector hourly pay premium for low skilled and penalty for high skilled. Differentials higher for female workers. For all workers: France: 9.5%, 6.4%, 0% at 10th, 50th, 90th percentile. Italy: 11.4%, 6.1%, 0% at 10th, 50th, 90th percentile. UK: 13.7%, 7.3%, 0% at 10th, 50th, 90th percentile. Differences in returns: Men: France: 8.6%, 2.4%, -5.5% at 10th, 50th, 90th percentile. Italy: 8.1%, 2.1%, -1.9% at 10th, 50th, 90th percentile. UK: 5.8%, 3.4%, -3.3% at 10th, 50th, 90th percentile. Women France: 10.7%, 8.4%, 3.4% at 10th, 50th, 90th percentile. Italy: 8%, 5.2%, 1.3% at 10th, 50th, 90th percentile.

				UK: 16.3%, 8.3%, 0% at 10^{th}, 50^{th}, 90^{th} percentile.
France				
Bargain and Melly (2007)	French Labour Force Survey	1990-2002	Quantile regression Fixed effects quantile regressions	Public sector hourly pay gap: Pooled estimates for men (women): at median: -7.2% (+9.4%); 90^{th} -10^{th} : -18.2% (-14.6%); 75^{th}-25^{th}:-9% (-8.6%). Public sector hourly pay gap: Pooled estimates for men (women): at median: -0.2% (+0.2%); 90^{th} -10^{th} : -3.4% (-2.5%); 75^{th}-25^{th}: -1.1% (-0.5%)
Germany				
Dustmann and Van Soest (1997)	German Socio-Economic Panel (GSOEP)	1984-1993	OLS	Pooled public sector hourly pay premium: -6.5% men and +10.6% women. For men penalty increases and for women premium declines with higher level of education.
Dustmann and Van Soest (1998)	German Socio-Economic Panel (GSOEP)	1984	Endogenous switching regression	In the public sector, blue collar workers earn about 7% lower hourly pay than white collar workers. In the private sector, this difference amounts to 16%. On average, the public sector workers have a comparative advantage in the public sector. Instruments taken from 1986 data set: the labour market status and occupation of the father when the child was aged 15, whether the mother participated in the labour market or not, the age of father and mother when the individual was born, and the education level of father and mother.
Melly (2005)	German Socio-Economic Panel (GSOEP)	1984-2001	Decile Decomposition	Most experienced and those with basic schooling gain the most from public sector status. Public sector hourly pay gap stable over almost 2 decades. In 2001: Men: 5% at 10^{th} percentile and -17.4% at 90^{th} percentile Women: 29.6% at 10^{th} percentile and -6.9% at 90^{th} percentile Low education: -2.9; Medium education: -5.4; Higher education: -10.1; University: -13.1.
Melly (2006)	German Socio-Economic Panel (GSOEP)	2003	Quantile regression IV in quantile regressions	Public sector compresses the hourly pay for men (i.e. positive premium at the low end and negative at the upper tail). At the median: -11.5%. Instruments: 5 variables related on parents' occupational status (whether a father is a civil servant, blue or white collor worker or self employed and a mother did not work when the respondent was 16 years old). At the median after correcting for endogeneity: +3.3% The public sector pay compression remains or is even accentuated. Hence, the different distributions of wages were not caused by different distributions of unobserved ability.
Ireland				
Boyle, McElligott, O'Leary (2004)	European Community Household Panel (ECHP) for Ireland	1994-2001	OLS Quantile regression	Public sector monthly gross pay premium all workers: 14.07% in 1994 and 12.98% in 2001. Interactions between public sector status and level of education showed that there are no significant differences in returns to education between sectors. 1994: 17.4% at 10^{th} and 8.2% at 90^{th}; 2001: 16.88% at 10^{th} and 9.41% at 90^{th} percentile.

Netherlands				
Hartog and Oosterbeek (1993)	Unnamed microdata	1983	Endogenous switching model	Public sector hourly pay premium for lower and higher educational qualification: OLS (15% and 14%) and selection (17% and 13%). Instruments: number of siblings/100, father's occupation, father's and mother's education. Workers select the better paying sector for them.
Van Ophem (1993)	Dutch OSA Labour Market Survey	1986	Endogenous switching model	Public sector hourly pay premium 11.4% OLS but penalty after controlling for selection (public sector pay gap -38% for high skilled). Sector choice equation includes: 6 education levels, age and age squared, gender and country of birth.
Portugal				
Machado and Mata (2001)	*Quadros de Pessoal* by the Portuguese Ministry of Employment	1982 and 1994	Quantile regression	Greater hourly pay compression in state owned firms. All workers: 1984: 17.60% at 10^{th} and -6.81% at 90^{th} percentile 1994: 11.83% at 10^{th} and -1.63% at 90^{th} percentile
Sweden				
Albrecht, Bjorklund, Vroman (2003)	Statistics Sweden LINDA data set for research purposes	1998	OLS Quantile regression	Public sector monthly pay gap -9.5% (-2.9%) men (women) -0.9% (+3.7%), -7.9% (2.1%), -15.5% (10.1%) at 10^{th}, 50^{th} and 90^{th} percentile respectively for men (women).

The results from microeconometric methods vary across countries and are sensitive to the econometrical methods applied. Starting from a simple OLS dummy variable approach, UK researchers estimated that in the early 1980s there was around 10% of the public sector wage premium. This premium has changed over time. For example, after controlling for age and education, Disney and Gosling (1998) find that the public sector male wage premium declined from 5% in 1983 to 1% in the early 1990's. At the same time, the public sector female wage premium increased from 11% to 14%.

In Germany over the period from 1984 until 1993 only female workers collected a public sector pay premium of around 11% whereas male workers obtained 6.5% public sector penalty (as estimated by Dustmann and Van Soest, 1997). In Australia, Birch (2006) points that the wage premium appears to be around 10% in early 1980's for male workers and has not changed considerably over time (i.e. by the end of 1990's). A public sector pay gap of a similar order is found by Jacobsen (1992) for federal government male workers in US in 1980 whereas the pay gap for females was twice as large. However, Poterba and Rueben (1995) found that US state and local government male workers obtained a penalty relative to their private sector counterparts in the early 1980's which declined towards zero by the 1990's. Female workers in state and local government are estimated to gain around a 3% premium in the early 1980's and this premium has not changed much over time.

In general, most of the studies found that the public sector pay effects vary by gender, race (i.e. whites and non-whites as showed by Jacobsen (1992)), occupational level (i.e. manual and non-manual as showed by Dustmann and Van Soest (1998)) and educational qualification (as showed by Disney and Gosling (1998), Dustmann and Van Soest (1997), Melly (2005)). In particular, females, non-whites and workers in the less skilled occupations are found to receive greater 'mark-up's to a public sector status. Moreover, studies that used decomposition methods (Moore and Raisian (1991), Mueller (1998), Bender (2003), Lucifora and Meurs (2004)) mainly found that men differ more in characteristics (endowments) and women in returns (coefficients).

However, simply comparing wages between public and private sectors from cross-sectional data may produce biased estimates, largely because of non-random selection. In particular, given that workers can choose whether to work for the public or private sector there

is a potential for sample selection bias by both 'single' (i.e. dummy variable approach) and 'double' equation methods estimated by ordinary least squares (OLS). For this reason, a group of studies attempted to correct for sector selection bias by applying different forms of instrumental variable procedures (for example two stage least squares (2SLS), Heckman (1979)/Lee (1978) correction for selectivity, endogenous switching regression models).

The results of these studies suggest less agreement about the size of the public-private sector pay differential. This may be largely due to different identification assumptions and instruments used in the analysis. For example, Van Ophem (1993) used the level of workers' education and age as an identification strategy. He finds that the estimated 11.4% public sector premium in 1986 in Netherlands translates into a penalty after controlling for selection. On the other hand, also for Netherlands, but for the year 1983, Hartog and Oostenberg (1993) used worker background characteristics such as the number of siblings and parental occupation and education variables. As opposed to Van Ophem (1993) they do not find considerable differences between the mean estimates before and after controlling for selection.

In this context, Dustmann and Van Soest (1998) showed that the positive relation between education level and public sector choice may be due to unobserved heterogeneity rather than a structural effect. In addition, they suggest that the estimates of wage equations may be biased because the correction for selectivity is often identified by using different specifications of the educational variables in selection and wage equations. In particular, Dustmann and Van Soest (1998) using German data in 1984 found that correcting for non-random selection not based on instruments reflecting parental background characteristics leads to significantly different conditional sector pay differentials. Hence, they write: 'Thus the main methodological conclusion is that correcting for non-random selection is important, but is only useful if appropriate instrumental variables are available which play a role in the selection mechanism, but can be excluded from the wage equation', (Dustmann and Van Soest (1998), pg. 1419). Using a number of family background variables (such as the labour market status of the father when the child was aged 15, whether the mother participated in the labour market or not, the age of father and mother when the individual was born, and the education level of the father and mother) the selection models employed in this study suggested that workers self-select into the sectors where they have the greatest comparative advantages.

Much of the other studies also explored various instruments to correct for a worker self-selection. For the UK, Bender (2003) estimated the public sector premium in 1986 by using workers' attitudes towards unionisation and the fathers' occupation as instruments for sector selection. She found that the premium was greater after correcting for selection bias (i.e. estimates increase from 9% to 14% and from 24% to 41% for men and women, respectively).

Another strand of studies avoided identification issues by tracking the same individuals over a given period of time. The panel data based methods net out the fixed individual effects by differencing sample observations around the individual sample means (so called 'fixed effects' or within group estimator). By applying 'fixed effects' methods on British Household Panel data for the period during 1990s, Disney and Gosling (2003) find that a negative differential for male university graduates previously found in the cross sections (i.e. in Disney and Gosling, 1998) appeared to have arisen from selection.

On the other hand a considerable number of studies across different countries used quantile regression methods to compare the pay dispersion between the public and private sectors. A common finding from these studies, irrespectively of the cross-sectional procedures applied ('single equation' approach, decompositions and instruments to control for selectivity) is that the public sector pay is more compressed than the private sector pay (Disney and Gosling (1998), Blackaby, Murphy, O'Leary (1999), Yu, Van Kerm, Zhang (2004) for UK; Poterba and Rueben (1994) for US; Birch (2006) for Australia; Mueller (1998) for Canada; Lucifora and Meurs (2004) for Italy, France and UK; Melly (2005) for Germany; Boyle, McElligott, O'Leary for Ireland; Machado and Mata (2005) for Portugal and Albrecht, Bjorklund, Vroman (2003) for Sweden).

For example, Poterba and Rueben (1994) found that in the US in 1979 male workers at the 10^{th} percentile fared the same across the sectors but those at the 90^{th} percentile had almost a 20% pay penalty (after controlling for education, experience, marital status, race and residence). The pay gap had changed by 1991. Workers at the 10^{th} percentile gained a 7.6% premium whereas the penalty for those at the 90^{th} percentile had declined to 8%.

In the UK, Disney and Gosling (1998) investigated the role of privatisation and compulsory competitive tendering based on the British Household Panel data. They found that

the wage distribution conditioned on age and education increased from 1983 until the early 1990's in both public and private sectors, but more in the private sector. They also estimated that the public sector pay compression was the largest for university graduates.

Considering the same period (i.e. 1982-1994) but using Portuguese data, Machado and Mata (2001) showed that the wage inequality of state-owned enterprises increased during the period of structural reforms and privatisations in Portugal. After controlling for gender, education, experience, tenure, firm size and industry they found that the state-owned enterprises premium for workers at the 10^{th} percentile declined from 18% in 1982 to 12% in 1994. For workers at the 90^{th} percentile they estimated a decline in the the state-owned enterprises' pay penalty from 7% in 1982 to 2% in 1994.

Other studies estimated quantile regressions for the public and private sector workers separately and presented the estimates by decomposition techniques (Blackaby, Murphy, O'Leary (1999), Mueller (1998) Lucifora and Meurs (2004), Melly (2005)). Although these studies differ in decomposition methods applied (i.e. Blackaby, Murphy, O'Leary (1999) apply decomposition method outlined in Juhn, Murphy and Pierce (1993) while Mueller (1998), Lucifora and Meurs (2004) and Melly (2005) apply decomposition method outlined in Machado and Mata (2005)) their results in general are quite similar.

In particular, Lucifora and Meurs (2004) obtained cross-country estimates on public-private sector pay differentials for UK, France and Italy in 1998 controlling for education, age, marital status, occupations, part-time jobs and regions. The same technique is applied on 1990 Canadian data by Mueller (1998) [1] and on 2001 German data by Melly (2005)[2]. Conclusions from these studies can be summarised as follows. The public sector workers are found to collect the largest premia at the lower-end of the earnings distribution. The relationship between earnings and public sector status is negative for workers earning very high wages. This pattern holds for both men and women in Canada and Germany but with female workers obtaining a greater premium or lower penalty than men. For female workers in the UK, France

[1] after controlling for a large set of characteristics: level of education, province of residence, marital status, age group, mother tongue, household head, disability, visible minority, immigrant, occupation, number of employees, job tenure, union status, part-time status, and job-related pension.

[2] after controlling for education, experience, occupation, marital status, tenure and part-time status.

and Italy the earnings advantage occurs across the whole pay distribution but declines to zero as one moves towards the top-end.

As an improvement to these studies Blackaby, Murphy, O'Leary (1999) include a sector selection correction term in wage equations. However, their results are found not to be affected by the endogeneity of sectoral choice. They estimated that UK public sector male workers earned a 1.5% premium at the 10^{th} percentile and a 2% penalty at the 90^{th} percentile after controlling for a range of individual, job specific and demographic characteristics[3] based on Quarterly Labour Force Survey data from 1993 until 1995. The public sector premium for female workers is estimated at 3.3% at the 10^{th} percentile and zero at the 90^{th} percentile.

Finally, Melly (2006) proposed an instrumental variable method for estimating the effects of the public sector status on the entire wage distribution controlling for endogenous sector choice. He used variables related to the parents' occupational status (whether a father was a civil servant, blue or white collar worker or self employed and the mothers' employment status when the respondent was 16 years old) as instruments. These were based on German Socio-Economic Panel data for 2003. Melly (2006) found that at the median the public sector 11.5% penalty translates into 3.3% premium after correcting for endogeneity but that the public sector pay compression remained or was even accentuated. Hence, he concludes that the different distributions of wages were not caused by different distributions of unobserved ability.

Nonetheless, Bargain and Melly (2007) using the same data set as in Lucifora and Meurs (2004) for France but applying fixed effects panel data estimations on quantile regressions over the period from 1990 until 2002 found that the public sector wage compression is mainly due to unobserved characteristics. This study showed that the long term sectoral differences are essentially zero for both male and female employees. Their result may be related to Postel-Vinay and Turon (2007) who showed that the greater variance of private sector incomes in the UK is due to the transitory component of income. In particular, Postel-Vinay and Turon (2007) estimated that the average total income public sector premium for highly employable individuals in terms of the present discounted sum of future incomes would

[3] full-time education, work experience and its square, health, marital status, ethnic origin, highest educational qualification, region of residence, tenure with current employer, size of workplace, trade union affiliation, occupation, industry and a constructed selectivity term to model sectoral attachment.

be positive (although small) if individuals remain all their working life in either sector and zero if job mobility is taken into account.

Similar results are obtained by Disney and Gosling (2007) for the UK, but by using different panel data methods, when considering the long term period over the 1970s, 1980s, 1990s and the early 2000s. They proposed a new method to construct time-varying sector pay gap estimates and to control for changing unobservable as well as observable characteristics of the workforce. They found that the long run public sector pay differentials do not seem to depart strongly from zero but that the fluctuations in the public sector pay gap induce compensating changes in workforce quality.

Summarising the results presented in the Table 2.1, the size of the public sector pay effect estimated in developed market economies appears to depend upon gender, educational qualification and worker position across the pay distribution. Female workers, lower qualified and those at the lower end of the earnings distribution seem to collect the largest 'mark-up' to public sector status. Nevertherless, these conclusions have proved relatively sensitive to the empirical methods used as well as to the length of time and country considered.

2.3.2 Empirical Evidence from Countries in Economic Transition

How big is the public sector pay gap in transition economies? The studies on public-private sector pay differentials in the countries of Eastern Europe cover the period from the earl 1990s when the public sector faced private sector competition for workers for the first time after half a century.

A general concern of the empirical research is related to the quality of the public sector workforce due to difficulties to retain and recruit competent workers that were poached to private sector by significant pay premia estimated at the start of economic transition. Table 2.2 summarises the main results in the empirical literature on public-private sector pay differential in the transition economies of Eastern Europe.

Table 2.2: Summary of the empirical literature on public-private sector pay gap in transition economies

Study	Country	Data source	Years covered	Methodology	Results
Flanagan (1995)	Czech Republic	Survey of Expectations and Attitudes	1993	OLS	Workers (owners) in state-owned enterprises earn lower montly after tax wage than those in the new private firms: -18% (-43%). The wage gap associated with university degree about -30%.
Rutkowski (1996)	Poland	Labour Force Survey	1993	Unconditional pay ratios	Public sector after tax monthly pay gap -2% for men and -6.5% for women. Workers with university degree penalised the most (-12% men and -40% women).
Newell and Socha (1998)	Poland	Labour Force Survey	1992, 1996	OLS	Public sector after tax hourly wage gap relative to private sector was -5.1% (-8.6%) in 1992 and +7.9% (-0.2%) in 1996 for men (women). In 1996 for men the public sector pay gap was negative only for those with university degree (-8%).
Lehmann and Wadsworth (2000)	Poland	Labour Force Survey	1994-1996	OLS	State and private sector firms in Poland offer the same weekly after tax wages to new recruits.
	Russia	Russian Longitudinal Monitoring Survey	1994-1996	OLS	The weekly after tax wage gap between the new state sector jobs relative to new private sector jobs in Russia -13% .
Adamchik and Bedi (2000)	Poland	Labour Force Survey	1996	Endogenous switching regression model	-7% (-10%) public sector monthly after tax pay gap for full-time men (women). Male (female) workers with university degree and 5 years of work experience had monthly after tax earnings disadvantage: -22% (-21%). Instruments: age and whether the individual entered post-1989 labour market.

Newell (2001)	Poland	Labour Force Survey	1994, 1998	OLS	Public sector hourly after tax wage gap changed from -12.9% in 1994 to -8.5% in 1998 for full time employees.
Jovičić, Nojković and Paranos (2000)	Serbia	Labour Force Survey	1998	OLS	The public sector pay penalty for men between 35 and 49 years old (and proportionately to their education) when compared to their private sector counterparts who work long hours and preferably run their own businesses.
Brainerd (2002)	Russia	All-Russian Centre for Public Opinion Research	1993, 1994, 1997, 1998	OLS	Workers in the state-owned relative to the privately-owned enterprises earned monthly after tax wage penalty: -27% in 1993; -23% in 1994; -21% in 1997 and -16.5% in 1998.
				Quantile Regression	The pay gap for workers in the 1st through 3rd deciles about -16% and in the 9th decile -47% in 1993.
Adamchik, Hyclak and King (2003)	Poland	Labour Force Survey	1994, 2001	OLS	Public sector monthly after tax earnings gap -9% (-6.3%) in 1994 and -3.4% (-4.5%) in 2001 for men (women).
Jovanović and Lokshin (2003)	Serbia	Labour Force Survey	2000	Endogenous switching regression model	Public sector hourly after tax earnings gap -9.4% (-4%) for men (women). Instruments: marital status and number of jobholders in the household.
Reilly (2003)	Serbia	Labour Force Survey	1995-2000	Quantile Regression	Public sector hourly after tax wage gap for men: 1995: 0% -17% -19% -25% -65% at 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th} respectively. 1996: statistically insignificant at all percentiles. 1997:-21%,-18% at 10^{th}, 25^{th} respectively; other percentiles insignificant 1998: 0% -21% -21% 0% -25% at 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th} respectively. 1999: -18% 0% 0% -17% -28% at 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th} respectively. 2000:-26% -37% -33% -31% -28% at 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th} respectively.

					Pooling 1995-2000 data, OLS public sector gap -32.7%. Quantile regression estimates: -17% at 25th percentile and almost -70% ' at 90th percentile while workers at other percentiles of the wage distribution obtained no significant penalty.
Falaris (2004)	Bulgaria	Integrated Household Survey	1995	Endogenous switching regression model	Positive selectivity in both sectors for men. For women positive selectivity in the public but negative selectivity in the private sector. Instruments: farmland received in the restitution program increases the probability of employment in the private sector.
Jovanović and Lokshin (2004)	Russia (Moscow)	Labour Force Survey	1997	Endogenous switching regression model	The hourly after tax pay gap for male workers in the state sector -14.3% relative to their counterparts in the private sector on average. For women: -18.3%. For male (female) workers with university degree: -44% (-22%) Instruments: industry employment prior in 1991, marital status and number of children in the household.
Newell and Socha (2005)	Poland	Labour Force Survey	1994-2002	Double equation Quantile Regression Heckman corrected wage equation for employment selection	Separate equations for public and private sectors for each year from 1994 until 2002 showed lower returns to all forms of post-primary education and white skilled occupations (professional, managerial, technical) in the public than in the private sector. Positive relationship between firm size and wages more pronounced in the private sector. Public sector pays higher monthly after tax earnings at the bottom end of the wage distribution and lower at the top end. The pay gap changes from -12% in 1994 to statistically insignificantly different from zero in 2002.
Keane and Prasad (2006)	Poland	Household Budget Survey	1985-1992 and 1994-1996	OLS	Public sector penalty in quarterly labour income in 1986: -7.5%,1988: -5.9%,1989: -6.7%, 1990: -8.2% 1991: -13% 1992: -9%. Monthly labour income gap for public sector relative to small private firms in 1994: 8.7%, 1995: 11%, 1996: 10.2%. Monthly labour income gap for public sector relative to large private firms in 1994: -18% 1995: -19.8% 1996: -18.3%.
Leping (2006)	Estonia	Labour Force Survey	1989-2004	Quantile Regression	Public sector monthly pay gap in year 1989: -23%, -31.2%, -76.8%; in 1994: 19.2%, -8.6%, -20%; 1998: 13%, 0%, -9.4%; 2002: 2.4%, -4.6%, -7.1%; 2004:0%, -2.8%, -11.4% at 10th, 50th, 90th percentile respectively.

Newell and Socha (2007)	Poland	Labour Force Survey	1994-2004	OLS	Public sector hourly after tax pay gap -11% in 1994, -8% in 1998 and statistically insignificantly different from zero in 2002 and 2004.
				Quantile regression	Public sector hourly after tax pay gap -3%, -5%, -5%, -6 %, -10% on 10th, 25th, 50th, 75th and 90th percentile respectively in 1998. Public sector hourly after tax pay gap 8%, 5%, 0%, 0%, -6% on 10th, 25th, 50th, 75th and 90th percentile respectively in 2002.
				Heckman corrected wage equation for employment selection	Public sector hourly after tax pay gap -6% in 1998 and insignificant in 2002.
Delteil, Pailhé and Redor (2004)	Hungary	Harmonised Hungarian Wage Survey	1992-1998	OLS	State-owned enterprises relative to privately owned: -1.3% pay gap in 1992, statistically insignificantly different from zero in 1994, 1996 and 1997, 3.2% and 7.4% in 1995 and 1998, respectively. State-owned enterprises relative to foreign-owned: -24.5%, -23.5%, -23%, -25.5%, -28.4%, -22.7 % in each year observed.
Telegdy (2006)	Hungary	Harmonised Hungarian Wage Survey	2000-2004	OLS	Public sector average monthly gross pay gap: -27% in 2000, -25.7% in 2001, -20.5% in 2002, 7% in 2003 and 8.4% in 2004. Difference in returns:-13.4% (14%); -13.3% (13.7%); -22% (9.8%); -43.2% (-3.7%) for primary school or less; vocational; high school; university, respectively in 2000 (2004). In 2000 lower returns to all occupations in the public than in the private sector. In 2004 returns to all occupations except professional greater in the public sector.
Hámori (2007)	Hungary	Harmonised Hungarian Wage Survey	1994-2003	OLS and Quantile Regression	Public monthly gross pay gap for male workers -23% (OLS) (-13% at the bottom quantile and -40% at the top quantile) in 1994, -21% (OLS) in 1995, -31% (OLS) in 1996, -38% (OLS) in 1997 (-25% at the bottom quantile and -62% at the top quantile), -37% (OLS) in 2000, -36% (OLS) in 2001, (-32%) in 2002, (-14%) in 2003 (24% at 10th, 4% at 25th quantile). Low skilled men: 1.1% (-4.4%); 10% (-14.1%); 0.9% (-14.4%); 11.4% (-20%) in 1994;1997;2000;2003, respectively at 10^{th} (90^{th}) percentile. Middle skilled men: -7.1% (-2.4%); -3.3% (-17%); -11.8% (10.5%); 3.4% (-25.7%) in 1994;1997;2000;2003, respectively at 10^{th} (90^{th}) percentile. High skilled men: -30.3% (-41.9%); 6.2% (-47.6%); -8.5% (-36.2%); 12.3% (-48%) in 1994;1997;2000;2003, respectively at 10^{th} (90^{th}) percentile.

The empirical studies apply different econometric techniques on cross-sectional data. This is simply because panel data have not been collected in these countries. Nearly all empirical studies, irrespective of econometric method applied, found evidence of public sector pay penalties which tended to withdraw with the progress of transition towards market economy.

However, it is difficult to make a comparison across studies as the size of the public-private sector pay differential may vary depending on: (1) public and private sector samples given by data availability (2) earnings definition (i.e. after or before tax, monthly or hourly, wage arrears incidence and non-wage compensations) (3) measurement error (i.e. employer-provided data or self-reported data) and (4) empirical method applied. For this reason we first summarise the main difficulties in public-private sector pay gap estimation in transition economies and then we present the main findings of studies reviewed in Table 2.2.

(i) Difficulties in Public-Private Sector Pay Gap Estimation in Transition Economies

Definition of Public and Private Sectors

The way the public and private sectors are defined varies across countries. For example, in the Polish Labour Force Survey used by Adamchik and Bedi (2000), Adamchik, Hyclak and King (2003), Newell and Socha (2005 and 2007), a sample of public sector workers includes employees of public sector enterprises and local and central government civil servants paid out of the government budget. The sample of private sector workers includes employees of industrial, service and trade economic entities belonging to physical persons or trade co-operatives where the share of private capital is greater than 50%, co-operatives with foreign capital joint ventures, foreign small enterprises and individual agricultural farms.

Jovanović and Lokshin (2004), using the Russian Labour Force Survey, classify respondents as working in the private sector if they work in a new private enterprise, a privatişed enterprise with the majority of ownership in private hanḍs, or an enterprise with another form of ownership (mostly foreign owned and joint-venture enterprises and public associations). In this study public sector employees are those employed in state-owned

enterprises and institutions, municipal services, and privatised enterprises with the majority of ownership still under a state control.

Jovičić, Nojković, Paranos (2000), Jovanović and Lokshin (2003) and Reilly (2003) using Serbian Labour Force Survey defined the public sector to include state sector (central and local administration, education and health care financed from the budget and public state and public local enterprises) as well as socially-owned and mixed enterprises and co-operatives whereas the private sector includes employees at entrepreneurships, new private and privatised firms.

On the other hand, in Hungarian Harmonised Wage Survey used by Hámori (2007) and Telegdy (2006) the public sector includes only budgetary institutions whereas all production units (including state-owned) are classified in the private sector. The empirical results from these studies indicate a more negative public-private sector pay differentials.

Other studies such as Flanagan (1995), Lehman and Wadsworth (2000), Brainerd (2002), Delteil, Pailhé and Redor (2004) compare workers' earnings only in the commercial sphere i.e. between enterprises of different ownership types (state, state-joint stock companies, mixed, private new and privatised and foreign-owned).

Earnings definition

Many studies use monthly wages, arguing that the concept of a monthly wage is more appropriate for the labour market in transition economies because most workers are paid on a monthly basis (Adamchik and Bedi (2000), Adamchik, Hyclak and King (2003), Newell and Socha (2005)). In addition, studies such as Delteil, Pailhé and Redor (2004), Telegdy (2006), Hámori (2007) simply did not have hours of work available in the data set.

In this context, Jovanović and Lokshin (2004) point that although the monthly wages may yield more accurate assessment of the wage structure, the private sector worker's premium may simply arise from longer working hours. Yet, Table 2.2 shows that the overall findings between monthly and hourly estimates are not materially altered (for example Newell and Socha (2005) and (2007)). This is because the studies using monthly wages either control for monthly hours in an earnings equation and/or focus on full-time employees only.

Moreover, most of the data sets from transition economies contain the information only on after tax wages (before tax (i.e. gross) wages are available only in Hungarian

Harmonised Wage Survey). Hence, the estimated sector pay gap by most of the studies does not account for differences in social contributions (such as health care insurance and pension). This tends to overestimate the negative public sector pay gap.

Empirical studies also differ with respect to whether they include non-wage components into the earnings measurement (such as meal and travel allowances, subsidies, payments in-kind, bonuses etc.) or not. For example, Jovanović and Lokshin (2004) point out that the Russian Labour Force Survey has information on benefit incidence but not on their value. This study argues that the private sector wage advantage may be a form of compensation for not providing workers with non wage benefits which are more likely in the public sector.

Another difficulty in comparing wages across sectors and countries is the incidence of wage arrears. Some data surveys do not provide the information whether the worker failed to report earnings or did not receive the payment for the reference period. Moreover in transition economies it also may be the case that the worker received the payment with a delay but the data do not contain the information for which month and year his/her payment was received. Hence, the sector pay gap may be affected by wage arrears if they are not randomly distributed between sectors and across the wage distribution (i.e. low-wage earners more likely to be affected by wage arrears than high-wage earners).

In this context, other sources of biases in cross sectional data should also be acknowledged when interpreting public-private sector pay gap estimates. A public sector pay effect may emerge simply due to the sampling procedure. For example, the data may be disproportionately collected from a predominantly formal sector or salaried (tax-paying) earners. Moreover, some surveys may only cover private sector employees working for employers above a certain size (as in Hámori (2007)) in which case the public sector penalty may be overestimated due to the private sector wage-firm size effect.

Measurement Error

Finally, the estimated public-private sector pay differentials in studies that used self-reported microdata (all studies in Table 2.2 except Delteil, Pailhé and Redor (2004), Telegdy (2006) and Hámori (2007)) may be biased due to a measurement error in public sector status. In her study on Russia Brainerd (2002) suggested that the measurement error is especially possible during economic transition given the workers' confusion over the

employers' ownership status due to the speed with which the mass privatisations programs were implemented.

(ii) Review of the Results from Empirical Literature on Transition Economies

Having acknowledged the issues in public-private sector pay gap comparisons across transition economies the rest of the section presents the main findings of empirical studies from Eastern Europe.

In general, studies using a dummy variable OLS approach find on average 20% public sector penalty at the beginning of economic transition. This penalty declined to about 10% in the mid-transition and approached zero by the end of economic transition (Flanagan (1995), Newell and Socha (1998), Lehmann and Wadsworth (2000), Newell (2001), Brainerd (2002) Adamchik, Hyclak and King (2003), Newell and Socha (2007), Hámori (2007)).

Using the 'double equation' OLS approach Newell and Socha (2005) find larger increases in the returns to all forms of post-primary education as well as to skilled white-collar occupations (professional, managerial and technical) in the private sector than in the public sector from 1994 until 2002 in Poland. This study argued that this was a confirmation of greater and faster rising wage dispersion in the private than in the public sector. Similar findings are reported by other studies when using this method (Jovičić, Nojković and Paranos (2000) for Serbia, Brainerd (2002) for Russia, Telegdy (2006) and Hámori (2007) for Hungary).

Consequently, studies applying a quantile regression approach find that the sector pay gap differs across the pay distribution. In particular, quantile regression studies suggest a greater pay compression in the public sector than in the private sector (Brainerd (2002) for Russia, Reilly (2003) for Serbia, Leping (2006) for Estonia, Newell and Socha (2007) for Poland, Hámori (2007) for Hungary).

For example, at the beginning of economic transition in Russia, Brainerd (2002) reports 16% public sector penalty at the lower part of the earning distribution and 47% at top end in 1993. Leping (2006) provides evidence of an increasing public sector pay dispersion over the period of economic transition in Estonia. He finds a 23% public sector penalty at the 10^{th} percentile and a 76.8% at the 90^{th} percentile in 1989. Ten years later, in 1998, workers at the 10^{th} percentile are found to enjoy 13% public sector premium whereas for those at the 90^{th} percentile the penalty declined to 9.4%. For the same year,

1998, but for Poland, Newell and Socha (2007) estimated a 3% public sector penalty at the 10th percentile and a 10% public sector penalty at the 90th percentile. By the end of the economic transition, in 2002, the same study reports 8% public sector premium at the bottom and 6% penalty at the top of the pay distribution.

In Hungary, the public sector earnings penalty across the male earnings distribution is estimated by Hámori (2007) to have increased until the mid-transition point and then declined by the end of economic transition. This decline is found to be more pronounced for workers at and below the median. Finally, for Serbia, Reilly (2003) suggested no settled pattern of public-private sector pay differential across the pay distribution for male workers over 1995-2000 period.

Another strand of empirical literature attempted to correct for sector selection bias (Adamchik and Bedi (2000) for Poland, Brainerd (2002) for Russia, Jovanović and Lokshin (2003) for Serbia, Jovanović and Lokshin (2004) for Moscow). These studies faced issues of weak or absent instruments. For example, as showed in the previous section, researchers in developed market economies usually use a worker's parental background (such as the labour market status, occupation or sector of employment of the parents) to correct for self-selection because these variables can be excluded from the wage equation. However, this data is typically not available in cross-sections from transition economies. Even if they were available one may argue that this data would not be of much use in the analysis. In particular, for the majority of workers in transition economies the institutional setting has changed so rapidly and fundamentally from the world in which their parents lived and worked (evidence will be presented in chapter 3).

Nevertherless, some studies faced with the lack of instruments used variables whose effect is rather doubtful. Moreover, these variables are usually included with different specifications in both selection and the wage equation. For example, Adamchik and Bedi (2000) argued that economic transition allowed younger individuals greater access to the private sector and lower entry costs. Hence, their switching regression model included education, age and dummy for individuals entering the post-1989 labour market as sector identification variables. This study found that those entering the post-1989 labour market were more likely to work in the private sector but the coefficient on this indicator variable is statistically significant only for males. Adamchik and Bedi (2000) found positive selection of males into the private sector and negative in the public sector. They estimated that public sector wages were 7% and 10% lower than in the private sector for

men and women, respectively, in Poland in 1996. However, the lack of better identifying instruments and the change of signs in sensitivity analysis call for caution in interpreting selection effects.

Furthermore, using Serbian data for 2000, Jovanović and Lokshin (2003) argued that marital status and the number of jobholders in the household might account for the importance of a secure job and associated benefits if the formal and informal sectors co-exist. Yet, the number of jobholders in the household is found to have a significant and positive effect on private sector choice of females but it did not affect the employment choice of males. Jovanović and Lokshin (2003) found positive selection of females into the private sector and negative in the public sector. The authors reported on average public sector penalty of 9.4% for men and 4% for women in 2000.

Finally, Jovanović and Lokshin (2004) using data for Moscow in 1997 had at their disposal a better instrument. In particular, they used a worker's industry of employment in 1991 (i.e. before the start of the economic reform in 1992) as identification of the sector choice. Marital status and number of children in the household are also added into a selection equation. Employment prior to economic reform in all industries, except health and education, is found to have a positive effect on the probability of employment in the private sector. Rather surprising and opposed to arguments in Adamchik and Bedi (2000) and Jovanović and Lokshin (2003), Jovanović and Lokshin (2004) found that younger workers who were not in the labour force prior to economic reforms in 1991 were less likely to work in the private sector.

Overall, estimates showed that the private sector paid 14.3% more for men and 18.3% more for women than the public sector in 1997. The larger wage gap between the public and private sector for women is argued to indicate the greater importance of sector-specific non-wage benefits for a women's choice of a sector. Moreover, workers with a university education are found to earn a private sector premium of 44% for males (which is more than double in Poland based on estimates using the same method reported in Adamchik and Bedi, 2000) and 22% for females.

Therefore, the studies that corrected for sector selection indicated that the public sector penalties may be lower than those estimated by treating the sector selection as exogenous. This implies that workers in the public sector may have a lower unobserved earning potential than workers in the private sector. However, apart from the lack of good

instruments the main weakness of these studies is that they focus on a single year estimates rather than considering a period of economic transition as a whole.

2.3.3 Summary of Empirical Evidence

This section summarised the empirical evidence from developed market economies and transition economies. Two main points can be pinned down.

First, the literature review showed that the estimated public sector pay effect differs in sign between market and transition economies. In particular, whereas in developed market economies a public sector pay gap is found to range from positive to zero, in countries of economic transition it is mainly negative but becomes to zero by the end of economic transition.

Second, the public sector pay effect differs across the pay distribution. It is more negative (or less positive) among high earners than among low earners. This suggests that public sector pay is more compressed than private sector pay. This largely holds for both transition and market economies. Studies that analysed the effects of privatisations provide some evidence of increasing public sector pay distribution towards that of the private sector pay inequality. This is an important result for modelling public sector pay determination in the next chapter.

2.4 Conclusions

This chapter provided broad explanations for differences in pay between public and private sector workers. Non-exhaustive answers related to compositional differences, worker selection and incentives, objectives and constraints, and market power (either of workers or employers) are the most quoted reasons for public-private sector earnings differentials.

Much of the same arguments can be applied to transition economies. Nevertheless, there are also some additional reasons frequently used to explain why in general the private sector was found to pay more than the public sector for similar work during the economic transition. These arguments take into account the risk premia for first movers to emerging sectors, efficiency wages for harder effort in new jobs, compensating differentials for fewer non-wage benefits and reduced job security. Overall, a competition for workers seems to be a major argument.

Although the theoretical literature reviewed in this chapter did not primarily focus only on public-private sector wage differentials, it provided a useful perception of public sector pay determination. Theoretical models suggest that public sector pay and employment preferences will depend upon the budget available and objective assumptions i.e. whether the public sector chooses to maximise social welfare or the personal objectives of politicians and bureaucrats or whether there are unions engaged in cooperative or non-cooperative bargaining. In transition economies the effect of privatisations on wages paid by privatised firms is suggested to depend on the type of owners: outsiders or insiders. On the other hand, the emerging private sector pay strategy to pull workers away from public sector jobs may depend on initial endowments of high-productivity workers and the public sector lay-off rate.

The chapter also surveyed empirical literature on public-private sector pay differentials. The issues raised showed that these effects are not easy to estimate. In particular, common problems facing researchers in this area include data limitations, measurement error, sampling bias, selection issues and omitted variables. The public sector pay effects proved sensitive to the empirical method, time period, country and sample selected. In general, the main results suggested by empirical literature on developed and transition economies are outlined as follows.

First, whereas in developed market economies a public sector pay gap is found to range from positive to zero, in countries of economic transition it is mainly negative but grows to zero by the end of economic transition. Second, public sector pay compression is a common feature to both market and transition economies. Third, most of the empirical studies from transition economies faced a limited choice of instruments in data available and inconsistency of instruments used in different specifications in the switching equation.

Finally, the fact that a negative public sector pay effect is estimated across all surveyed countries in transition indicates that the intrinsic public sector pay determination may be an important underlying factor for public-private sector pay differentials in a transition economy. Moreover, the empirical results showed evolution of estimated public-private sector pay differentials over the course of economic transition towards estimates obtained in developed market economies (i.e. decline in the public sector pay penalty and increase in the public sector pay inequality). This further reinforces the argument about the changes in the public sector pay determination over the course of economic transition.

Although there are an expanding number of empirical studies over the last two decades in both developed and transitional economies, the literature is rather deficient in the theoretical analysis of the implications of different pay-setting arrangements between private and public sectors particularly of the consequences for pay of economic reforms. This may be because the transition process is complex and hence not easy to model. In particular, during the economic transition some workers were transferred from the public to private sector simply due to privatisation, but some other workers changed sector voluntarily. At the same time, workers who remained in the public sector also experienced changes in their wages as public sector pay determination altered due to the workers' enhanced private sector options. Moreover, employment alternatives differed across workers with different skills and abilities and hence the changes in available options were not uniform along the pay distribution.

Indeed, a single model that considered labour supply during economic transition by Boeri (1998) showed that different pay for similar workers may emerge as a result of private sector pay strategies to 'poach' workers away from public sector jobs. Yet, this model does not consider changes in the public sector pay distribution during the economic transition. The next chapter attempts to fill this gap in the literature. It provides a theoretical framework of public sector pay determination to examine the effects of economic transition on public sector pay-setting and its labour market consequences.

Chapter 3

3 Public-Private Sector Wage Differentials in a Transition Economy: The Role of Monopsony

3.1 Introduction

This chapter develops a theoretical model to underpin changes in wage inequality over the period of economic transition. These changes are closely related to public sector restructuring and its effects on the labour market. Differences in pay-setting arrangements across the public sector and the emerging private sector during the process of economic transition are argued to cause systematic trends in sector wage differentials.

One implication of this process of transition is that, over time, wage differentials may evolve in a manner that is unrelated to productivity differentials. This chapter argues that this may arise from changes in the degree of market power of employers during the transition – in particular changes in the degree of public sector monopsony power in the labour market. The argument is followed through three stages of economic restructuring: pre-transition, transition and post-transition, in the context of Eastern European economies. Empirical evidence in the chapter and elsewhere in this thesis indeed confirms that different sectors pay similar workers different wages over the period of economic transition. We hypothesise that employer market power is one reason for these changing differentials.

The chapter is organised as follows. Since the source of wage differentials may be employer-market power, the section 3.2 sets out the standard private sector monopsonist model to describe a monopsonistic employer's wage-setting behaviour. The next section 3.3 documents evidence of wage-setting mechanisms by public sector employers which demonstrates that they, too, may exploit market power in setting wages. However, whereas the private sector monopsony model derives from profit-maximising behaviour by an employer facing an upward sloping supply curve of labour, an alternative model is needed for a public sector employer with some degree of monopsony power, arising from the public sector manager facing an exogenous budget constraint and an upward sloping supply curve of labour. Such a model is described in the section 3.4 of the chapter. Some conclusions are then drawn for the ensuing analysis of public-private wage differentials, and wage dispersion, over the course of economic transition. These are illustrated with data from transition economies in section 3.5.

3.2 The Private Monopsony Model

3.2.1 Theoretical Background

In every textbook on labour economics, the perfectly competitive labour market is explained as the market where each worker chooses the employment that offers the maximum utility across all possible job opportunities. Wage differences across workers reflect only variation in individual worker productivity and differences in the nonpecuniary attributes of the jobs held. Mortensen (2003) questions the efficacy of the standard perfectly competitive model as the accepted mechanism of wage determination, pointing out that observable worker characteristics, which are supposed to account for productivity differences, typically explain no more that 30 percent of the variation in compensation across workers. Mortensen (1990) and Burdett and Mortensen (1998) offer the alternative proposition that imperfect competition is a necessary explanation for the distribution of pay and they formulate a model of the labour market as a non-cooperative price setting game played in a market characterised by search friction. Mortensen (2003) and Manning (2003), building on Burdett and Mortensen (1998), demonstrate that dispersion in wage offers is an equilibrium outcome of imperfect wage competition even when all workers and employers are identical.

These models assume that the typical employer in an unorganised labour market has some degree of monopsony power in the sense that it can set its own wage policy even when many competitors populate the market. Therefore, this power is classified as monopsony not in the sense of a single buyer of labour services but rather in the sense that each firm faces an upward sloping supply curve given the wages paid by competitors. These models posit the existence of an equilibrium wage dispersion given that the supply of labour to the firm is a function of its position in the wage distribution. Although this chapter considers public rather than private sector monopsony, it is worth spelling out the traditional model of monopsony by a profit maximising employer before considering the public sector case.

3.2.2 Monopsony Model

In the static partial equilibrium model of monopsony presented in Manning (2003) and in several textbooks of labour economics (for example in Cahuc and Zylberberg, 2004) the firm is assumed to face an inverse labour supply curve, $w(E)$, that relates the wage paid, w, to the level of employment, E. Firm wants to choose E to maximise its profit taking the labour supply function as given. Formally, the profit maximisation problem of the monopsonist firm is written as:

$$Max\pi = Y(E) - w(E)E \tag{3.1}$$

where π is profit, $Y(E)$ is a revenue function and $w(E)E$ are total labour costs (i.e. wage bill). The first order condition of (3.1) with respect to E is:

$$Y'(E) = w(E) + w'(E)E \quad \text{where} \quad w'(E) > 0 \tag{3.2}$$

The left hand side of the equation (3.2) is the marginal revenue product of labour and the right hand side is the marginal cost of labour (i.e. the wage that must be paid to the new worker hired and the increase in wages that must be paid to all existing workers). In this case equation (3.2) implies that the wage paid to the each worker is less than his or her marginal revenue product, because of the extra term $w'(E)E$.

Since the elasticity of the labour supply curve is: $\varepsilon_{Ew} = wE'(w)/E(w) \geq 0$, from (3.2) we can derive the relationship between wage, w, and marginal revenue product, Y', as following:

$$\frac{Y'-w}{w} = \frac{1}{\varepsilon_{Ew}} \tag{3.3}$$

where Y' is the marginal revenue product, w is the wage and ε_{Ew} is the elasticity of the labour supply.

Therefore, the proportional gap between the wage and the marginal revenue product is a function of the elasticity of the labour supply curve facing the firm. The less elastic the labour supply curve to the employer, the more market power the employer possesses and thus the greater the difference between the wage paid and the marginal revenue product. The reverse also holds: the greater the ability of workers to move from employer to employer, the more elastic the labour supply curve and faster that wages will be driven towards the marginal product by worker mobility. Hence, monopsony power can be measured by ratio $\frac{Y'}{w}$. It decreases with the elasticity of the labour supply.

Perfect competition corresponds to the case when the inverse of the labour supply elasticity is zero, $1/\varepsilon_{Ew} = 0$. This means that the elasticity of labour supply approaches infinity, $\varepsilon_{Ew} \to \infty$. In this case the wage, which we can denote as w^*, is independent of the level of employment, which can be denoted as E^*, and thus equal to the marginal revenue product, because the profit maximisation problem is given by: $Max\pi = Y(E^*) - w^* E^* \Rightarrow FOC: Y'(E^*) = w^*$.

The monopsony model is presented in Figure 3.1. It is assumed that each employee produces an exogenous quantity of Y' of output. The iso-profit curve is given in a form: $\pi(w) = E^s(w)(Y'-w)$ with the labour supply curve, $E^s(w)$, as a tangent, determining its maximum and therefore giving the equilibrium wage and employment. The wage chosen by the monopsonist, denoted as w^m, is lower than perfectly competitive wage, $w^* = Y'$:

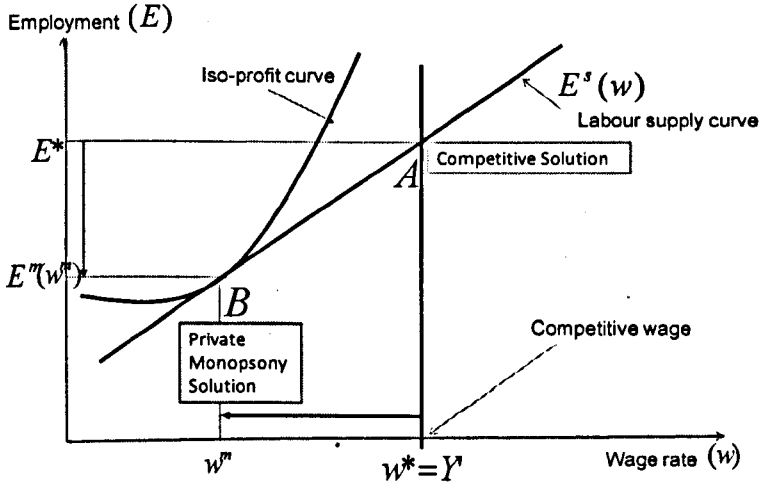
$$w^m = \frac{\varepsilon_{Ew}}{1+\varepsilon_{Ew}} Y' \text{ because } 0 \leq \frac{\varepsilon_{Ew}}{1+\varepsilon_{Ew}} \leq 1 \tag{3.4}$$

where ε_{Ew} is the elasticity of labour supply, Y' is the marginal revenue product of labour (equal to perfectly competitive wage w^*) and w^m is the monopsony wage. The

monopsony wage, w^m and the competitive wage, $w^* = Y'$, will be equal only if the elasticity of labour supply to the employer is infinitely elastic, $\varepsilon_{Ew} \to \infty$. Thus, a profit maximising monopsonist exerts negative pressure on both the wage and employment. When $\varepsilon_{Ew} < \infty$ the profit maximising monopsonist obtains a strictly positive profit: $\pi(w^m) = Y'E\ (w^m)/(1+\varepsilon_{Ew})$, whereas in a perfectly competitive market, when $1/\varepsilon_{Ew} = 0$, this profit is zero.

As noted by Cahuc and Zylberberg (2004) if the labour supply is inelastic, a monopsonist has the opportunity to reduce wages to maximise profit. Because monopsony wage differs from marginal revenue product of labour ($w^m \neq Y'$), then differences in monopsony power of employers may lead otherwise identical workers to be paid different wages.

Figure 3.1: The profit maximising monopsony model



Private sector monopsony in the traditional, static, sense is generally held to be a rarity (see the survey paper by Boal and Ransom, 1997). In particular, it seems unlikely to be of great importance in economic transition because the emerging private sector is more likely to operate under the competitive than under monopsony market structure. However, public sector monopsony power may be more important to understand wage differentials

in transition. In order to justify this argument we discuss the institutional background of transitional economies in the next section.

3.3 Qualitative Evidence of Monopsony: Wage-Setting in Eastern European Countries

Intrisically, the public sector has monopsony power in buying certain kinds of labour. This fact may be especially important in the era of central planning where countervailing power (such as independent trade unions) was weak and where the public sector was officially the only existing sector of employment. Examples of the pre-transition public sector dominance in employment in the countries of Eastern Europe is presented in Table 3.1.

Table 3.1: Public sector employment as a proportion of the labour force, 1988 (percent)

Country	Share
Socialist average	90.0
Czechoslovakia	98.8
U.S.S.R.	96.3
Romania	95.2
German Democratic Republic	94.7
Hungary	93.9
Bulgaria	91.5
Yugoslavia	78.9
Poland	70.4
OECD average	21.2

Notes to Table 3.1: all averages are unweighted. Czechoslovakia, Poland and Romania, 1989; German Democratic Republic, 1987. The public sector includes the government, social services run by the state (health and education) and state-owned enterprises, including agricultural cooperatives (kolkhozes in U.S.S.R.). OECD data from the late 1970s and mid-1980s.

Source: Milanović (1998)

It can be observed from Table 3.1 that, during the period of central planning in CEE countries, nearly all employment was in the public sector. At the same time, and in contrast, average public sector employment for OECD countries was one fifth of total employment.

The numbers in Table 3.1 for socialist countries should be treated with caution. Mencinger (1983) points that, since it was extremely difficult to dismiss a worker once employed, a certain amount of disguised unemployment may be found among those formally employed in the public sector. For example, he estimated that around one-fifth of the social sector employees in Yugoslavia represented hidden unemployment. Moreover,

in Yugoslavia the remaining employment resided in private agriculture[4] offering employment as a last resort for mainly unskilled labour. These peasants largely opted to move into temporary employment abroad. For example, Primorac and Babić (1989) explain that the employment maximisaton objective of the public sector implied that the surplus labour in agriculture had to be provided with productive jobs elsewhere. In the Yugoslav case this goal was achieved together with more than 700,000 workers finding employment abroad (on average during 1965-1984) and nearly half of these were recruited from the private agricultural sector.

The empirical literature argues that the pre-transition labour markets in the CEE economies shared two similar features: (1) over-employment and (2) egalitarian wage structure. We argue that this second characteristic at least, may be explained, in part, as the outcome of the public sector exerting monopsony power to control wages of certain types of labour. In order to confirm this subsegment argument by qualitative evidence, we proceed with a review of the empirical evidence on pre-transition wage determination.

First, the absence of competitive wage determination can be documented. Wages were set centrally and were not directly linked to enterprise performance during the period of central planning. Köllő (1998) explains that, in the short run, firms under central planning, instead of profit maximisation, had an incentive to continuously bargain for cash budgets to increase employment that was compatible with revenues. Although Krstić and Reilly (2003) state that, in contrast to most centrally planned economies, the Yugoslav so-called 'self-management' model was more reliant on market forces, with worker incomes partly linked to enterprise performance, nevertheless, even in this more decentralised system, the workers' role in setting individual wages within the firm was strictly limited by the boundaries determined by the government. In order to even out differences in pay among firms, the government fixed the firm's wage bill at a rate which was called a "socially warranted" wage bill (Haltiwanger and Vodopivec, 2003). Thus, competitive forces in pre-transition Yugoslavia were extremely limited and the standard communist mechanism of enterprise bargaining with central government to maximise cash limits in order to increase employment remained.

[4] Primorac and Babić (1989) report that private employment in agriculture in 1980 was 91% of total agricultural employment.

Vodopivec (1993) provides details of wage determination in the 1970s and the 1980s in Yugoslavia during the system of 'contractual socialism'. He argues that workers actually had little say in the determination of their earnings. He points out that despite the proclaimed autonomy of workers, political elites set workers' earnings with the goal of massive inter-firm income redistribution in order to avoid consequences of large wage differentials such as social unrest and layoffs. The study finds that the personal earnings in Yugoslavia followed the same pattern of compression as that in other Central and Eastern European socialist economies, as shown by Table 3.2. Although Table 3.2 suggests a rather more uneven income distribution in Yugoslavia than elsewhere in Eastern Europe, this was due to the existence of greater inter-regional differences within the Yugoslav federation.

Table 3.2: Comparison of earnings distribution (Gini coefficient)

	Gini Coefficient
Yugoslavia	26.8
Slovenia[1]	22
Eastern Europe	
Czechoslovakia	19.9
Hungary	25.6
Poland	19.7
United Kingdom	33
United States	34

Note to Table 3.2: Data refer to net earnings in the public sector for 1989 (for Hungary, 1988) for CEE countries and for UK and US Gini coefficient is after taxes and transfers in the mid 80s. [1] Slovenia was part of the Yugoslavia before 1990.

Source: Vodopivec (1993) for Yugoslavia and Eastern Europe and http://stats.oecd.org for UK and USA

Vodopivec (1993) explains how this egalitarian distribution of earnings across firms was implemented by directly controlling the wage-bills of enterprises. The methodology for determining the "socially warranted" personal earnings fund of the firm, based on Yugoslavia's example, consisted in a determination of an index of the firm's relative business success. This index was computed by comparing the firm's actual income with the prescribed norm which was internally calculated by applying the norm for personal earnings per worker and the norm for capital accumulation rate to the number of workers of the firm and the capital of the firm, respectively. He describes how these norms were assessed by a special body representing the Republic's government and other political and economic agents. This index was then converted into the "correction factor". The main purpose of the correction factor was to dampen the index of business success for

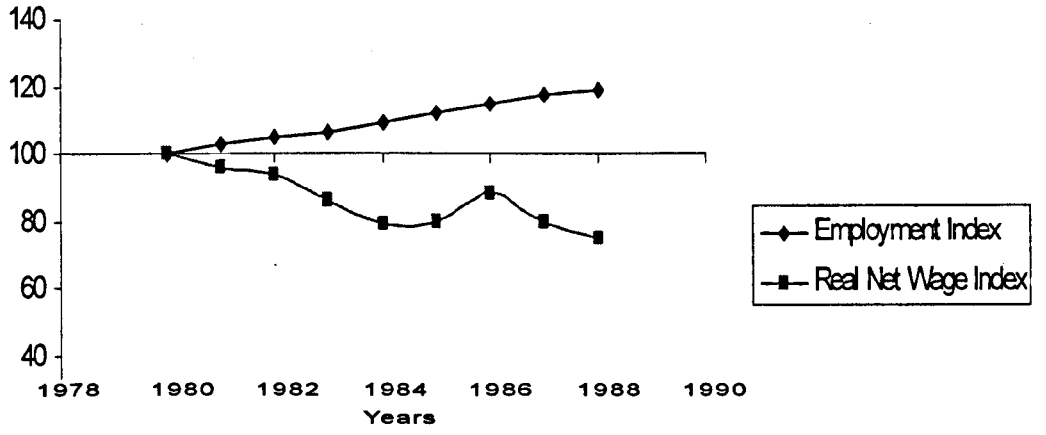
the above-average firms and to raise the index for the below-average firms. Therefore, the essence of the earnings policy, embodied in the socially warranted personal earnings fund, was intended to level the earnings across firms of comparable size and occupational structure. The supplementary levelling of earnings among enterprises was achieved through soft budget constraints and numerous channels for income redistribution called "inter-firm redistribution" (Vodopivec, 1993).

Furthermore, the pay equalising mechanism was based upon managers' incentives to increase employment coupled with political constraints and prohibitive taxes on wage increases (Köllő (1998), Flanagan (1995)). Consequently, the risk that some firms set wages high above the industry average or lag behind substantially, was actually rather small (Köllő, 1998). Moreover, in the so called 'non-productive' spheres such as civil service, education, health and administration, traditionally, remuneration levels were based on the average wage in the 'productive' enterprise sector (Jovanović and Lokshin, 2003).

These examples illustrate that individual wages bore little relation to differences in the underlying marginal products of labour. Consequently, centrally determined wage grids with minimum and maximum wages (with the latter being a pre-determined multiple of the latter) created one of the most egalitarian distributions of the income in the world (Rutkowski, 1996).

Furthermore, although wage levels in CEE countries were kept low, the quit rates were severely circumscribed by housing shortages (Flanagan, 1995). Labour unions in centrally planned economies had no bargaining role and according to Flanagan (1995), their main function was to challenge dismissals. This rigid system created over-employment which is usually called 'hidden' unemployment since the reality of open unemployment was not permitted. Firms were restricted in the use and allocation of labour, being forced to hire and ensure job security for every worker. Moreover, there were heavy restrictions on part time and fixed term work. The consequence was increased employment and falling real wages during the pre-transition period as illustrated by Figure 3.2.

Figure 3.2: Wage and employment trends during the pre-transition Serbia, 1980-1988



Notes to Figure 3.2: Employment and Real Net Wage Index, 1980=100, calculated from the annual average of all employed.

Source: Statistical Yearbook of Serbia, 1998, Statistical Office of the Republic of Serbia, Belgrade

However, under the system of central planning that paid low wages and absorbed redundant labour, the importance of non-wage benefits such as health, vacation, housing, child care, transport and meal allowances etc. was high (Nunberg, 1999). Estrin (1994) records significant role of social welfare provided by enterprises which, for example, in Czechoslovakia, amounted to around 5 percent of the total wage bill.

The structure of wage setting inherited from central planning strongly influenced the pay determination process at the start of the economic transition. Compared with other fields, relatively little changed in terms of control of wages (Köllő, 1998). A link between wages, the state budget and money supply remained particularly strong. Lane (1992) surveys various wage policies that were utilised at the beginning of the economic transition such as: a specific wage constraint, a ceiling on the enterprise wage bill, a ceiling on the average wage, a wage bill ceiling with adjustment for output, a wage bill ceiling with adjustment for value added and adjustments for profits. The wage controls entailed rigidity in wages in state enterprises but most of the studies stress their necessity in the absence of strong profit motives and the fact that these enterprises were encouraged to emphasise employment over productivity (for example Corricelli and Revenga (1992), Allison and

Ringold (1996)). Lane (1992) explains that the main rational for these controls was a weakness in the governance of state enterprises pending privatisation.[5]

Flanagan (1995) discussed the negative consequences of tax-based incomes policies which were adopted in Eastern Europe. He explains that a policy that targeted the average wage penalised companies that downsized to shed their least efficient workers or those that expanded to hire highly skilled workers, which further compressesed the public sector wage structure. For that reason, he advocated policies that targeted the enterprise wage bill, allowing for downsizing that could be accompanied by an increase in average wage to attract and retain skilled workers.

The wage setting mechanism in sectors under direct supervision of the government, public and civil services in transition economies, was founded on a fixed base wage with wage scales, obtained by a multiplication of the base with appropriate coefficients, varied by educational attainment, seniority, working conditions and level of responsibility (Haltiwanger and Vodopivec, 2003). Nunberg (1999) argued that highly structured wages in the public sector provided intricate schemes of salary and benefit incentives. The belief is that this had crucial implications for the government's ability to hire and retain well-qualified employees.

Summarising this evidence: even in 'decentralised' Yugoslavia, central management of pay structure was strong, with a tendency towards compression of pay differentials, low and falling real wages in the face of a growing labour force and limited scope for enterprise pay flexibility, especially in relation to skilled workers.

[5] Some of the same arguments have been applied by Leslie (1985) in discussion on the impact of cash constraints on public employment and wages in the United Kingdom. But there was no attempt in the United Kingdom to influence wage levels directly by cash limits, merely to control wage bills. The 'Review Body' system is used to administer wage levels in major parts of the public sector in the United Kingdom.

3.4 The Public Monopsony Model

3.4.1 The Model

In this section we lay out a public sector monopsony model that can allow us to observe the distributional outcomes of public sector restructuring on wages and employment during economic transition. Our hypothesis is that the pay compression associated with public sector wage determination in a pretransition economy would decline alongside the decline in public sector monopsony power over the course of economic transition.

As mentioned in section 3.2, because the public sector is the sole purchaser of labour it has a degree of monopsony power, which can be exploited according to the varying elasticities of supply of different types of workers. However, unlike in the private sector monopsony model, the public sector's objective function is not to maximise profit but to hire labour until its available budget is exhausted, assuming each sector faces a hard budget constraint. Hence, we assume that during central planning the objection function of the public sector is output maximisation subject to a budget constraint. This is equivalent to maximising total output where profit (or surplus) is zero. We also assume that workers have no bargain power (no right to strike etc.) and that the government budget constraint is given exogenously by the level of total tax revenues that determine the total wage bill. Thus, the budget constraint is defined as the total wage bill $\overline{wE}$.

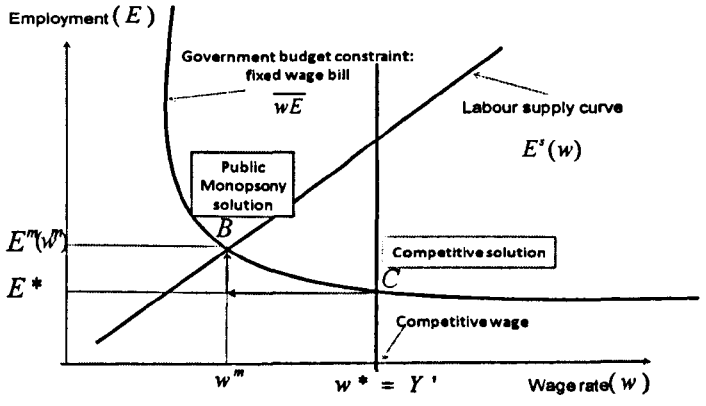
Now, we assume that the public employer can choose any combination of wage, w, and employment, E, to satisfy this constraint. This can be represented in the Figure 3.3 by the rectangular hyperbola, $\overline{wE}$. This inverse relation between employment and wage rate, representing the labour demand function in the public sector, is also used by Leslie (1985) to describe the union wage-employment combination given by the wage bill fixed by the available public budget (i.e. so-called 'cash limit'). In our model the public sector is an output maximiser that faces two constraints: first the budget constraint and second the labour supply curve.

Each worker of a particular type has a constant marginal revenue product presented in the Figure 3.3 as Y'. As in the private monopsony case, the labour supply curve $E^s(w)$ for this type of worker is a function of the wage rate, w. This wage rate can be set below marginal revenue product, Y', depending on the labour supply elasticity, ε_{Ew}. Hence,

when ε_{Ew} is some constant number (i.e. $\varepsilon_{Ew} < \infty$), the public sector has some monopsony power such that $\frac{Y' - w}{w} = \frac{1}{\varepsilon_{Ew}} > 0$.

The intersection of the labour supply curve, $E^s(w)$ and labour demand curve, $\overline{wE}$ determines the equilibrium wage-employment combination for the public sector employer of this type. This is because we assume no discrimination in the wage between workers and that the public sector is maximising employment, rather than profit as in the private case. Thus at point B, the total budget $\overline{wE}$ is exhausted and the public sector is exploiting its monopsony power to employ E^m of workers at wage w^m rather than E^* of workers at the competitive wage w^*.

Figure 3.3: The public sector monopsony model



3.4.2 Characteristics of the equilibrium with two kinds of labour

To understand the implications of this model for wage and employment inequality, we now extend this simple model to a case where there are two types of labour, skilled and unskilled. If these types of labour have different labour supply elasticities, ε_s and ε_u, respectively, this will have implications for the skill premium and for the inequality of pay.

There are two labour markets corresponding to skilled labour, L_s and unskilled labour, L_u. Assume that there are the following 'states' in the labour market: E_s denoting employment of skilled labour, U_s denoting unemployment of skilled labour, E_u denoting

employment of unskilled labour and U_u denoting unemployment of unskilled labour. Then the labour force can be expressed in the following way:

$$L_s = E_s + U_s \Rightarrow E_s = L_s(1-u_s),\ u_s = \frac{U_s}{L_s}$$

$$L_u = E_u + U_u \Rightarrow E_u = L_u(1-u_u),\ u_u = \frac{U_u}{L_u}$$

where u_s and u_u are the rates of unemployment of skilled and unskilled labour, respectively. The model is going to solve optimal levels of employment by public sector employer, E_s and E_u with no presumption that all workers are thereby employed[6]. The wage of employed skilled labour is denoted by w_s and of unskilled labour by w_u .

The public sector objective function is to maximise employment and therefore output as a function of two worker types, such as to exhaust the exogenous budget constraint:

$$\max_{E_s,E_u} f(E_s,E_u) \qquad (3.5)$$

$$\text{s.t. } \overline{wE} = w_s E_s + w_u E_u$$

where $\overline{wE}$ is the exogenous budget constraint (i.e. fixed wage bill) and w_s and w_u are wages of employed skilled, E_s and unskilled labour E_u, respectively. The central planner chooses the highest possible levels of employment of skilled and unskilled labour that are affordable.

The solution of the problem of output maximisation subject to a budget constraint allow us, with the help of a particular form of the production function, to obtain conditional demand functions for the two types of labour in explicit form. When we take into consideration no more than two different types of labour, skilled and unskilled and assume that inputs to the public sector are wholly labour services, the production function,

[6] We therefore abstract from the issue that, in economies where there is ten "open" unemployment, there may also be "hidden" or "disguised" unemployment of various forms. The model here is intended to address pay compression, not the general reduction in wages arising from oversupply.

$Y = f(E_s, E_u)$ can utilise the Cobb-Douglas production function with constant returns to scale (Cobb and Douglas, 1928)[7] in the following form:

$$Y = E_s^{\alpha} E_u^{1-\alpha},\ 0 < \alpha < 1 \tag{3.6}$$

where α is the elasticity of output with respect to skilled labour when unskilled labour is held constant: $\alpha = \frac{\partial Y}{\partial E_s}\frac{E_s}{Y}$ and $(1-\alpha)$ is the elasticity of output with respect to unskilled labour when skilled labour is held constant: $(1-\alpha) = \frac{\partial Y}{\partial E_u}\frac{E_u}{Y}$. Therefore, α and $(1-\alpha)$ represent approximately the percentage change in output relative to the percentage change in skilled and unskilled labour, respectively. One of the reasons why the Cobb-Douglas production function is popular is that these elasticities are constant. In the case of Cobb-Douglas technology, the elasticity of substitution between E_s and E_u is defined as:

$$\sigma = \frac{d\ln(\frac{E_s}{E_u})}{d\ln(\frac{w_u}{w_s})} = \frac{d\ln e}{d\ln\frac{1}{\omega}} = 1 \tag{3.7}$$

where the relative wage of skilled workers is expressed by $\frac{w_s}{w_u} = \omega$ and the relative employment of skilled workers is expressed by $\frac{E_s}{E_u} = e$.

From (3.7) it follows that:

$$\frac{de}{e} = -\frac{d\omega}{\omega} \tag{3.8}$$

which shows the slope of demand function with unit elasticity of demand.

The central planner chooses the highest possible levels of employment of skilled and unskilled labour that are affordable. Given that the central planner trades wages for employment (i.e. the lower the wages the greater the employment and output), its market

[7] This is a version of Cobb-Douglas function $Y = AE_s^{\vartheta\alpha} E_u^{\vartheta\beta}$ for $A = 1$, $\vartheta = 1$ where A is technological progress and ϑ is the degree of homogeneity of the production function. When $\alpha + \beta = 1$ the production function has constant returns to scale.

power is given by the elasticity of the labour supply of each type of labour. Therefore, for each type of labour there are two possible solutions of the model: (1) 'Competitive Solution' when the central planner has no market power and takes the wages as given by the marginal revenue product (point C in Figure 3.3) and (2) 'Monopsony Solution' when central planner has monopsony power and can cut wages below marginal revenue product depending on the labour supply elasticity (point B in Figure 3.3).

(i) The Competitive Solution

The 'Competitive Solution' of the model requires that the wage of each worker type is independent of the level of employment: $w'_s(E_s) = \frac{dw_s}{dE_s} = 0$ and $w'_u(E_u) = \frac{dw_u}{dE_u} = 0$. Hence, the wage of each worker type is exogenously given and equal to marginal revenue product of a worker of each type:

$$Y'_s = \frac{dY_s}{dE_s} = w_s, \; Y'_u = \frac{dY_u}{dE_u} = w_u \tag{3.9}$$

If the relative marginal revenue product of skilled workers is denoted by $\gamma = \frac{Y'_s}{Y'_u}$, from (3.9) it follows that $\gamma = \omega$ and we express the relative wage of skilled workers under competitive case by:

$$\gamma = \frac{Y'_s}{Y'_u} = \frac{w_s}{w_u} \tag{3.10}$$

To benchmark the monopsony case, consider first the determination of ratios $\gamma = \frac{w_s}{w_u}$ and $e = \frac{E_s}{E_u}$ under the 'Competitive Solution'. Here, the labour supply elasticities of skilled and unskilled workers approach infinity and hence, the public sector has no monopsony power. This can be expressed in the following form:

$$\frac{Y'_s - w_s}{w_s} = \frac{1}{\varepsilon_s} = 0 \text{ and } \frac{Y'_u - w_u}{w_u} = \frac{1}{\varepsilon_u} = 0$$

given the labour supply elasticity of each worker type: $\varepsilon_{Ew} = wE'(w)/E(w)$.

The optimization problem given by (3.5) can be solved as:

$$\max_{E,E_u} E_s^{\alpha} E_u^{1-\alpha} - (w_s E_s + w_u E_u) \tag{3.11}$$

This leads to the first-order conditions with respect to E_s and E_u [8]:

$$w_s = \alpha E_s^{\alpha-1} E_u^{1-\alpha} = Y'_s \tag{3.12}$$

$$w_u = (1-\alpha) E_s^{\alpha} E_u^{-\alpha} = Y'_u \tag{3.13}$$

The zero profit condition given by:

$$E_s^{\alpha} E_u^{1-\alpha} = (w_s E_s + w_u E_u) \tag{3.14}$$

can be written as: $Y = \overline{wE}$.

The ratio of (3.12) to (3.13) is the relative wage of skilled labour which under competitive case equals relative marginal revenue product of skilled labour, γ, and is given by:

$$\gamma = \frac{w_s}{w_u} = \frac{\alpha}{1-\alpha}\frac{E_u}{E_s} = \frac{\alpha}{1-\alpha}\frac{L_u(1-u_u)}{L_s(1-u_s)} = \frac{Y'_s}{Y'_u} \tag{3.15}$$

The (3.15) can be re-written in the following form:

$$\frac{\alpha}{1-\alpha} = \frac{w_s E_s}{w_u E_u} = \frac{Y'_s E_s}{Y'_u E_u} \tag{3.16}$$

so that we can express the employment levels of skilled and unskilled labour given by:

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[8] $\frac{\partial f}{\partial E_s} = \alpha E_s^{-1+\alpha} E_u^{1-\alpha} - w_s = 0$ and $\frac{\partial f}{\partial E_u} = (1-\alpha) E_s^{\alpha} E_u^{-\alpha} - w_u = 0$

$\frac{\partial^2 f}{\partial E_s^{\,2}} = (-1+\alpha)\alpha E_s^{-2+\alpha} E_u^{1-\alpha} < 0$ and $\frac{\partial^2 f}{\partial E_u^{\,2}} = -(1-\alpha)\alpha E_s^{\alpha} E_u^{-1-\alpha} < 0$ and

$\frac{\partial^2 f}{\partial E_s \partial E_u} = \alpha E_s^{-1+\alpha}(1-\alpha) E_u^{-\alpha} > 0$.

$$E_u = \frac{Y(1-\alpha)}{w_u} = \frac{Y(1-\alpha)}{Y'_u} \text{ and } E_s = \frac{Y\alpha}{w_s} = \frac{Y\alpha}{Y'_s}$$

and obtain the relative employment of skilled labour, e:

$$e = \frac{E_s}{E_u} = \frac{\alpha}{1-\alpha}\frac{Y'_u}{Y'_s} = \frac{\alpha}{1-\alpha}\frac{1}{\gamma} \tag{3.17}$$

It is easy to verify that the technical rate of substitution between unskilled and skilled workers is equal to the ratio of the costs of skilled and unskilled workers. The equalities given in formula (3.15) show that ratio of unskilled and skilled workers $\frac{E_u}{E_s}$ is proportional to the ratio $\frac{w_s}{w_u}$. Since by definition the elasticity of substitution, σ, between unskilled and skilled workers measures precisely the elasticity of the ratio $\frac{E_u}{E_s}$ with respect to relative cost $\frac{w_s}{w_u}$ we will have $\sigma = 1$. This implies that technological progress has no effect on relative input demand. Moreover, the relation $\frac{w_s}{w_u} = \frac{\alpha}{1-\alpha}\frac{E_u}{E_s}$ implies that the share s of skilled workers in the total cost is simply equal to parameter α. This means that:

$$\alpha = \frac{w_s E_s}{w_s E_s + w_u E_u} = \frac{w_s E_s}{wE} \tag{3.18}$$

The final expression of the steady state conditional demand for skilled and unskilled labour can be deduced from relations (3.6) and (3.15). After standard transformations we get final expressions for steady state level of employment for skilled and unskilled labour:[9]

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[9] The steady state level of employment for skilled labour E_s is obtained in the following way: express E_u from formula (3.6): $Y = E_s^{\alpha} E_u^{1-\alpha} \Rightarrow E_u = Y^{\frac{1}{1-\alpha}} E_s^{\frac{-\alpha}{1-\alpha}}$ and from formula (3.15): $\frac{Y'_s}{Y'_u} = \frac{\alpha}{1-\alpha}\frac{E_u}{E_s}$ $\Rightarrow E_u = \frac{(1-\alpha)}{\alpha}\frac{Y'_s}{Y'_u}E_s$. Since these two solutions are equal we express E_s and get (3.19).

$$E_s = \left[\frac{\alpha}{(1-\alpha)}\frac{Y'_u}{Y'_s}\right]^{1-\alpha} Y \text{ and} \tag{3.19}$$

$$E_u = \left[\frac{(1-\alpha)}{\alpha}\frac{Y'_s}{Y'_u}\right]^{\alpha} Y \tag{3.20}$$

(ii) The Monopsony Solution

The 'Monopsony Solution' describes the situation when the wage of each worker type is a function of its level of employment (i.e. dependent on employment). In this case, for each worker type, labour supply elasticity, ε_{Ew}, is some constant number (i.e. $\varepsilon_{Ew} < \infty$), and differs across skills. Hence, the public sector has monopsony power insofar as $\frac{Y' - w}{w} = \frac{1}{\varepsilon_{Ew}} > 0$. The intersection of the labour supply curve, $E(w)$ and the labour demand curve, $\overline{wE}$ determines the equilibrium wage-employment combination for the public sector monopsony. Since public sector monopsony can reduce the wage of each worker type below its marginal revenue product, the public sector can hire more workers, given the fixed total wage bill and zero profit condition.

In textbook labour economics, the overall elasticity of supply for unskilled workers is usually held to be greater than the elasticity of supply for skilled workers, $\varepsilon_s < \varepsilon_u$. The extent of public sector monopsony power depends on the elasticity of the labour supply of each worker type. The less elastic labour supply, the lower the wage and the more workers can be employed for the given budget constraint. Hence, $\varepsilon_s < \varepsilon_u$ implies greater public sector monopsony power over skilled workers.

To show the relationship between monopsony power and the labour supply elasticity we consider the skilled worker type, in the case when the wage of skilled

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The steady state level of employment for unskilled labour E_u is obtained in the following way: express E_s from formula (3.6): $Y = E_s^{\alpha} E_u^{1-\alpha} \Rightarrow E_s = Y^{\frac{1}{\alpha}} E_u^{\frac{-1-\alpha}{\alpha}}$ and from formula (3.15): $\frac{Y'_s}{Y'_u} = \frac{\alpha}{1-\alpha}\frac{E_u}{E_s}$ $\Rightarrow E_s = \frac{\alpha}{1-\alpha}\frac{Y'_u}{Y'_s}E_u$. Since these two solutions are equal we express E_u and get (3.20).

workers is a function of their level of employment: $w'_s(E_s) = \frac{dw_s}{dE_s} > 0$. It follows that in this case, the labour supply elasticity of the skilled workers is not infinite but a constant number: $0 < \varepsilon_s = \frac{w_s E'_s(w_s)}{E_s(w_s)} < \infty$. Furthermore, it follows that:

$$\frac{Y'_s - w_s}{w_s} = \frac{1}{\varepsilon_s} > 0 \tag{3.21}$$

Thus, the public sector has monopsony power over skilled workers when $0 < \varepsilon_s < \infty$.

From (3.21) the wage of skilled workers can be expressed as:

$$w_s = \frac{\varepsilon_s}{1+\varepsilon_s} Y'_s(E_s) \text{ where } 0 < \frac{\varepsilon_s}{1+\varepsilon_s} < 1 \tag{3.22}$$

The same of course holds for unskilled workers when $0 < \varepsilon_u < \infty$.

The inverse of the monopsony power can be expressed by parameters: $\theta_s = \frac{\varepsilon_s}{1+\varepsilon_s}$ and $\theta_u = \frac{\varepsilon_u}{1+\varepsilon_u}$. These parameters ($\theta_s$ and θ_u) indicate the extent to which wage setting departs from the marginal product rule as showed by (3.22). When $\theta_{s,u} = 1$ the competitive setting holds, when $0 < \theta_{s,u} < 1$ the monopsony setting holds.

In order to derive the comparative statics of the optimal shares in employment of skilled and unskilled workers, under monopsony setting i.e. when ε_s and ε_u are constant numbers such that $\varepsilon_s < \varepsilon_u$, we again start from the optimisation problem given by (3.5):

$$\max_{E_s, E_u} E_s^{\alpha} E_u^{1-\alpha} - (w_s(E_s)E_s + w_u(E_u)E_u) \tag{3.23}$$

Therefore, the public sector wants to maximise employment and as a result achieves zero profit, but the wage rate of each worker type depends on its employment level. The first order condition of (3.23) with respect to E_s [10] is:

$$\frac{dw_s}{dE_s}E_s + w_s = \alpha E_s^{\alpha-1}E_u^{1-\alpha} \tag{3.24}$$

Because $\varepsilon_s = \frac{w_s E'_s(w_s)}{E_s(w_s)} = \frac{w_s}{E_s}\frac{dE_s}{dw_s}$ we can write the left hand side of the equation (3.24) as: $\frac{dw_s}{dE_s}E_s + w_s = \frac{1}{\varepsilon_s}w_s + w_s$ and from (3.12) it follows that the right hand side of the equation (3.24) is: $Y'_s = \alpha E_s^{\alpha-1}E_u^{1-\alpha}$. Therefore, (3.24) is equivalent to: $\frac{1}{\varepsilon_s}w_s + w_s = Y'_s$ from which we get the expression for the wage of skilled labour:

$$w_s = \frac{\varepsilon_s}{1+\varepsilon_s}Y'_s = \theta_s Y'_s \tag{3.25}$$

Because $0 < \varepsilon_s < \infty$ it follows that $0 < \theta_s = \frac{\varepsilon_s}{1+\varepsilon_s} < 1$ and hence: $w_s < Y'_s$.

In the same way, the first order condition of (3.23) with respect to E_u [11] leads to the expression for the wage of the unskilled labour:

$$w_u = \frac{\varepsilon_u}{1+\varepsilon_u}Y'_u = \theta_u Y'_u \tag{3.26}$$

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[10] $\frac{\partial f}{\partial E_s} = \alpha E_s^{\alpha-1}E_u^{1-\alpha} - (\frac{dw_s}{dE_s}E_s + w_s) = 0$ and

$\frac{\partial^2 f}{\partial E_s^2} = (-1+\alpha)\alpha E_s^{-2+\alpha}E_u^{1-\alpha} - \frac{d^2w_s}{dE_s^2}E_s - 2\frac{dw_s}{dE_s} < 0$

[11] $\frac{\partial f}{\partial E_u} = E_s^{\alpha}(1-\alpha)E_u^{-\alpha} - (\frac{dw_u}{dE_u}E_u + w_u) = 0$

and $\frac{\partial^2 f}{\partial E_u^2} = -(1-\alpha)\alpha E_s^{\alpha}E_u^{-1-\alpha} - \frac{d^2w_u}{dE_u^2}E_u - 2\frac{dw_u}{dE_u} < 0$

Because $0 < \varepsilon_u < \infty$ it follows that $0 < \theta_u = \frac{\varepsilon_u}{1+\varepsilon_u} < 1$ and hence: $w_u < Y'_u$.

The zero profit condition given by:

$$E_s^{\alpha} E_u^{1-\alpha} = (w_s(E_s)E_s + w_u(E_u)E_u) \tag{3.27}$$

and can be written as: $Y = \overline{wE}$.

The ratio of (3.25) to (3.26) gives the expression for the relative wage of skilled workers under monopsony, ω:

$$\omega = \frac{w_s}{w_u} = \frac{\alpha}{1-\alpha}\frac{E_u}{E_s}\frac{\frac{1+\varepsilon_u}{\varepsilon_u}}{\frac{1+\varepsilon_s}{\varepsilon_s}} = \frac{\alpha}{1-\alpha}\frac{E_u^m}{E_s^m} = \frac{\alpha}{1-\alpha}\frac{L_u(1-u_u^m)}{L_s(1-u_s^m)} \tag{3.28}$$

where E_s, E_u denote the levels of employment of skilled and unskilled labour, respectively, under competitive solution, whereas E_s^m, E_u^m and u_s^m, u_u^m denote the levels of employment and rates of unemployment of skilled and unskilled labour, respectively, under monopsony.

(3.28) can be re-written in the following form:

$$\frac{\alpha}{1-\alpha} = \frac{w_s E_s^{\,m}}{w_u E_u^{\,m}} \tag{3.29}$$

so that we can express the employment levels of skilled and unskilled labour, under monopsony, given by:

$$E_u^{\,m} = \frac{Y(1-\alpha)}{w_u} \text{ and } E_s^{\,m} = \frac{Y\alpha}{w_s}$$

The final expression of the steady state conditional demands for skilled and unskilled labour under monopsony can be deduced from formulas (3.6) and (3.28) and after standard transformation we get:[12]

$$E^m{}_s = \left[\frac{\alpha}{(1-\alpha)}\frac{w_u}{w_s}\right]^{1-\alpha} Y \text{ and} \tag{3.30}$$

$$E_u{}^m = \left[\frac{(1-\alpha)}{\alpha}\frac{w_s}{w_u}\right]^{\alpha} Y \tag{3.31}$$

From (3.30) and (3.31) we can express the relative wage of skilled and unskilled workers as a function of steady state level of employment of unskilled and skilled workers, respectively:

$$\frac{w_s}{w_u} = \frac{\alpha}{1-\alpha}\left(\frac{E_u^m}{Y}\right)^{\frac{1}{\alpha}} \text{ and } \frac{w_u}{w_s} = \frac{1-\alpha}{\alpha}\left(\frac{E_s^m}{Y}\right)^{\frac{1}{1-\alpha}}$$

Therefore, the steady state wage rates for skilled and unskilled workers are given by:[13]

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[12] The steady state level of employment for skilled labour $E_s{}^m$ is obtained in the following way: express $E_u{}^m$ from formula (3.6) that, under monopsony, can be written as: $Y = (E_s{}^m)^{\alpha}(E_u{}^m)^{1-\alpha} \Rightarrow E_u{}^m = Y^{\frac{1}{1-\alpha}}(E_s{}^m)^{\frac{-\alpha}{1-\alpha}}$ and from formula (3.28): $\frac{\alpha}{1-\alpha}\frac{E_u{}^m}{E_s{}^m} = \frac{w_s}{w_u} \Rightarrow E_u{}^m = \frac{(1-\alpha)}{\alpha}\frac{w_s}{w_u}E_s{}^m$. Since these two solutions are equal we express $E_s{}^m$ and get (3.30).

The steady state level of employment for unskilled labour $E_u{}^m$ is obtained in the following way: express $E_s{}^m$ from formula (3.6) that, under monopsony, can be written as: $Y = (E_s{}^m)^{\alpha}(E_u{}^m)^{1-\alpha} \Rightarrow E_s{}^m = Y^{\frac{1}{\alpha}}(E_u{}^m)^{\frac{-1-\alpha}{\alpha}}$ and from formula (3.28): $\frac{\alpha}{1-\alpha}\frac{E_u{}^m}{E_s{}^m} = \frac{w_s}{w_u} \Rightarrow E_s{}^m = \frac{\alpha}{1-\alpha}\frac{w_u}{w_s}E_u{}^m$. Since these two solutions are equal we express $E_u{}^m$ and get (3.31).

[13] Using the formula $\frac{w_s}{w_u} = \frac{\alpha}{1-\alpha}\left(\frac{E_u^m}{Y}\right)^{\frac{1}{\alpha}}$ we impute for $w_u = (1-\alpha)\frac{Y}{E_u^m}$ and for $Y = (E_s{}^m)^{\alpha}(E_u{}^m)^{(1-\alpha)}$ and get (3.32).

$$w_s = \alpha(\frac{E_u^m}{E_s^m})^{1-\alpha} \text{ and} \tag{3.32}$$

$$w_u = (1-\alpha)(\frac{E_s^m}{E_u^m})^{\alpha} \tag{3.33}$$

The relative employment of skilled labour, under the monopsony solution, e^m, is obtained from (3.29):

$$e^m = \frac{E^m{}_s}{E^m{}_u} = \frac{\alpha}{1-\alpha}\frac{w_u}{w_s} = \frac{\alpha}{1-\alpha}\frac{1}{\omega} \tag{3.34}$$

where $e^m = \frac{E_s^m}{E_u^m}$ is relative employment of skilled workers and $\omega = \frac{w_s}{w_u}$ is the relative wage of skilled workers under monopsony. Note that e^m embeds relative monopsony power by containing the terms ε_s and ε_u such that $\varepsilon_s < \varepsilon_u$. Equation (3.34) implies that keeping α constant, the relative employment of skilled workers, given by the ratio $\frac{E_s^m}{E_u^m}$, will be greater, the lower the relative labour supply elasticity of skilled workers to unskilled workers, $\varepsilon = \frac{\varepsilon_s}{\varepsilon_u}$. Hence the wage gap $\frac{w_s}{w_u}$ between skilled and unskilled labour will be lower (i.e. the greater the wage compression), the lower the relative labour supply elasticity of skilled to unskilled workers. These are the key results of this section.

This section has therefore demonstrated that compression of wage differentials can arise from public sector monopsony with implications for relative employment. Moreover, this section showed that if, initially, $\varepsilon_s < \varepsilon_u$, an increase in the relative elasticity of skilled labour, ε, will lead to an increase in the relative wage of skilled workers, ω and so in greater wage inequality, and a decline in the relative employment of skilled workers, e^m, for a fixed public sector wage bill. This will be illustrated next.

Using the formula $\frac{w_u}{w_s} = \frac{1-\alpha}{\alpha}(\frac{E_s^m}{Y})^{\frac{1}{1-\alpha}}$ we impute for $w_s = \alpha\frac{Y}{E_s^m}$ and for $Y = (E_s{}^m)^{\alpha}(E_u{}^m)^{1-\alpha}$ and get (3.33).

(iii) Comparative Statics between Competitive and Monopsony Solutions

The relationship between the competitive and monopsony solutions can be expressed based on formulas (3.17), (3.25), (3.26), (3.28) and (3.30) in the following form:

$$e^m = e\frac{\theta_u}{\theta_s} = \frac{\alpha}{1-\alpha}\frac{1}{\omega} = \frac{\alpha}{1-\alpha}\frac{\theta_u}{\theta_s}\frac{1}{\gamma} \tag{3.35}$$

where $\frac{\theta_s}{\theta_u} = \frac{\frac{\varepsilon_s}{1+\varepsilon_s}}{\frac{\varepsilon_u}{1+\varepsilon_u}}$ and $\varepsilon_s < \varepsilon_u$. If we think of transition as a decline in the degree of monopsony power of the public sector, then, as we move towards the competitive outcome, relative wages and relative employment of skilled workers change with the increase in the relative labour supply elasticity of skilled workers i.e. $\frac{\theta_s}{\theta_u} \to 1$.

The changes in relative employment of skilled workers, e^m, keeping the relative marginal revenue product of skilled workers, γ, constant, depends on the changes of two parameters: θ_s ,θ_u . Comparative statics shows that:

$$\frac{\partial e^m}{\partial \theta_s} < 0 \text{ and } \frac{\partial e^m}{\partial \theta_u} > 0$$

$$\frac{\partial e^m}{\partial \theta_s} = -\frac{\alpha\theta_u}{(1-\alpha)\,\theta_s^2\gamma}$$

$$\frac{\partial e^m}{\partial \theta_u} = \frac{\alpha}{(1-\alpha)\,\theta_s\gamma}$$

Similarly, the relative wage of skilled workers can be expressed as a function of the relative employment of skilled labour under the monopsony solution, e^m:

$$\omega = \frac{w_s}{w_u} = \frac{\alpha}{1-\alpha}\frac{1}{e^m} = \frac{\alpha}{1-\alpha}\frac{1}{e}\frac{\theta_s}{\theta_u} = \frac{\theta_s}{\theta_u}\frac{Y'_s}{Y'_u} = \frac{\theta_s}{\theta_u}\gamma \tag{3.36}$$

Thus, changes in the relative wage of skilled workers depend on the changes of two parameters: θ_s, θ_u . Comparative statics shows that:

$$\frac{\partial \omega}{\partial \theta_s} > 0 \text{ and } \frac{\partial \omega}{\partial \theta_u} < 0$$

$$\frac{\partial \omega}{\partial \theta_s} = \frac{\alpha}{(1-\alpha)\,\theta_u\, e}$$

$$\frac{\partial \omega}{\partial \theta_u} = -\frac{\alpha \theta_s}{(1-\alpha)\,\theta_u^{\,2} e}$$

Finally, we now consider the overall differential between monopsony and competitive relative wages and employments of skilled workers derived from formula (3.35):

$$\frac{\omega}{\gamma} = \frac{e}{e^m} = \frac{\theta_s}{\theta_u} \text{ and } \gamma e = \omega e^m = \frac{\alpha}{1-\alpha} \qquad (3.37)$$

A very strong result now follows from the fact that the elasticity of the skilled labour is lower than the elasticity of unskilled labour. Namely, because the monopsony implies that $0 < \theta_s = \frac{\varepsilon_s}{1+\varepsilon_s} < 1$ and $0 < \theta_u = \frac{\varepsilon_u}{1+\varepsilon_u} < 1$ and because $\varepsilon_s < \varepsilon_u \Rightarrow \theta_s < \theta_u$, the formula (3.37) confirms that the relative wage of skilled workers obtained under monopsony solution is lower than under competitive solution: $\omega < \gamma$ and that the relative employment of skilled workers under monopsony solution is greater than under competitive solution: $e^m > e$. In addition, a decline in the relative public sector monopsony power over skilled workers may be expressed as $\frac{\theta_s}{\theta_u} \to 1$ implying a decline in the public sector relative employment of skilled workers, e^m towards competitive e and an increase in the public sector relative wage of skilled workers, ω towards competitive, γ.

In summary, this section showed that:

1. The wage ratio w_s / w_u is lower (more compressed) in the public monopsony case than in the competitive market
2. The employment ratio $E^m{}_s / E^m{}_u$ is greater in the public monopsony case than in the competitive market.

The theoretical model derived allows us to observe the distributional outcomes of public sector restructuring on wages and employment during economic transition. In the pre-transition economy, public sector monopsony power especially towards skilled workers, reduces wage inequality and increases the use of skilled workers. Restructuring, and the development of a private sector, especially for skilled workers, creates "outside options". In transition economies, even though the government may continue to impose restrictions on pay, workers may opt to change the sector of employment as there is a private sector job alternative. Hence, the pre-transition (command economy) and post-transition (market economy) may be related to comparison of monopsony and competitive outcomes based on the main differences summarized by Večerník (2001) in Table 3.3.

Table 3.3: The main characteristics of the pre-transition and the post-transition economies

Characteristic	Command economy	Market economy
General economic goal	amount of product	productivity, efficiency
Generator of inequality	the state and (marginally) the labour market	labour market
Distribution according to	basic needs, loyalty to the regime	skills, performance, network appartenance
Main factors of disparities	gender, age, hard manual labour	human capital, entrepreneurship
The role of education	state investment generating small disparities	individual investment generating large disparities
The role of age	generation, accumulated loyalty (linear increase)	career, accummulated experience (concave)
Preferred branches	mining, metallurgy, heavy manufacturing	finance, top techologies, professional services
Managerial premia given for	political position, risk aversion	innovation, risk taking
Public/private sector distinction	no	important

Source: Večerník (2001)

The model derived here therefore demonstrates that the increase in the wage inequality during economic transition may be considered as a result of decline in public sector monopsony power rather than simply the erosion of an "egalitarian wage policy". This is derived from the increase in the relative labour supply elasticity of skilled workers during transition, as can be demonstrated by a simple calibration model.

3.4.3 Calibration Model

This part of the chapter illustrates the implications of the theoretical framework with a simple calibration model. We simulate the impact of the decline in public sector monopsony power on the relative employment and wages of skilled workers. From empirical estimates of workers' labour supply elasticities we can derive predictions as to the changes in wage inequality and employment that result.

Comprehensive surveys of the labour supply literature, such as Boal and Ransom (1997) and Bashkar, Manning and To (2002) reveal a great deal of uncertainty in the estimates of the relevant elasticities. This is in part because the literature considers different approaches to measure the market power of the employer, different time horizons (short and long run) as well as different types of workers.

The group of studies starts from the dynamic theory of monopsony by which the level of employment in a steady state is the ratio of the recruitment to the separation rate (Bashkar, Manning and To, 2002). Hence, the elasticity of employment with respect to wages is the difference between the elasticity of recruits with respect to wages and the elasticity of separations with respect to wages. Using this approach on US data, Card and Krueger (1995) calculate that the upper bound for the overall wage elasticity is 5, implying that wages are on average 17 percent below the workers' marginal products. A similar estimate is obtained by Manning (2003) using UK data. Van Der Berg and Ridder (1993) using data from the Netherlands, apply the Burdett and Mortensen model and measure monopsony power as the ratio of job offers and job destruction rates. They find the average elasticity of labour supply to be around 7. This is fairly elastic but considers workers as a whole. Our model differentiates skilled and unskilled workers.

More pertinent studies have focused on either skilled or unskilled workers. One of the very first studies that considered skilled workers is Scully (1974). He estimated that pay was about 20 and 15 percent of the marginal product for average and 'star' professional baseball players in US, respectively. That implies that the elasticity of labour supply for these professionals is only 0.25 and 0.18 respectively. Sullivan (1989) used panel data to estimate the employer size - wage effect for nurses, after controlling for other factors (individual hospital effect, measures of hospital caseload etc). The wage elasticity of labour supply of nurses in the short run was estimated to be 1.26 and in the long run 3.86, meaning that wages were 79 percent of the marginal product. Bashkar, Manning and

To (2002) concluded that, while this is not an enormous difference, it is comparable in size to estimates of the union wage markup. On the other hand, Staiger, Spetz and Phibbs (1999) estimated a much lower short run wage elasticity of labour supply of 0.1 for registered nurses in US hospitals run by the Veterans Administration (VA). Their estimate is based on the change in employment at individual VA and non-VA hospitals, relative to changes in wages of competitors and other important factors. According to Bashkar, Manning and To (2002) this study seems to come closest to the ideal experiment one would like to conduct for several reasons. The most important reasons are that the changes in the wages were an outcome of exogenous legislated change and that initial wages in VA hospitals were low relative to the prevailing level of market wages for nurses.

In contrast, focusing on the supply elasticity for unskilled labour, Boal (1995), estimates that long run inverse elasticities of West Virginia coal miners, are at most 0.03, 0.05 or 0.09, using discount rates of 5 percent, 10 percent or 20 percent respectively, implying that the inverse elasticities are essentially zero. This means that the elasticity of the unskilled labour supply approaches infinity which is expected given that workers with general skills might be regarded as more mobile.

While these results suggest a range of estimates of labour supply elasticities, the following broad conclusions emerge: (1) results depend on the methods used such that inferences from recruitment and separation rates provide greater elasticities than individual case studies (2) short run elasticities are smaller then long run estimates and (3) skilled workers have a lower elasticity of labour supply than unskilled workers or the workforce as a whole.

The calibration model presented here applies elasticities which are within the bands of these estimates to actual data obtained from Hungary as a country in economic transition. The public sector employment shares and average wages of skilled and unskilled full-time male workers, during the economic transition, from 1994 until 2003, in Hungary are obtained from Hámori (2007) and presented in the Table 3.4.

The ratios calculated from the actual transition data in Table 3.4 are presented in Table 3.5 in the column titled 'real data'. The relative employment e^m and wage ratios ω in the public sector are determined distinguishing between two groups of workers only: unskilled and skilled. The unskilled group of workers is created by summing up unskilled and low-skilled groups and the skilled group of workers is created from middle-skilled and high-skilled groups. The relative employment of skilled workers in the public sector, e^m,

is the ratio of skilled to unskilled workers in the public sector in 1994 and 2003. The relative wage of skilled workers in the public sector, ω, is the ratio of the average wage of skilled workers to the average wage of unskilled workers in the public sector in 1994 and 2003. The ratio of the share of skilled workers in the total cost (wage bill), parameter α, to the share of unskilled workers in the total cost (wage bill), parameter $(1-\alpha)$ is calculated using the information on employment and average wages of skilled and unskilled workers in the public sector in 1994 and 2003.

Table 3.4: Employee educational composition and wages by ownership type in Hungary, 1994 and 2003

	Private sector		Public sector	
	1994	2003	1994	2003
Educational composition (%)				
Unskilled (U)	21.67	15.71	15.39	11.54
Low-skilled (L)	39.37	45.13	12.7	18.29
U+L	61.04	60.84	28.09	29.83
Middle-skilled (M)	25.38	25.97	28.08	21.44
High-skilled (H)	13.58	13.19	43.83	48.73
M+H	38.96	39.16	71.91	70.17
Monthly gross earnings for education group U	85,040.96	94,851.91	73,173.08	99,776.24
Monthly gross earnings for education group L	93,852.98	109,279.80	78,366.44	102,634.20
Mean monthly gross earnings Unskilled (U+L)	89,446.97	102,065.86	75,769.76	101,205.22
Monthly gross earnings for education group M	133,642.80	155,430.60	109,814.90	128,143.80
Monthly gross earnings for education group H	241,730.60	360,113.10	132,077.10	227,658.70
Mean monthly gross earnings Skilled (M+H)	187,686.70	257,771.85	120,946.00	177,901.25
Observations	54,138	50,700	7,903	8,659

Notes to Table 3.4: Monthly Gross Earnings are denoted in Hungarian currency HUF and converted to 2003 earnings by the annual CPI. *Source*: Hámori (2007)

For the purpose of assessing the compression of public sector wages we consider the wages paid by the private sector in 1994 as a benchmark. Hence, we assume that the relative wage of skilled private sector workers in the early years of the economic transition is the closest to the relative marginal revenue product of skilled workers γ. In addition, we assume that the relative marginal revenue product of skilled workers remains constant. Hence, knowing the relative wage ω and relative marginal revenue product of skilled workers γ we can calculate the inverse of the public sector relative monopsony power over skilled workers in 1994 and 2003: $\theta = \frac{\omega}{\gamma}$. Then we can calculate the relative employment of skilled workers under a competitive solution: $e = \theta e^m$.

The next two columns of Table 3.5 present the calibration models for years 1994 and 2003. The calibration of the models is based on the equalities derived from the theoretical model and given in (3.37): $\frac{\omega}{\gamma}=\frac{e}{e^m}=\theta$ and $\gamma e=\omega e^m=\frac{\alpha}{1-\alpha}$ by fitting the estimates of the elasticity of labour supply for skilled and unskilled workers from the literature.

Table 3.5: Public sector monopsony: real data and model calibration

Public sector	Real data		Model I calibrated values		Model II calibrated values	
Ratios:	1994	2003	$\varepsilon_s=3;\varepsilon_u=100$ 1994	$\varepsilon_s=5;\varepsilon_u=100$ 2003	$\varepsilon_s=3;\varepsilon_u=75$ 1994	$\varepsilon_s=5;\varepsilon_u=75$ 2003
e^m	**2.56**	**2.35**	**2.52**	**2.26**	**2.51**	**2.26**
θ	0.76	0.84	0.76	0.84	0.76	0.84
e	1.95	1.97	1.91	1.91	1.91	1.91
ω	**1.60**	**1.76**	**1.59**	**1.77**	**1.59**	**1.77**
γ	2.10	2.10	2.10	2.10	2.10	2.10
$\alpha/(1-\alpha)$	4.09	4.13	4.00	4.00	4.00	4.00

Notes to Table 3.5: From the Table 3.4 the following ratios in the column 'real data' are calculated: $e^m=\frac{E^m{}_s}{E^m{}_u}=\left(\frac{M+H}{U+L}\right)^{Public}$; $\omega=\frac{w_s}{w_u}=\left(\frac{\overline{w}_{(M+H)}}{\overline{w}_{(U+L)}}\right)^{Public}$; $\gamma=\frac{\gamma_s}{\gamma_u}=\left(\frac{\overline{w}_{(M+H)}}{\overline{w}_{(U+L)}}\right)^{Private1994}$ and $\frac{\alpha}{1-\alpha}=\frac{w_s E_s{}^m}{w_u E_u{}^m}$ whereas $\theta=\frac{\omega}{\gamma}$ and $e=\theta e^m$. The Model I calibrated by using the labour supply elasticities of skilled workers $\varepsilon_s^{1994}=3$ in 1994 and $\varepsilon_s^{2003}=5$ in 2003 and labour supply elasticity of unskilled workers $\varepsilon_u^{1994}=\varepsilon_u^{2003}=100$ in 1994 and 2003. The Model II calibrated by using the labour supply elasticities of skilled workers $\varepsilon_s^{1994}=3$ in 1994 and $\varepsilon_s^{2003}=5$ in 2003 and labour supply elasticity of unskilled workers $\varepsilon_u^{1994}=\varepsilon_u^{2003}=75$ in 1994 and 2003. In both Models γ and $\alpha/(1-\alpha)$ are taken from the 'real data' column whereas $\theta=\varepsilon_s/(1+\varepsilon_s)/\varepsilon_u/(1+\varepsilon_u)$ and ω, e^m and e are calculated using the equalities derived from the theoretical model and given in (3.37): $\frac{\omega}{\gamma}=\frac{e}{e^m}=\theta$ and $\gamma e=\omega e^m=\frac{\alpha}{1-\alpha}$.

The only parameters taken from the 'real data' column and used in columns titled as 'model I' and 'model II' are the relative marginal revenue product of skilled workers, γ, and the relative share of skilled workers in the total cost (wage bill), $\alpha/(1-\alpha)$. All other parameters are generated by the models. The 'free' parameters are labour supply elasticities of skilled and unskilled workers, ε_s and ε_u chosen to calibrate the inverse of

the relative public sector monopsony power θ given in the 'real data' column. Therefore, the calibration is carried out by fitting the values for skilled and unskilled labour supply elasticities to the corresponding ratio values from the 'real data' column. The resulting values for these parameters, chosen to maximise the fit of the model, are the following: for Model I, $\varepsilon_s^{1994} = 3$ and $\varepsilon_s^{2003} = 5$ and $\varepsilon_u = 100$ in both years, 1994 and 2003; for Model II, $\varepsilon_s^{1994} = 3$ and $\varepsilon_s^{2003} = 5$ and $\varepsilon_u = 75$ in both years, 1994 and 2003[14]. After fitting $\theta = \varepsilon_s/(1+\varepsilon_s)/\varepsilon_u/(1+\varepsilon_u)$ and knowing γ and α we calculate ω, e and e^m using formula (3.37): $\frac{\omega}{\gamma} = \frac{e}{e^m} = \theta$ and $\gamma e = \omega e^m = \frac{\alpha}{1-\alpha}$.

An inspection of Table 3.5 shows that if we take 'transition' as meaning that the elasticity of skilled labour supply ε_s increases from 3 to 5 (both within the range of empirical estimates) and benchmark as actual 1994 values for Hungary, we can predict 2003 rather well.

3.5 Evidence on Changing Wage Inequalities in Eastern Europe during Economic Transition

3.5.1 Wage Inequalities, Pre-transition

An implication of the model where transition implies an erosion in the differential monopsony power of the state across worker types is that wage inequality should increase faster in transition economies than in other OECD economies. This will now be demonstrated.

The literature on transition economies provides the bulk of evidence that planned economies limited the extent of inequality through explicit restrictions in earnings dispersion. Aghion and Commander (1999) note the perverseness of returns to skills

[14] We have explored the range of values for the elasticity of labour supply for unskilled workers estimated by Boal (1995). But for the whole range of $\varepsilon_u \in \{20,100\}$ the skilled workers' labour supply elasticities $\varepsilon_s^{1994} = 3$ and $\varepsilon_s^{2003} = 5$ give the relative wages and relative employments of skilled workers that are consistent to the corresponding ratio values from the 'real data' column in the Table 3.5. Moreover, these elasticities of labour supply of skilled workers fit (broadly) with the Sullivan (1989) estimates.

pointing to the fact that planned economies combined relatively high levels of human capital investment with extremely low returns to skills, due to pay compression.

Table 3.6: Wage inequality in the advanced OECD countries, 1979–1990 and in the CEE countries, 1988-1995: Log 90/10 wage differential

OECD	1979	1984	1987	1990	(1990)-(1979) change	Five year change [a]
			Males			
United States	1.23	1.36	1.38	1.40	0.17	0.077
United Kingdom	0.88	1.04	1.10	1.16	0.28	0.121
France	1.19	1.18	1.22	1.23	0.04	0.018
Japan	0.95	1.02	1.01	1.04	0.09	0.041
			Females			
United States	0.96	1.16	1.23	1.27	0.31	0.141
United Kingdom	0.84	0.98	1.02	1.11	0.27	0.123
France	0.96	0.93	1.00	1.02	0.06	0.027
Japan	0.78	0.79	0.84	0.83	0.05	0.023
CEE	1988	1989	1993	1994	1995	Five year change [a]
			All			
Czech Republic	...	0.88	1.16	...	1.31	0.358
Hungary	1.14	...	1.30	1.33	...	0.158
Poland	0.96	...	1.11	...	1.22	0.186
Romania	...	0.67	1.02	...	1.12	0.375

Notes to Table 3.6:

a) Wage inequalities for selected OECD countries by *Katz, Loveman and Blanchflower (1995)* and for CEE countries by *Rutkowski* (1996a) for 1988–1993 and *Rutkowski* (1997) for 1994/1995.

b) [a] The difference between the last year and the first year value expressed on a five year basis.

Source: Kertesi and Köllő (2000)

The empirical evidence presented in Table 3.6 confirms that the initial pre-transition (i.e. before 1990) earnings distribution in Central and Eastern European (CEE) countries was rather low by international standards. This is further observed by the educational group ratio values in selected OECD and CEE countries presented in Table 3.7. Lower levels of relative wages are evident when a comparison is made between OECD and CEE countries for the same period. However, the economic transition caused the process of wage decompression at an impressive pace as illustrated by the five year change in the last column of Tables 3.6 and 3.7. For example, in Table 3.6, the change in the 90^{th} to 10^{th} ratio of log wages between 1988/89 and 1994/95 in selected transition economies is in a range from 16 to 37 percentage points. The change in the similar measure of wage inequality varies from 2 to 14 percentage points in selected OECD

countries, even including the US, which exhibited one of the highest rates of growth of wage inequality.

Table 3.7: Changes in educational differentials in the advanced OECD countries and in the CEE countries

OECD	Educational group ratio	Initial year	Ratio value	Second year	Ratio value	Five years change [a]
United States	College/ High school	1979	1.37	1987	1.52	0.11
United Kingdom	College/No qualification	1980	1.53	1988	1.65	0.08
France	Males: Nonmanual/Manual [b]	1976	1.58	1987	1.53	-0.03
	Females: Nonmanual/Manual [b]	1976	1.38	1987	1.35	-0.01
Japan	College/Upper high school	1979	1.26	1987	1.26	0.00
Canada	University/High school	1980	1.4	1985	1.43	0.03
West Germany	(14-18)/(11-13) years	1981	1.36	1983	1.42	0.10
Sweden	University/Post Secondary	1981	1.16	1986	1.19	0.03
Netherlands	University/Secondary	1983	1.43	1987	1.23	-0.25
CEE						
Czech Republic	Higher education/Secondary	1988	1.29	1992	1.41	0.15
Hungary	Higher education/Secondary	1989	1.44	1994	1.47	0.03
	Higher education/Vocat.training sch.	1989	1.56	1994	1.86	0.30
Poland	Higher education/Vocational secondary	1988	1.23	1993	1.39	0.16

Notes to Table 3.7:

a) For OECD countries: the calculations by *Davis* (1992), except France. [b] Educational differentials for males and females nonmanual/manual workers in France by *Katz, Loveman and Blanchflower (1995).*

b) For CEE countries: calculations for Hungary by *Kertesi and Köllő* (2000) and for Czech Republic and Poland by *Rutkowski* (1996a).

c) [a] The difference between the second year and the initial year value expressed on a five year basis.

Source: Kertesi and Köllő (2000)

The sharp increase in relative wages of skilled to unskilled workers in transition economies can be illustrated by looking at changes in educational differentials for the UK and Hungary in Table 3.7. In particular, the growth in the relative wage of college trained workers to workers with no qualifications expressed on a five year basis was 8 percentage points in the UK in the 1980s whereas the change in relative wage of higher to vocational education in Hungary in the late 1980s / early 1990s was 30 percentage points. Hence, the economic transition allowed earnings differentials, measured by 90^{th} to 10^{th} ratios in Table 3.6 or by educational differentials in Table 3.7, to become more comparable with those observed in advanced market OECD countries.

Table 3.8: Raw Gini coefficients

Year	1987 – 1988		1989		1993		1994	1993 –1994	
Author	*C*	*H*	*AM*	*AC*	*P*	*W*	*P*	*C*	*H*
Bulgaria	0.25	0.23	0.3					0.34	0.34
Czech Republic	0.19	0.19	0.20	0.20				0.19	0.26
Hungary	0.21	0.21	0.25	0.25		0.27		0.23	0.24
Poland			0.27	0.27					0.31
Romania	0.23	0.23				0.255		0.29	0.29
Slovakia	0.20	0.20	0.20					0.20	0.20
Estonia	0.23	0.30				0.39			0.39
Latvia	0.23	0.27				0.27			0.27
Lithuania	0.23	0.28				0.34			0.36
Russia	0.24	0.28		0.28	0.40	0.50	0.41		0.48

Notes to Table 3.8: The Ginis are identified in columns by year and by different sources, indicated by letters: *AC Aghion and Commander* (1999), *AM Atkinson and Micklewright* (1992), *C Corricelli* (1997), *H Honkkila* (1997), *P Popov* (1996), and *W World Bank* (1997). *Source*: Rosser, Rosser and Ahmed (2000)

The similar pattern of increasing earnings inequality during first years of transition (i.e. early 1990s) relative to the pre-transition period (i.e. late 1980s) is presented by Gini coefficients in Table 3.8 for a number of transitional countries using different sources of empirical evidence.

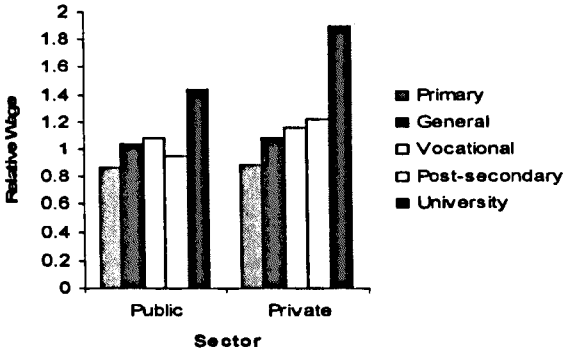
3.5.2 Wage Inequalities, Transition

In this section we amplify these general findings on inequality trends with further evidence. First, there was a significant increase in earnings inequality, especially for workers with higher levels of education during transition in CEE countries. Second, greater earnings inequality is observed in the private sector (where there is, presumably, no monopsony power) than in the public sector. Third, the main changes in the earnings distribution took place largely at the upper end i.e. among skilled workers, especially graduates.

The increases in educational differentials and their correlation with the sector of ownership have been analysed by many researchers. Rutkowski (1996b) analysed the change in the wage structure in Poland, which is typical also of other CEE transitional economies, and concluded that the widening of wage differentials, can be largely explained by increases in the returns to education. For example, he finds that in 1988 a worker with a university degree had only 19 percent higher earnings than the worker with basic vocational training. The education wage differential increased by 27 percentage points during the economic transition. In addition, in 1993, a public sector worker with a

university degree earned around 50 percent more than a public sector worker with basic vocational training while the private sector worker with university degree earned around 90 percent more than the private sector worker with basic vocational training. Greater compression of the public sector wages compared to the private sector wages can be observed in the Polish example in Figure 3.4.

Figure 3.4: Raw earnings differentials by educational attainment in Poland, 1993



Notes to Figure 3.4: Earnings are average net monthly earnings. Relative wage of each educational qualification (primary, general, vocational, post-secondary school and university degree) relative to the reference basic vocational education.

Source: Rutkowski (1995)

Furthermore, Rutkowski (1995) reports the ratio of earnings of white collar workers to earnings of blue collar workers in 1993 in Poland. At the median this ratio was 1.12 in the public sector and 1.30 in the private sector. White collar workers at the top deciles had 1.13 and 1.60 higher earnings than blue collar workers at the top deciles, in the public and the private sectors, respectively.

Public-private wage differentials by educational attainment from the same study are presented in the Table 3.9. Table 3.9 shows that all workers, regardless of educational attainment, earned a premium in the private sector. But the private sector pay 'mark-up' was the highest for workers with a university degree. This confirms that highly skilled workers gained much more from private sector employment than workers with lower skills during transition. Rutkowski (1995) estimated that the private sector rewarded high skills by 30 percent higher wages, relative to the public sector, while workers with lower skills earned at most 11 percent more than in the public sector. In addition, the age-earnings profile in the private sector was found to be significantly steeper than in the public sector meaning that earnings peaked about four years earlier in the private sector than in the public sector.

Table 3.9: Raw earnings in the private sector relative to earnings in the public sector by educational attainment in Poland, 1993

Educational level	All	Men	Women
All levels	105.7	102.0	106.5
Tertiary, university level	127.3	112.3	141.4
Tertiary, below university	132.8	105.0	140.8
Secondary vocational	111.1	107.3	112.3
Secondary general	105.8	102.2	103.4
Vocational training	103.3	103.0	105.9
Primary	110.9	108.6	107.7

Notes to Table 3.9: Public sector = 100.
Source: Rutkowski (1995)

Empirical evidence from other sources also confirms that private sector employers were using wage policy to attract relatively qualified workers away from the public sector jobs where they suffered from greater wage compression. For example, Flanagan (1995) finds that private firms in Hungary and Czech Republic tried to pay higher salaries than the public sector: 10 percent more for unskilled workers and up to twice more for skilled workers, according to the World Bank survey in 1993. Yet, he and other researchers, such as Basu, Estrin and Svejnar (1997), argue that to some extent this differential might be offset by higher nonwage benefits paid by the public sector. Flanagan (1995) concludes that private firms appear to pay higher average wages when they compete directly with the public sector for particular skills, although the margin and composition of the overall compensation package varied across sectors and countries.

The insufficiently competitive public sector salary structure relative to the private sector firms of comparable size is clearly evident from the Table 3.10. The results are estimated by Nunberg (2000) for the Czech Republic. Table 3.10 shows that the difference between public and private sector pay is more pronounced at the higher skill levels and larger size companies.

Table 3.10: Public-private salary comparisons in the Czech Republic in 1998

Type of Private Sector Position	Private Sector Compensation (US$)	Public Sector Compensation (US$)	Public Compensation as % of Private Sector	Type of Public Sector Position, Qualification and Salary Point: Grade	Education Requirement	Min/Mid/Max of Salary Range
CEO	6175	1875	30.4		Minister	
Chief Financial Officer	3803	1406	37		First Deputy Minister	
Business Director	3006	906	30.1		Director	
HR Director	2816	784	27.9	12	5 y University degree	Max
Marketing Director	2712	689	25.4	11	5 y University degree	Max
Info Systems Director	1897	603	31.8	10	5 y University degree	Max
Sales Representative	703	466	66.3	9	5 y University degree	Mid
Executive Secretary	729	421	57.7	8	3 or 5 y University degree	Mid
Accounting Assistant	470	380	81	7	Full high school	Mid

CEO Salaries

Size of Private Sector Firm	Private Sector Compensation ($)	Public Sector Compensation ($)	Public Compensation as % of Private Sector	Type of Public Sector Position
500+staff	2656	1875	70.6	Minister
Smaller than 500 staff	1875	1406	75	First Deputy Minister

Source: Nunberg (2000)

However, there is some evidence of public sector pay restructuring in an attempt to move towards a competitive wage distribution. In the case of Hungary, Kézdi (1998) shows that public sector earnings have actually increased between 1986 and 1996, but still could not keep up with private sector earnings levels. This is illustrated by the Table 3.11. The highest pay increase can be observed for the occupations requiring the highest level of educational qualification, in both public and private sectors, but this increase was three times higher in the private than in the public sector. As one goes down the occupational scale, the difference between increases in the public and private sector earnings declines. Moreover, Table 3.11 shows that the lowest educational occupations experienced higher growth of earnings in the public than in the private sector.

Table 3.11: Relative salary position of certain occupations in the public administration and private sector, 1986-1996 (whole economy average of the year = 100)

Occupation	1986		1996		1986-1996 % change	
	Public administration	Private sector	Public administration	Private sector	Public administration	Private sector
Chief executives [a]	191	208	243	379	27	82
Business administration [a]	148	148	180	234	22	58
Higher educated bureaucrats [a]	138	147	173	221	25	50
Lower educated bureaucrats [b]	82	105	108	121	32	15
Administrative occupations [b]	78	83	89	93	14	12

Notes to Table 3.11: [a] With higher education level. [b] With secondary school education level.

Source: Kézdi (1998)

Nunberg (2000) provides some further evidence of public sector pay restructuring in civil service in Hungary. This is illustrated by the increases in civil servants' salaries in the Table 3.12. The attempt to decompress public sector pay is shown by pay increases disproportionally concentrated among the top skilled occupations.

Table 3.12: Civil Servants with Increased Salaries in Hungary, 1997

	Percent of staff in class with salaries increased
Senior Managers	74.2
Non-Managers with Higher Level Qualifications	47.5
Civil Servants with Secondary Level Qualifications	36.5
Administrative Grades	30.1
Blue Collar Workers	19.3

Source: Nunberg (2000)

This section therefore provided the following evidence: (1) faster increases in wage inequality in transition economies compared to the OECD countries driven by the impact of a growing private sector on labour markets (2) a private sector wage policy that attracted qualified workers away from public sector jobs which suffered from greater wage compression and (3) public sector incentives to adjust wages, especially of skilled workers, once exposed to competition.

3.5.3 Employment reallocation in transition

The competition between public and private sectors for scarce skills, initiated by the economic transition in CEE countries, can be further revealed by the information on employment reallocation across different ownership types. There is much empirical evidence on fundamental changes in employment structure in CEE economies during transition. Davis and Haltiwanger (1999) provide evidence of tremendous industrial reallocation and private sector growth. For example, based on the evidence collected from 17 transition economies, they find that the private sector share of GDP rose from an average of 14% prior to economic reform (late 1980s) to 46% in 1995.

The enormous shifts in the sectoral composition of output are supported by the data from 26 transition economies, among which the most advanced reformers experienced up to an 11% decline in the share of industry in GDP and up to almost a 15% increase in service share in GDP, between 1989 and 1994. Davis and Haltiwanger (1999) argue that profound changes in ownership and industrial reallocation would seem to set the stage for large gross flows of workers in and out of employment. However, the available evidence says otherwise. Davis and Haltiwanger (1999) show that the majority of the transition economies experienced a stagnant unemployment pool with very small unemployment outflow rates - especially flows from unemployment to employment. Instead, they observed large net flows of workers across firms and sectors. Available surveys of multi-country evidence confirms that a high fraction of open positions were filled by workers who transit directly from another job, rather than from unemployment or non-participation. Blanchard (1997) reports that the fraction of new hires that came directly from another job, was 40% in Poland and 71% in Hungary in 1992, as compared to only 20% in the United States.

In this context, some empirical studies argue that the emerging private sector hired exclusively directly from the public sector because unemployment was seen by employers as a signal of lower qualification (for example Večerník, 1993, Allison and Ringold, 1996, Boeri, 1998, Jurajda and Terrell, 2003).

Table 3.13: Labour turnover in CEE countries at the beginning, during and at the end of economic transition

i) Job creation and job destruction rates

Period and	By	enterprise	type			
Country	Collective		Private		State	
Annual	Creation	Destruction	Creation	Destruction	Creation	Destruction
1989 Estonia	0.37	1.41	64.89	1.06	0.00	2.12
1993 Estonia	0.00	22.53	59.96	12.12	0.44	13.56
1997-2000	**Privatised**		**Private**		**State**	
Hungary	4.70	4.90	7.80	3.30	4.30	6.90
Romania	2.20	10.10	26.20	2.90	1.30	12.70
Russia	6.70	5.00	13.50	5.10	0.60	4.80
OECD			**All**			
1984-1991			Creation	Destruction		
France			12.70	11.80		
Netherlands			8.20	7.20		
United Kingdom			8.70	6.60		
United States			13.00	10.40		

ii) Hiring and separation rates

By enterprise type	**Collective**		**Private**		**State**	
Annual	Hiring	Separation	Hiring	Separation	Hiring	Separation
1989 Estonia	9.89	10.93	70.21	6.38	8.6	10.72
1993 Estonia	15.06	37.59	76.51	28.68	14.63	27.74
1993 Poland			37.20	34.80	14.20	15.80
1999 Poland			35.20	31.40	14.00	18.70
By employment size	**20-99**		**100-400**		**500+**	
Annual	Hiring	Separation	Hiring	Separation	Hiring	Separation
1989 Estonia	14.09	11.02	7.78	11.01	6.91	9.63
1993 Estonia	36.19	24.46	18.60	31.30	9.68	29.04

Notes to Table 3.13: Ownership in Hungary, Romania and Russia are based on ownership type in 2000 and the job creation and job destruction rates are average rates during 1997-2000 period. 'Privatised' firms are those with private ownership share exceeding 50 per cent in 1997. Private includes private firms established since 1990. State sector for Romania excludes six state-owned firms changing title in 1997–1998. For OECD countries job creation and destruction rates are annual average rates as a percentage of total employment during 1984-1991 except for United Kingdom during 1985-1991.

Sources: Haltiwanger and Vodopivec (2002) for Estonia, Socha and Weisberg (2002) for Poland, Commander and Köllő (2008) for Hungary, Romania and Russia and Cahuc and Zylberberg (2004) for OECD countries

The empirical evidence on differences in hiring and separation rates as well as job creation and job destruction rates between public and private sectors presented in the Table 3.13 are striking. For example, the private sector accounted for virtually all of the job

creation in Estonia. It can be observed that private firms experienced relatively high rates of separations and job destructions but these were more than offset by remarkably high hiring and creation rates. Socha and Weisberg (2002) described the private sector labour market as close to a 'perfect competition' model based on the calculated annual hiring and separation rates during the period of economic transition in Poland given in Table 3.13.

Furthermore, Table 3.13 shows that the job destruction rates in the state-owned and collective enterprises were excessively high at the start of transition but by 1993 had declined to rates comparable to those in the private sector. Haltiwanger and Vodopivec (2002) explain that state-owned and collective firms were hiring only to replace separating workers on the remaining jobs. The same pattern is confirmed by Bilsen and Konings (1998) for Bulgaria, Hungary and Romania, by Jurajda and Terrell (2001) for Czech Republic and Konings, Lehmann and Schaffer (1996) and Socha and Weisberg (2002) for Poland. Moreover, Commander and Köllő (2008) using data for Hungary, Romania and Russia presented in Table 3.13, confirmed that the pattern of the contribution of new private firms to job creation and of state-owned and privatised firms to job destruction remained, even by the end of the economic transition, although of much smaller magnitude (which became comparable in size with the rates in OECD countries).

Finally, if one looks at the hiring and separation rates by employment size presented in Table 3.13 we observe that hiring rates declined with the size of the enterprise, but the separation rates increased with the size of the firm. This is in contrast with firm behaviour in market economies where large employers have the lowest separation rates (for example Manning, 2003). However, this was not unusual for transition economies having in mind the over-employment in the so called 'dinosaur' (due to the giant size) firms created under central planning. This data is of course compatible with workers moving from sectors with lower wages into jobs with higher wages.

A similar pattern is confirmed by Nunberg (2000) for the 'non-productive' branches of the public sector. She reports that for CEE countries in 1997, staff turnover in civil service ranged from around 7 to 11 per cent per annum (Hungary 9, Estonia 6.8, Czech Republic 11) while international attrition standards tended to be under 5 percent per annum.

This sub-section therefore provided evidence on employment reallocation across different ownership types. The main findings confirmed that the private sector contributed to job creation whereas the public sector contributed to job destruction over the course of

the economic transition. Moreover, a high fraction of open positions were filled by workers who transited directly from another job, rather than from unemployment. In addition, hiring rates declined with the size of the enterprise, but separation rates increased with the employment size of the firm, as workers moved from over-employed state-owned factories to competitive private businesses. All this is compatible with the onset of a competitive private sector which enhances the 'outside option' of public sector workers, especially the most skilled.

3.6 Conclusion

This chapter has addressed the effects of public sector restructuring on employment and wages during the economic transition in Central and Eastern European countries. The restructuring took place against a background of a decline in public sector labour market monopsony power. The results in this chapter suggest that the differential elasticity of labour supply for skilled and unskilled workers may be important for the understanding of public sector wage compression in centrally planned economies and to the changes in the wage distribution that occurred during the transition. Both the theoretical framework and the empirical evidence are provided to support this argument.

The theoretical part of the chapter supports our intention and effort to illustrate two main characteristics of the public sector in pre-transition economies:

- greater wage equality than in a competitive market
- differential monopsony power over skilled and unskilled workers.

The chapter has argued that these factors were connected: low productivity workers had a more elastic supply and therefore, the ability of the public sector to exploit its monopsony power is less for low productivity workers than for high productivity workers. An egalitarian wage strategy thereby exploits the lower elasticity of supply of high productivity workers. The chapter has shown that a rationale for the public sector paying more equal wages to workers of differing productivity is that it is exploiting its monopsony power, and therefore we have shown that the relative employment of skilled workers to unskilled workers in the public sector will be greater than in the competitive market.

Furthermore, the theoretical framework developed in this chapter shows the outcomes of a decline in public sector monopsony power along the transition. These are reflected in an increase in the relative elasticity of labour supply for skilled workers, a

decline in the relative employment of skilled workers in the public sector and an increase in public sector wage inequality.

The empirical part of the chapter confirms six foundation points for the theoretical framework developed: (1) earnings differentials were more compressed in the pre-transition period in CEE countries than in the market OECD economies (2) the economic transition sees a decline in the ability of the government to 'manage' pay structure (3) economic transition allowed earnings inequality to become comparable with inequality observed in advanced market OECD economies (4) the main changes in the earnings distribution were caused by increases in the returns to high skills (5) changes in the relative wages guided labour reallocation between public and private sectors and (6) greater earnings inequality in the competitive private sector caused a higher sector pay gap for high skilled workers but this differential declined over the course of the economic transition. The evolution of public relative to private sector wages over the transition, and how this varied over worker types, will be considered at greater length in subsequent chapters.

Chapter 4

4 Public-private earnings differentials in Serbia

4.1 Introduction

The economic transition in Eastern Europe represents a fruitful case-study of the evolution of the wage structures between the private and public sectors. In Serbia, during the period analysed in this chapter from 1995 until 2008, the public sector has been privatised and restructured through a number of significant reforms. The transformation of ownership will have a potential effect not only on employment composition but also on relative wages and hence on the distribution of the wages in the two sectors of employment.

The purpose of this chapter is to analyse the evolution of earnings in the private and public sectors during the period of economic transition in Serbia. This will be done by examining changes in public-private wage differentials, on average and across the percentiles of the wage distribution, for male and female employees, controlling for characteristics. Distributional aspects of wages are especially important for the analysis of the development of public and private sector wages during the period of economic transition for two reasons. Firstly, as we saw in chapter 3, wage setting mechanisms in the public sector imply that wages are more compressed than in the private sector, which means that estimates of the average effect of public sector status may not give an entire insight into public-private wage differentials. Secondly, public sector restructuring over the period of economic transition is likely, from the analysis in the previous chapter, to induce a widening of the public sector wage distribution as the economy moves towards a competitive private sector dominated wage distribution.

This chapter tackles several issues: (1) it provides a detailed explanation of the changes in the employment and wage composition during the period of economic transition in Serbia, using administrative and micro data. (2) it discusses changes in the coverage and methodology of micro data. (3) it augments the earlier literature of public-private wage differentials by using a more comprehensive definition of earnings and longer series of data. (4) it then provides an analysis of the evolution of public-private wage differentials for male and female employees in Serbia on average and across the earnings distribution using different sources of micro data over the transition period. (5) it attempts to correct for a measurement error and endogeneity arising from large-scale privatisations in cross-sectional public sector pay gap estimates from individual reported data.

Although the chapter distinguishes systematic differences in hourly remuneration across the public and private sectors using a variety of data sets, the cross-sectional nature of the available data and the difficulty in finding rational exclusion restrictions for possible sectoral self-selection issues, limit the capacity to identify structural models of simultaneous sector selection and wage determination. Nevertheless, the chapter proposes a novel instrument to exploit the variation in public sector status across individuals arising from the large-scale privatisation. This is done by combining different sources of data.

The chapter is organised in four parts. The first section portrays the institutional setting in Serbia and describes the main stages of privatisation during the economic transition. The next section presents changes in sectoral composition by using administrative and household data. The third section contains the estimation of public-private sector pay differentials at the mean and at the selected percentiles of the pay distribution. The empirical analysis in third section is therefore based on OLS and quantile regression methods. A final section uses instrumental variable methods to obtain results that are robust to measurement error. An instrument based on industry level changes in the proportion of workers working for the public sector is applied. This instrument is proposed to infer the likelihood of changes in the public sector status and hence in whether an individual is affected by privatisation.

4.2 Transition in Serbia

4.2.1 Macroeconomic Context and Wage Developments

Serbia was one of the very last countries of Eastern Europe to initiate a process of economic transition. The economic transition in Serbia began in 1989 but from 1991 onwards it was interrupted by wars and the disintegration of the former Yugoslavia, by UN sanctions (introduced in 1992), by hyperinflation in 1993-1994 and the NATO bombing campaign. This was followed by estimated 18% decline in real GDP and chronic economic depression in 1999.

Market reforms that had been undertaken at the beginning of the 1990s in other Eastern European economies started in Serbia only after democratic changes in October 2000. In 2001 the main macroeconomic policy changes took place. Economic sanctions were lifted and most price controls were relaxed. The managed floating exchange rate was introduced and IMF Stand-by Arrangements were approved. A restrictive monetary policy was combined with an expansionary fiscal policy. The New Privatisation law was adopted and a comprehensive tax reform was implemented. Following the approval of an investor-oriented law in June 2001, a comprehensive privatisation programme was initiated (EBRD, 2002). Real GDP grew annually on average by 6% from 2001-2008, as presented in Table 4.1a.

The growth of real net wages was significantly higher than the growth of real GDP during the post-2000 period, with the exception of 2008. For example, Table 4.1b shows that real GDP increased by 5% but the real average net wage rose by 16% on average during 2001-2008 period.

Table 4.1a: Main macroeconomic indicators in Serbia, 1990-2008

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Growth in real GDP (%)	-7.9	-11.6	-27.9	-30.8	2.5	6.1	7.8	10.1	1.9	-18.0	5.2	5.1	4.5	2.4	9.3	6.3	6.5	6.9	5.4
Inflation (%)	593	121	9237	116.5*10[12]	3.3	78.6	94.3	21.3	29.5	37.1	60.4	91.1	21.2	11.3	9.5	17.2	13.0	8.0	6.1
Government Balances (%GDP)	na	na	na	na	na	-4.3	-3.8	-7.6	-5.4	na	-1.0	-4.9	-8.3	-3.4	0.0	0.9	2.7	-1.9	-2.4
Current Account (%GDP)	na	na	na	na	na	na	-9.8	-6.5	-4.2	-4.4	-5.1	-5.0	-17.5	-16.4	-14.8	-10.0	-8.8	-15.7	-17.2
Foreign Direct Investment	na	na	na	na	na	na	0	740	113	112	25	165	475	1360	966	1481	3500	2523	2717

Notes to Table 4.1a: Foreign Direct Investn't net inflows recorded in the balance of payments in US$ million. *Data Source*: EBRD Transition Report various years

Table 4.1b: Economy and labour market indicators in Serbia, 1994-2008

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Nominal GDP per capita (in US$)			1367	1562	1308	1220	863	1413	1910	2542	2977	3234	3953	5393	6774
Nominal Monthly Earnings (% change) [1]	na	na	na	48.2	33.3	23.1	91.1	129.6	51.7	25.3	23.7	24.1	24.4	22.0	17.9
Real Monthly Earnings (% change) [1]	na	na	na	26.9	3.8	-14.0	30.7	38.5	30.5	14.0	14.2	6.9	11.4	15.3	6.2
Labour force (end-year) (% change)	-2.3	0.9	1.1	-1.2	-0.5	-7.2	-2.4	1.8	1.3	2.5	-4.5	2.2	-1.1	-6.1	-2.0
Employment (end-year) (% change)	-2.4	-0.9	-0.4	-1.4	-1.8	-8.6	-2.6	0.2	-1.6	-1.3	-6.4	0.9	-2.3	-1.5	-0.1
Employed in Private Sector (% change) [2]	na	na	na	na	na	na	na	na	5.0	6.0	4.0	6.0	-2.0	3.0	11.0
Employed in Sectors other than Private (% change) [2]	na	na	na	na	na	na	na	na	-7.0	-7.0	-6.0	-10.0	-9.0	-6.0	-9.0
Unemployment (end-year) [3]	23.3	24.6	25.7	25.9	26.8	27.9	24.4	25.5	27.6	30.3	31.7	32.4	33.2	29.9	28.5
Privatisation Revenues (cumulative in % GDP) [4]	na	na	na	na	na	na	na	na	2.4	6.9	7.7	10.2	17.4	20.2	21.4
Private Sector Share in GDP (%) [5]	na	na	na	na	na	na	40	40	45	45	50	55	55	55	60
Share of industry in GDP (%)	41.0	40.1	38.6	39.3	39.7	38.2	26.0	27.2	34.3	23.2	22.8	21.8	21.8	21.4	20.7
Share of agriculture in GDP (%)	31.4	31.1	29.4	29.4	19.0	25.1	17.6	17.2	19.3	12.1	13.3	12.0	11.3	9.8	10.1
Population end-year, millions [6]	10.5	10.5	10.6	10.6	10.6	8.4	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5

Notes to Table 4.1b: na denotes that data is not available; [1] annual average gross but from 1999 net; [2] from annual average number of employed persons published in Statistical Yearbook of Serbia (1996-2008); [3] % of labour force (end-year); [4] government revenues from cash sales of enterprises, not including investment commitments; [5] rough EBRD estimates, based on available statistics from both official (government) sources and unofficial sources. The underlying concept of private sector value added includes income generated by the activity of private registered companies, as well as by private entities engaged in informal activity in those cases where reliable information on informal activity is available; [6] decrease in 1999 is the result of excluding Kosovo population from the total.

Data Source: EBRD Transition Report various years and Statistical Office of the Republic of Serbia

Remarkably high growth in average monthly real wages during 2001 and 2002 was to some extent due to the fiscal reform through which additional payments that were previously non-taxable (such as meals and travel allowances) were included in the net wage. Therefore, the total remuneration increased by approximately 15% relative to the "wage".[15] This measure changed the definition of earnings, allowing a greater similarity to the pay concept utilised in market economies.[16]

Apart from the new method of wage calculation the unexpectedly high real growth in wages from 2001 was also caused by a number of other factors. One of them was the government's effort to regulate wage growth consistently across certain branches of the public sector such as public education, public health and public services. Other factors included the liberalisation of wages in the rest of the economy, the stabilisation of the growth in prices and the cost of living and the inflow of the funds from abroad in the form of aid, loans or privatisation proceeds.

Importantly, a part of the reported growth in average wages may have stemmed from privatisation and from the decline in the number of workers in public sector enterprises. Table 4.1b shows that public sector employment decreased (by around 8% per year) while the number of employed in the private sector increased over the post – 2000 period (with the highest growth of 11% in 2008).

Nevertheless, despite the decline in employment and large-scale privatisation, the public sector remains the major employer in Serbia. In 2008, the public sector employment represented around a quarter of the total labour force (24.75%) and almost a third of the total number of employed (28.79%) in Serbia (Statistical Office of the Republic of Serbia, Labour Force Survey, October, 2008).

Public pay is an important component of government spending as well as its growth rate having implications for the budget deficit and internal and external macroeconomic

[15] Approximation based on Labour Force Survey data and Statistical Yearbook, Statistical Office of the Republic of Serbia (2002). Similar confirmed by an estimation of obligatory payment of meal allowances and vacation bonuses to employees given by the 2005 amendment to the Labour Law for increase in wages (i.e. taxable base) in Quarterly Monitor of Economic Trends and Policies in Serbia (2006) No. 7.

[16] Although OECD economies often have defined remuneration in the form of pensions and various fringe benefits and share options.

balance. Personnel expenses represent the main cost to the government budget with public pay costs making up one quarter of total public expenditures in Serbia. The public wage bill share constituted 9.6% of GDP in 2007 and is planned to be 9.1% in 2010 (Bulletin of Public Finances, 2007).

The following sub-section explains public sector wage-setting arrangements during three periods: pre-transition, the transition period during the 1990s and the transition period after 2000.

4.2.2 Pre-transition: regulating public sector wages

In Yugoslavia 'self-managed' socialism replaced the Soviet economic system from 1950. Empirical research by Estrin (1981) points out that in Yugoslav 'self-managed' firms incomes were centrally determined until 1958. The firms were granted a greater role in income distribution only from 1965 until 1972. Income policies introducing guidelines for income distribution in 1972 are described by Estrin (1981) as an effective reassertion of central control over earnings. According to his estimates Yugoslav wage differentials were narrow by Western standards, but wider than in some Eastern European countries. For example, he records that the ratio of highest to lowest skill group earnings in the UK in 1960 was 3.5 whereas in the same time in Eastern Europe varied from 1.5 in East Germany to 2 in Poland (excluding bonus payments) and 2.6 in Yugoslavia. Considering the period until 1975 Estrin (1981) finds that skill differentials remained relatively narrow and stable over time.

During the period preceding the transition process in Yugoslav economy (1974-1988) wage levels were determined through a "social compact" based on bargaining among the associations of working organisations, trade unions and executive council of socio-political communities (Ognjenović, 2003). Collective bargaining agreements first appeared in 1989 but Krstić (2002) points out that in practice trade unions exerted minimal influence on wage setting outcomes. A special interest in maintaining a minimal difference in wages between skilled and unskilled workers remained as the main concern was given to employment maximisation (see earlier chapter 3).

The key pre-transition distinction in public-private sector employment was actually a division between agricultural and non-agricultural markets. Primorac and Babić (1989)

describe the private agricultural sector as having low productivity, low incomes and a considerable amount of disguised unemployment. They point out that, although this sector accounted for almost a third of total employment, it was completely ignored by official statistics and the accepted practice was to discuss problems of employment in relation to the public (i.e. so called 'social') sector only.

4.2.3 Pay setting during the economic transition in the 1990s

The introduction of a new special Collective Bargaining Agreement Law in 1990, finally allowed wage determination to have some regard to expertise, complexity of work, responsibility and working conditions (Ognjenović, 2003). In addition, for the first time, flexible types of employment were allowed.

However, the restructuring of the labour market was slowed down by the disintegration of Yugoslavia at the beginning of the 1990s. In 1992, when real GDP declined by 27.9% (EBRD, 2002), a law was passed in which it was forbidden to lay-off employees in the public sector during the period of UN sanctions (Krstić, 2002). Moreover, the difference between the highest and the lowest public sector wage during the UN sanctions was prescribed to be 3 : 1 and workers on the so-called 'paid leave of absence' received part of their wages from a special fund (Krstić, 2002). The proclaimed policy that jobs had to be preserved during the period of economic sanctions served as a new form of subsidy, similar to unemployment benefits (Jovičić, Nojković and Paranos, 2000). As a consequence the policy in the public sector resulted in a steep decline of real wages (Jovičić, Nojković and Paranos, 2000).

Despite very low earnings in the public sector, Krstić (2002) explains that most of the employees kept formal employment status to preserve social benefits in the form of pension and health insurance, transportation and food allowances, compensating low wages by second job earnings in the informal sector. Krstić (2002) estimated that 33% of employees in 1997 had a second job in the informal private sector.

The economic policy on privatisation during the 1990s was uncertain and contradictory causing diversified ownership types (Jovičić, Nojković and Paranos, 2000). In particular, the first privatisation attempt started with the reform programme in 1989 and lasted

until 1994. In this period around a third of all public sector enterprises in Serbia had begun ownership transformation (Cerović, 2002). The majority of these firms were privatised through share issues to employees at privileged terms. In this way few enterprises have been privately owned; most of them transformed their status into worker shareholdings or other types of companies typically in the so called 'mixed ownership' (i.e. partially privatised).

However, after hyperinflation[17] in 1994, the amendments to ex-post capital revaluation effectively blocked the privatisation process and led to a considerable decline of the relative share of privatised capital. At the same time the new ownership type – the 'state' sector was created. This sector was formed by transformation of around 40% socially owned enterprises into state owned companies by re-nationalisation in the early 1990s and after hyperinflation in 1994 (Uvalić, 2001). The state sector included the most important infrastructure enterprises both on the state level and on the local level (so called 'public state' and 'public local' enterprises) in such sectors as transport (railways, roads, highways and air transport), water supply, radio and television, forestry and energy. In the period from 1994 to 1997, the privatisation process of the remaining socially-owned enterprises was mainly directed towards local investors and ownership transfers by enterprises remained voluntary.

The new private sector had been emerging in a 'spontaneous' manner and was mainly present in the informal sector. The ratio of the informal economic activity to registered GDP in 1997 was 34.5% and to total GDP was 25.7% (Krstić, 2002). These figures confirm that effectively the private sector was large but not controlled.

At the end of 1998, 76% of the total number of enterprises in the economy were new emerging private firms into the market (Uvalić, 2001), mostly in the trade and service sector and processing industry. These firms were mainly very small in terms of employment i.e. usually single proprietor firms with less than 10 employees and were largely pushed into the informal sector of business activity due to restrictive regulations. Unlike in the public sector, the wages in the new emerging private sector consisting of large number of small firms were determined by free market forces.

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[17] Yugoslav hyperinflation lasted 24 months, between February 1992 and January 1994. During this period the price level rose by a factor of 3.6×10^{22}. It was the second highest recorded hyperinflation in the world history after the Hungarian hyperinflation of 1945–1946 and the second longest ever recorded after the Russian hyperinflation in the 1920s which lasted 26 months (Petrović, Bogetić and Vujošević, 1999).

4.2.4 Pay setting and privatisation during the economic transition after 2000

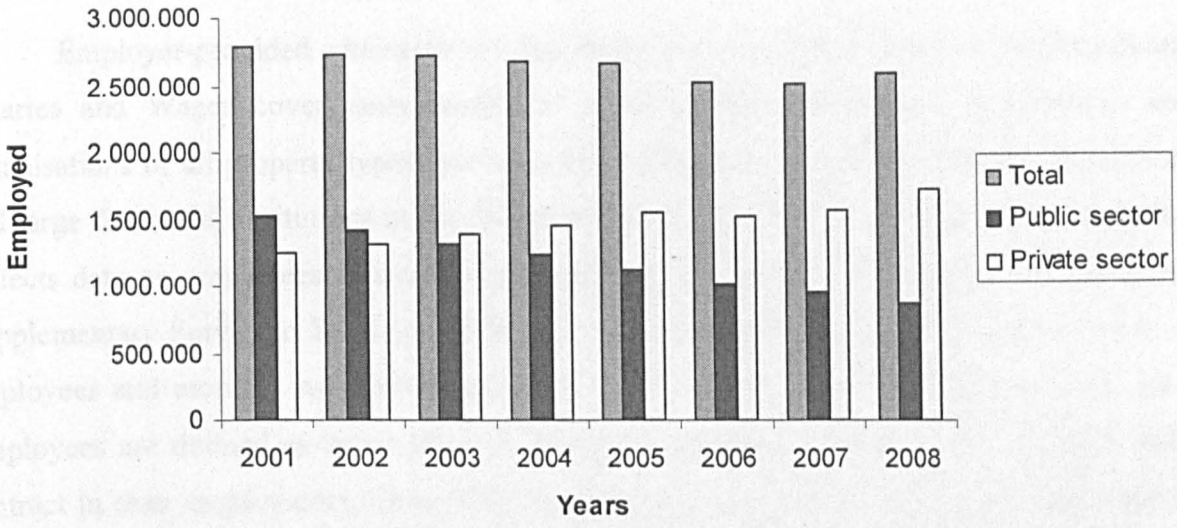
In 2000 after democratic changes, Serbia initiated structural reforms and attempted to integrate the informal private sector into the formal economy. Economic activity was channeled from the informal to the formal private sector by fiscal reforms, financial sector restructuring, low corporate tax rates (10%) and the introduction of a value added tax (18%) (EBRD, 2002).

The Serbian labour market as it is today was laid down by the new Labour Law in 2001. The Law allowed employers the possibility to encourage highly educated workers and workers who contribute to development of the company through greater discretion in the determination of individual wages of employees (Ognjenović, 2003). Moreover, from 2001 the government wage policy aimed to adjust the disparities across wages in activities that employ large portion of highly educated workers that had lagged behind the Republic's average growth for years, such as public education, public health and public services (Ognjenović, 2003).

Apart from the wage inflation pressures in the public sector arising from attempts to implement "catch-up" in some skilled professions, the influence of other labour market institutions such as unions and minimum wage was negligible. In particular, Arandarenko and Avlijaš (2009) point that the union strength and coverage of employees by collective agreements had diminished during the entire period. The minimum wage has not been excessive (40% of the average wage during the 2000s) and its enforcement is found to be weak to such an extent that the average wages in some of the low-paid sectors of the economy amounted to below the minimum wage.

A radical change in the core concept of privatisation, from the insider's model to commercial sales, was made from 2001. The privatisation process was supervised by the Agency for Privatisation and has been predominantly based on the method of sale by auctions and tenders. Most of these firms have been sold after being restructured. Complete privatisation of the socially-owned enterprises was set to be finished by the end of 2008 while the privatisation of the mixed sector (i.e. partially privatised but still with substantial capital stakes held by the state) was planned to be finalised by the end of 2010 (Ministry of Labour, Employment and Social Policy (2005).

Figure 4.1: The composition of the work force by ownership type in 2001-2008 period



Notes to Figure 4.1: Number of employed persons is a sum of: employed in enterprises, insititutions and organisations from the Semiannual Survey on Employees and Salaries and Wages (the data on employees in small size enterprises (up to 50 employees) from the Supplementary Survey to the Semiannual Survey also included), individual entrepreneurs persons solely running business and their employees from the Health Insurance Office of Serbia and agricultural producers from Labour Force Survey. Private sector includes number of employed persons in private property and public sector includes number of employed persons in all other types of property (state, social, mixed, cooperative).

Data Source: Statistical Office of the Republic of Serbia

Figure 4.1 presents sectoral shares in total number of formal employees by ownership type during the period of large-scale privatisation, from 2001 until 2008. A share of the private sector increased from 45% in 2001 to 67% in 2008 whereas the public sector declined from 55% in 2001 to 33% in 2008. The private sector surpassed the public sector share in employment from 2003.

4.3 Data

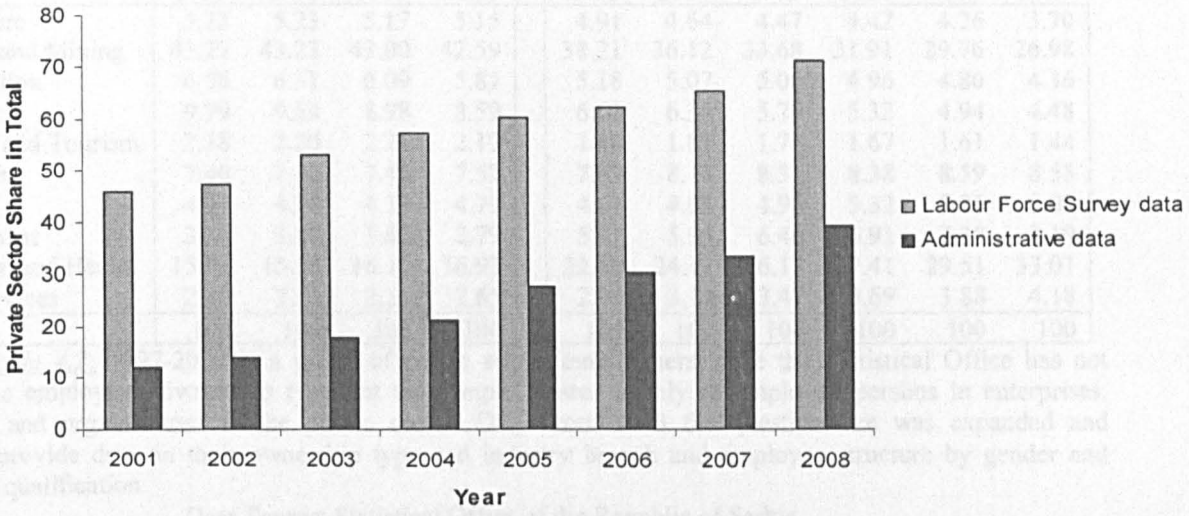
4.3.1 Administrative data

Employer-provided administrative data from bi-annual Survey data on Employees and Salaries and Wages cover those employed in enterprises, institutions, cooperatives and organisations of all property types that have been actually envisaged as censuses of medium and large firms and institutions in the formal sector. From 1997 the Serbian official statistics collects data on employees in small-size enterprises (i.e. up to 50 employees) by using the Supplementary Survey to Semi-annual Survey. Both surveys contain data on the number of employees and monthly wage bills collected on 31st March and 30th September each year. Employees are defined as those who are formally employed – persons with a formal legal contract in their employment. From 2003 the data from personnel records are disaggregated by industry branch, region, gender, educational qualification and ownership type.

Nevertheless, administrative data does not provide a representative sample of the labour market for public-private sector earnings estimation during the period of economic transition. This is because: (1) data is disproportionately collected from public sector employers and does not include individual entrepreneurs (i.e. shops, self-employed, agencies) and their employees (2) this source of data covers the formal sector only and (3) the average monthly wages before and after taxes, contributions and deductions are calculated by simply dividing wage bills by total number of workers regardless of whether workers received remuneration in the actual month or not.

The fact that the private sector is largely underestimated by this data source is best presented in the Figure 4.2. This depicts the share of the private sector in total employment recorded by administrative data and by the Labour Force Survey data during the period of large-scale privatisations. Figure 4.2 suggests that the Labour Force Survey data provides a more accurate picture of the labour market during the economic transition in Serbia.

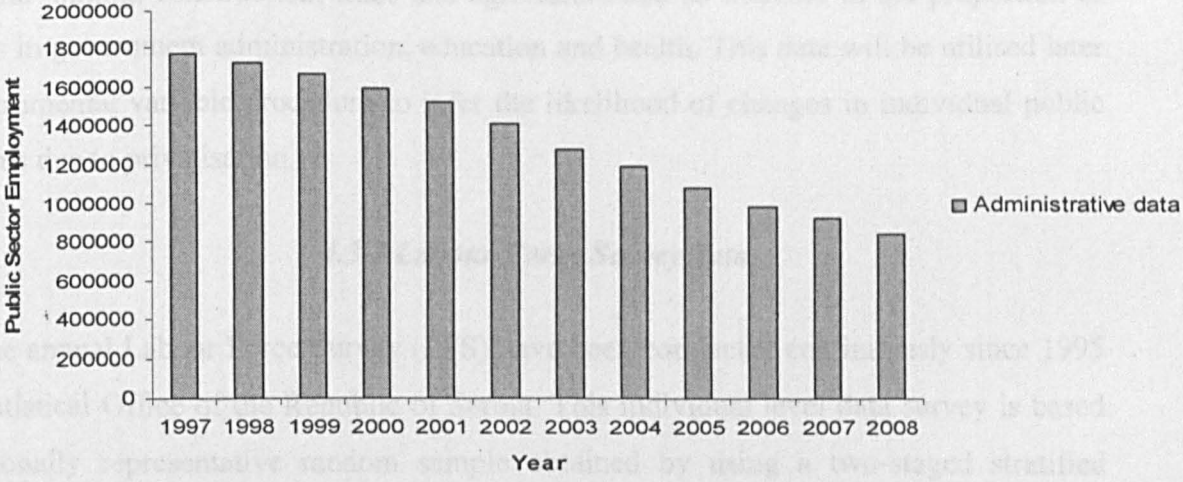
Figure 4.2: The private sector share in total employment by different sources of data



Data Source: Statistical Office of the Republic of Serbia

However, administrative data may provide an insight into changes in public sector employment during the period of economic transition as given by Figure 4.3.

Figure 4.3: Public sector employment during economic transition



Notes to Table 4.3: 1997-2000 is a proxy of public sector employment since the Statistical Office has not recorded the employer's ownership type during this period. But the sample relates mainly to employed persons in public sector enterprises, institutions and organisations. Ownership type is provided from 2001.

Data Source: Statistical Office of the Republic of Serbia

Table 4.2: Public sector employment structure by industry branch

	1997	*1998*	*1999*	*2000*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Agriculture	5.23	5.23	5.17	5.15	4.91	4.64	4.47	4.42	4.26	3.70
Industry and Mining	43.27	43.23	43.00	42.59	38.21	36.12	33.68	31.91	29.76	26.98
Construction	6.56	6.31	6.09	5.81	5.18	5.07	5.00	4.96	4.80	4.36
Trade	9.79	9.24	8.98	8.59	6.66	6.36	5.79	5.32	4.94	4.48
Catering and Tourism	2.18	2.20	2.26	2.17	1.98	1.81	1.74	1.67	1.61	1.44
Transport	7.40	7.42	7.44	7.53	7.97	8.18	8.31	8.38	8.59	8.55
Finance	4.91	4.78	4.79	4.79	4.61	4.62	4.96	5.32	5.26	5.09
Government	3.21	3.48	3.62	3.79	5.31	5.95	6.46	6.91	7.38	8.19
Education and Health	15.00	15.59	16.11	16.93	22.18	24.12	26.12	27.41	29.51	33.01
Other services	2.47	2.52	2.54	2.65	2.98	3.14	3.47	3.69	3.88	4.18
Sum	100	100	100	100	100	100	100	100	100	100

Notes to Table 4.2: 1997-2000 is a proxy of public sector employment since the Statistical Office has not recorded the employer's ownership type but the sample relates mainly to employed persons in enterprises. institutions and organisations in the public sector. Only from 2003 the questionnaire was expanded and employers provide data on their ownership type and industry branch and employee structure by gender and educational qualification.

Data Source: Statistical Office of the Republic of Serbia

In addition, Table 4.2 shows the public sector employment structure by industry branch from 1997 until 2008. Since the large-scale privatisations only started in the post-2000 period, changes in the public sector industry branch structure recorded by Table 4.2 in the 2003-2008 period are mainly due to privatisation. Public sector restructuring during the period of large-scale privatisations is best observed by the decline in the proportion of employees in industry and mining, construction, trade and agriculture and an increase in the proportion of employees in government administration, education and health. This data will be utilised later in the instrumental variable procedure to infer the likelihood of changes in individual public sector status due to privatisation.

4.3.2 Labour Force Survey data

The annual Labour Force Survey (LFS) have been conducted continuously since 1995 by the Statistical Office of the Republic of Serbia. This individual level data survey is based on a nationally representative random sample obtained by using a two-staged stratified sampling method. The primary sampling units in LFS are census districts with a minimum of 20 households. The secondary sample units are households selected with equal probabilities. Five households are randomly selected in each census district.

Box 4.1: LFS main employment definitions from LFS Methodology, the Statistical Office of the Republic of Serbia

	LFS from 1995 until 2003	LFS from 2004
Total Employed	Individuals who performed some work for remuneration (in money or in kind) at least one day in the reference week (based on formal or oral agreement) as well as each person that has job but in the week observed was absent from work due to illness or injury, holiday or vacation, strike or lockout, educational or training leave, maternity or parental leave, reduction in economic activity, temporary disorganisation or suspension of work because of bad weather, mechanical or electrical breakdown, or shortage of raw materials or fuels, or other temporary absence. As employed are defined also supporting household members that were helping in the household more than 15 hours in the reference period to whom this work is the only way of providing subsistence and those who stated that they had not worked for pay in response to the standard question but performed some temporary short-term work during the reference week.	Individuals who performed some work for remuneration (in money or in kind) at least hour in the reference week (based on formal or oral agreement).
Paid Employed	Employees with formal or oral agreement (regardless of whether or not receive social benefits), Self employed, Owners and Co-owners.	
Employees	Employees with formal or oral agreement (regardless of whether or not receive social benefits).	Employees with formal or oral agreement, members of the household that help in household business (in the field or in firm) and are paid for the work, pupils and students on the paid practice and all those performing any other paid temporary activity.
Self-employed	Individuals that earn for living from individual profession (scientist, artists, lawyers etc.).	An individual that earns for living from individual profession (scientist, artists, lawyers etc.) or perform any other work without employees, farmers that work individually and do not provide paid help to family members or persons that independently find and organize jobs for themselves (usually unregistered jobs such as child keeping, private lessons, selling goods on the flea market etc.).
Owners	Owners and Co-owners of private or mixed ownership firm regardless of whether the firm is in the country or abroad.	An individual that is self-employed but employs at least one person, owners and co-owners of enterprises, entrepreneurs (private shops, agencies etc.) and farmers that use paid help of family members or others.
Helpers	An individual that has performed unpaid work more than 15 hours in the last (reference) week in the family firm, farm, shop if that job is the only way of providing subsistence.	An individual that helps family members in family business and is not paid for that job. Students who only temporarily help in family business that can be done without their help are not included.
Farmers	An individual that earns for living only from agriculture regardless whether works on its own land (farm) or not	
Temporarily Active	An individual who, during the reference period, performed some work for money, but which was not a permenent and regular source of income. Thus, here are included all individuals who stated that they had not worked for pay in response to the standard question i.e. they neither had any job nor they actively looked for one but still performed some temporary short-term work during the reference week.	
Other Active	An individual that earns for living by finding and organizing jobs independently (usually unregistered jobs such as child keeping, house cleaning, goods selling on a flea markets)	

Stratification is performed across settlement type (i.e., urban and rural) and across the Serbian territory (Vojvodina, Belgrade, Central Serbia).

The survey is conducted in October each year with the exception of the 1995 survey which was undertaken in March and September and that of 1996 which was conducted in May. From 2008 data is collected twice per year in April and in October. Each of the LFS data sets represents a cross-sectional view of the labour market.[18]

The long term trend in employee wages from 1995 to 2008 is hard to measure because there was a break in LFS methodology in 2004 when the employee definition was completely revisited and fully adjusted to the International Labour Organisation and Eurostat definition. Box 4.1 explains the main classificatory differences between two LFS data sets according to LFS Methodology in 1996 and 2004. The LFS 1995-2003 employment categories such as paid employed (employees, self-employed, owners and co-owners), helpers, farmers, temporarily active and other active do not match the new ones in LFS 2004-2008: employers, self-employed, employees and helpers.

In addition, the LFS sampling frame was changed in 2004. The LFS sampling frame between 1995 and 2003 was based on the 1991 Census of Population in the Republic of Serbia. The total number of selected households within 880 census districts was 4,400 and around 12,000 individuals were interviewed in each survey. The latter dataset, from 2004 to 2008, is based on the 2002 Census of Population in the Republic of Serbia. The number of census districts increased to 1,300; the total number of households increased to 6,500 (7,000 in 2008) and the number of individuals that were interviewed in each survey increased to around 20,000.

[18] rotating panel element is introduced only from 2008.

4.3.3 Living Standard Measurement Survey data

The Living Standard Measurement Survey (LSMS) is another source of individual level data. It is carried out by The Ministry of Labour, Employment and Social Affairs[19] in June 2002 and repeated in 2003.

The LSMS is a study of household living standards and contains a rich set of personal and household welfare characteristics as well as information on labour market status. The LSMS is nationally representative and designed as two-stage sampling survey based on 2002 Census of Population in the Republic of Serbia. In the first stage, Serbia is stratified by six main regions and within each region by urban and rural areas. Once the enumeration districts are selected in each unit a constant number of households are chosen and all the persons in the selected households are interviewed. The 2002 sample size included 6,386 households in 621 census rounds with 19,725 individuals interviewed. In repeated survey in 2003, the first stage units were selected from the basic sample (obtained in 2002) by including only even numbered census block units. This means that 2003 survey was conducted using a sample of 2,548 households with 8,027 individuals.

A labour market module of LSMS questionnaire is consistent with the 2004-2008 LFS. Both LFS from 2004 and LSMS determine the labour market activity in the same way and use the standard International Labour Organisation methodology for definition on employment.

[19] LSMS were implemented as the Governments' own studies supported by the World Bank advisory teams. The primary data collection for 2002 and 2003 was conducted by the Strategic Marketing and Media Research Institute (SMMRI) (see Bjeloglav, David, Krstić and Matković, 2007).

4.4 Public-private sector pay differentials

4.4.1 Changes in employment composition during the economic transition

In this sub-section, changes in employment composition between public and private sectors are examined from 1995 until 2008 by using LFS annual samples for employees aged from 15 to 64 who reported non zero main job wages and hours of work.

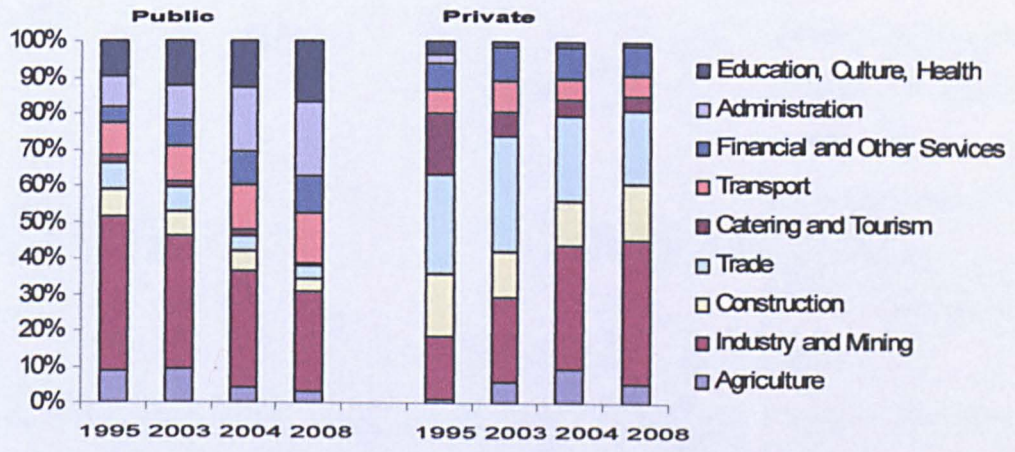
In LFS 1995-2003 the public sector is set to include all ownership types other than private (state, social, cooperative and mixed). The public sector in LFS 2004-2008 includes state and social ownership types whereas other properties are excluded because they are recorded from 2008 jointly as category 'other' which also includes unknown ownership types.

The main sample changes indicate: (1) the growth of private sector employment and (2) public sector restructuring towards a larger number of highly qualified workers (professionals) in education, government and health.

The proportion of employees in the private sector in LFS data sample has been increasing considerably since 1995. In the 1995 sample, 5.5% of men and 10.3% of women are working in the private sector and in the 2003 sample, this proportion had increased to 25% for men and 30% for women. Krstić (2002) highlights that women appear more likely to work in the private sector than men, but that this would be different if the focus of the analysis were not only on employees but also other employment categories such as self-employed and employers where males tend to be in the majority. In the 2004 data sample, 39% of men and 40% of women have a private sector job and in 2008 this proportion had increased to 60% of men and 53.5% of women.

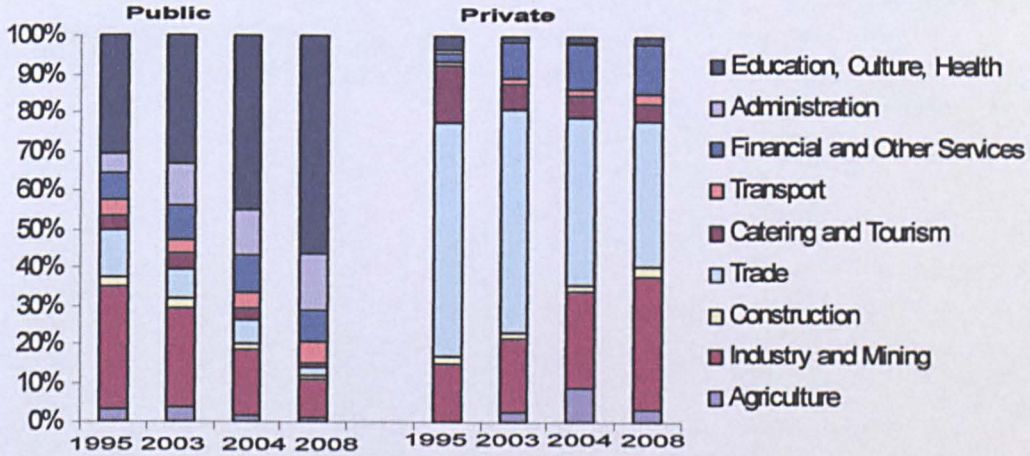
Changes in employment composition by industry branch across the public and private sectors are illustrated on Figures 4.4 and 4.5 for men and women separately. The effects of privatisation are clearly presented through a decline of the fraction of public sector men and women employed in industry branches such as industry and mining, construction, trade and agriculture and through increase of the share of these branches in the private sector. Public sector restructuring led to increases in a share of men and women working in government administration, education, culture and health.

Figure 4.4: Changes in employment composition by industry branch and sector for men



Data Source: Calculated by author from Labour Force Surveys for 1995, 2003, 2004 and 2008

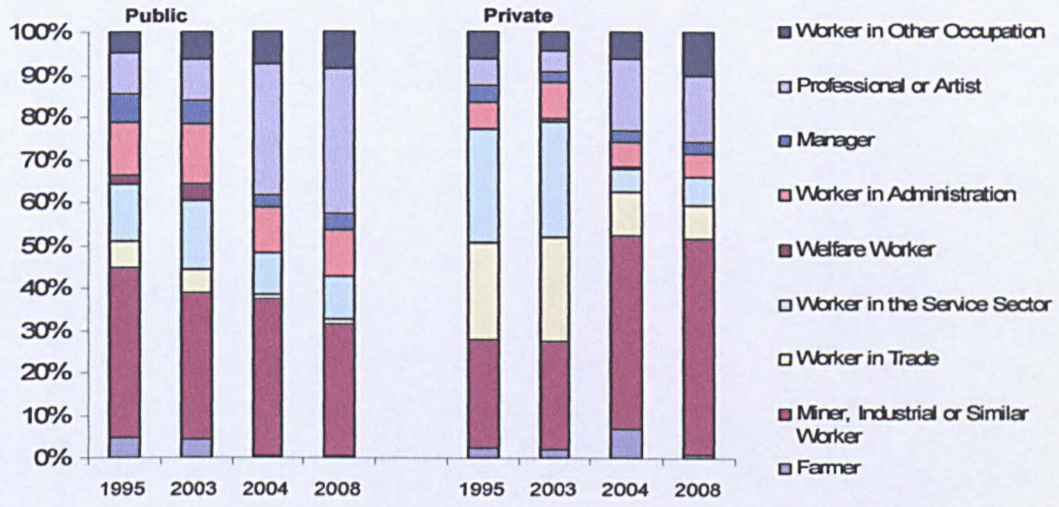
Figure 4.5: Changes in employment composition by industry branch and sector for women



Data Source: Calculated by author from Labour Force Surveys for 1995, 2003, 2004 and 2008

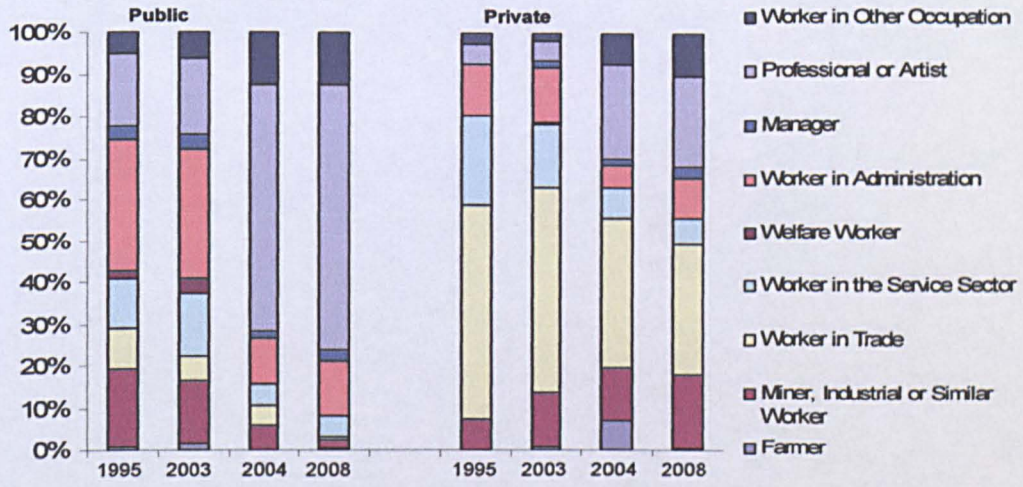
Noteworthy changes were also found in the occupational composition between 1995-2003 and 2004-2008 samples. Figures 4.6 and 4.7 show that the public sector has been restructured towards high skilled professions in education, health and administration.

Figure 4.6: Changes in employment composition by occupation and sector for men



Data Source: Calculated by author from Labour Force Surveys for 1995, 2003, 2004 and 2008

Figure 4.7: Changes in sector employment composition by occupation and sector for women



Data Source: Calculated by author from Labour Force Surveys for 1995, 2003, 2004 and 2008

These changes are more pronounced for women than for men. For example, in the 1995 sample women make up 40% of the public sector work force out of which around 35% works in education, health and administration. In the 2008 sample, the share of the female workforce in the public sector is 46% out of which around 70% works in education, health and

administration. In addition, whereas the share of blue collar occupations such as miners and industrials has declined in the public sector it has increased in the private sector.

Apart from the differences in occupational and industry branch structure public and private sector samples differ in other workers' characteristics. Public and private sector LFS sample proportions and means of the job and workers' characteristics are reported for men and women in Tables A4.2 and A4.3 in the Appendix. The following conclusions from these Tables can be pinned down. In general, public sector workers are on average older with more labour force experience than private sector workers. Moreover, public sector workers are better educated with roughly 5-9% more men and 9-14% more women with university degrees than private sector workers. Workers with secondary school degree are more likely to work in the private than in the public sector. Private sector workers are more likely to work longer hours per month and be single. From 2004 in particular, public sector workers are more likely to live in the cities and private sector workers in the rural areas.

4.4.2 Trends in pay levels and pay inequality in the public and private sectors during economic transition

This sub-section illustrates trends in unconditional real hourly earnings by gender and ownership type at different points of the pay distribution and summarises the magnitude of pay inequality in each sector. Three different measures of pay variability or dispersion are used: the standard deviation of the log of hourly earnings, the decile ratios and the Gini coefficients. The LFS provides earnings data net of taxes, pension and welfare payments. The earnings measure relates to total remuneration which includes regular wage and all non-wage benefits from the main job (such as meal and transportation allowances). The earnings are denoted in Serbian currency (dinar) and converted to October 2005 prices.

Trends in the real hourly earnings by ownership type at different points of the log pay distribution are presented for male and female workers on Figures 4.8 and 4.9. The Figures disclose variability in pay level during 1995-2003 and upward trend during 2004-2008 in both public and private sectors at all percentiles.

Figure 4.8: Real hourly earnings percentiles for male employees in public and private sectors in Serbia, 1995-2008

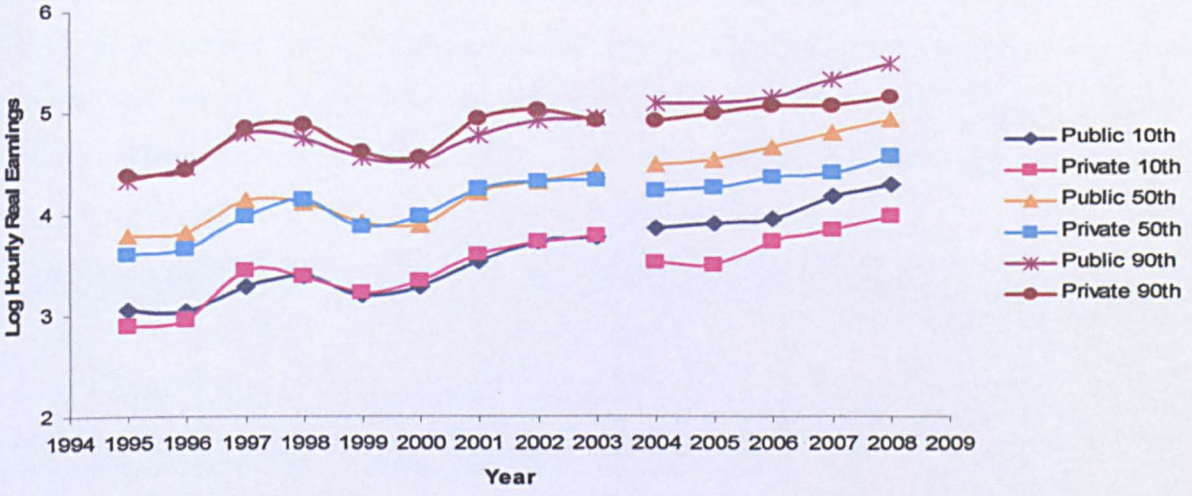
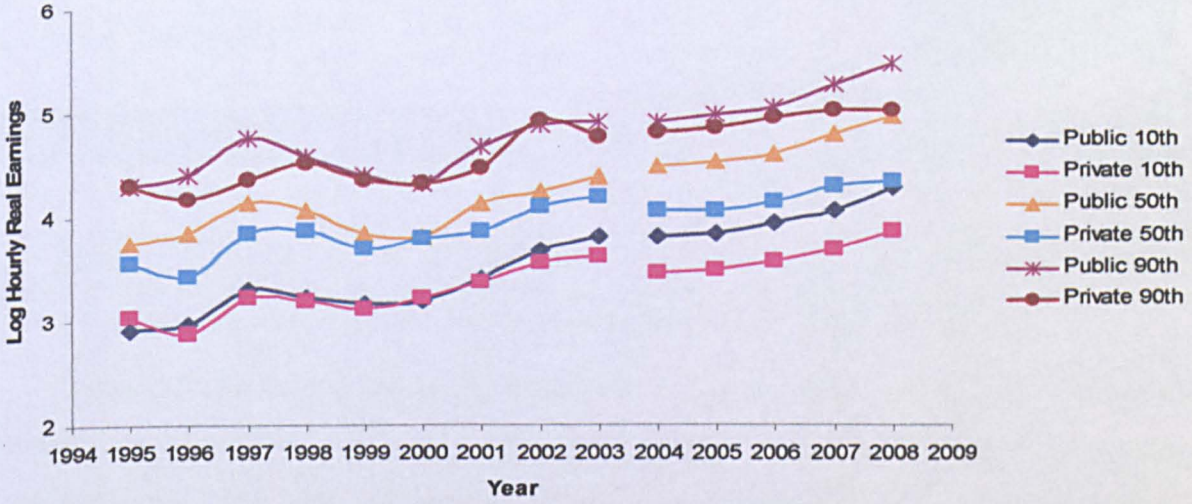


Figure 4.9: Real hourly earnings percentiles for female employees in public and private sectors in Serbia, 1995-2008



Notes to Figures 4.8 and 4.9: Hourly earnings percentiles are given in natural logarithm values. Earnings relate to total main job pay compensation (regular wage plus non-wage benefits) net of taxes, pensions and welfare benefits and expressed in October 2005 prices.

Data Source: Labour Force Survey of the Republic of Serbia (LFS), 1995-2008

In particular, Figure 4.8 shows that in most of the years, during 1995-2003 period, public and private sector male workers at and below the median of unconditional hourly earnings distribution fared similarly in terms of pay. But those above the median fared better in the private sector. Figure 4.9 shows that only female workers at the 10th percentile of the

unconditional hourly earnings distribution fared similarly across sectors whereas public sector provided pay advantage for all other percentiles during 1995-2003. During 2004-2008 period both male and female workers at all the percentiles of unconditional hourly earnings distribution fared better in the public than in the private sector. The advantage of holding a public sector job was the greatest for workers at and below the median.

Table 4.3: Earnings inequality by gender and ownership type in Serbia, 1995-2008

Year	90/10th Decile Ratio				Standard Deviation				Gini Coefficient			
	Men		Women		Men		Women		Men		Women	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
1995	1.30	1.48	1.39	1.27	0.54	0.57	0.59	0.50	0.28	0.31	0.29	0.29
1996	1.43	1.48	1.45	1.31	0.59	0.68	0.58	0.52	0.30	0.42	0.28	0.30
1997	1.51	1.39	1.46	1.14	0.61	0.55	0.58	0.54	0.31	0.31	0.29	0.28
1998	1.36	1.50	1.36	1.34	0.57	0.58	0.56	0.52	0.29	0.32	0.30	0.28
1999	1.36	1.40	1.24	1.24	0.54	0.62	0.52	0.54	0.28	0.34	0.26	0.30
2000	1.25	1.20	1.12	1.10	0.52	0.58	0.46	0.46	0.28	0.31	0.24	0.25
2001	1.25	1.34	1.27	1.10	0.51	0.54	0.52	0.44	0.26	0.30	0.26	0.24
2002	1.19	1.28	1.19	1.35	0.50	0.52	0.50	0.50	0.27	0.30	0.27	0.29
2003	1.17	1.13	1.10	1.13	0.50	0.48	0.46	0.49	0.26	0.27	0.24	0.28
2004	1.23	1.39	1.10	1.35	0.55	0.59	0.48	0.59	0.26	0.31	0.24	0.32
2005	1.20	1.48	1.14	1.35	0.50	0.60	0.49	0.56	0.26	0.31	0.25	0.32
2006	1.19	1.32	1.10	1.37	0.48	0.53	0.45	0.55	0.26	0.29	0.23	0.32
2007	1.15	1.20	1.20	1.31	0.49	0.56	0.48	0.52	0.25	0.30	0.25	0.30
2008	1.20	1.16	1.20	1.16	0.47	0.49	0.48	0.50	0.26	0.28	0.25	0.28

Notes to Table 4.3: Decile ratio 90/10th is calculated as the difference between the log earnings at the 90th percentile and at the 10th percentile. The Gini coefficient estimates use earnings in the unlogged form.

Data Source: Labour Force Survey of the Republic of Serbia (LFS) from 1995 until 2008

The magnitude of pay inequality measured by the standard deviation of the log of hourly earnings, the 90/10th decile ratio of the log of hourly earnings and the Gini coefficient of hourly earnings by gender and ownership type is summarised in Table 4.3. The standard deviation or square root of variance is the average difference of the scores from the mean of the log pay distribution. The 90/10th ratio presents the difference between estimated log pay on the 90th and on the 10th percentile of the pay distribution. Unlike the decile ratios that relate the pay at the different percentiles of the distribution, the Gini coefficient is a measure of inequality across the whole distribution, as it is influenced by the shape of the distribution at all percentiles.[20]

[20] If one randomly draws two people from the population then the expected wage difference between those two people as a proportion of the average wage is twice the Gini coefficient, so that Gini of 0.238 says that the expected wage gap between two men chosen at random is 47.6% of the average pay (Puhani, 1997).

According to all measures of pay inequality presented in Table 4.3 the private sector earnings distribution is wider than the public sector earnings distribution for both men and women over the most of the years observed. The public sector pay inequality during 1995-2003 period has rather an inverted U shape i.e. increasing in the first three years and declining afterwards. During the 2004-2008 period the public sector pay inequality declines until 2006 and increases in the last two years. On the other hand, there was a private sector pay compression in the last two years. This period coincides with tax reform that allowed tax exemption for the first 5,000 Serbian dinars of every wage from January 1, 2007[21] which is likely to have affected more private than public sector earnings given that minimum wage recipients or those receiving only slightly higher earnings are more concentrated in the private sector.

4.4.3 Empirical studies on public-private sector pay differentials

Public-private sector pay differentials have been estimated by studies that used Yugoslav Labour Force Survey data (YLFS) for either Serbia or the Federal Republic of Yugoslavia.[22] The reviewed studies in this sub-section differ in years covered by the analysis as well as in econometric methods used. The studies also differ in earnings definitions and workers' samples used. Nevertheless, they make the same distinction between the public and private sector. In particular the public sector is set to include all ownership types other than private.

A first study that estimated public-private pay differentials in the Federal Republic of Yugoslavia was by Jovičić, Nojković and Paranos (2000). The OLS method is used to estimate the sectoral gap in 1998. Apart from wage earners, owners and co-owners of private enterprises and the self-employed are also included in the working sample. Hence, the proportions of persons employed were roughly: 1/6 in the private sector and 5/6 in the public sector. The authors write that: "... differences in averages for some of the allowances (other than wages) are significantly in favour of the social (i.e. public) sector for lunch allowance,

[21] as well as reductions in the personal income tax burden from 14 to 12 percent of the gross wage, Quarterly Monitor of Economic trends and Policies in Serbia (2007) No. 8.

[22] Confederation of two Republics: Serbia and Montenegro. Montenegro became an independent state in 2006.

union help, and 'other earnings'. However, in total, wages make up as much as 85.3% of total earnings (83.3% in the social sector and 95.4% in the private sector) and we take monthly wage as a dependent variable", (Jovičić, Nojković and Paranos, 2000, p. 6). Therefore, although realising the difference in the total pay remuneration across sectors the analysis in this study is based not on the total monthly pay remuneration but rather on a regular monthly wage. Jovičić, Nojković and Paranos (2000) found that the private sector seems mostly to reward men between 35 and 40 years old (and proportionately to their education) who work long hours and preferably run their own businesses.

Considering the first years of economic transition from 1995 until 2000, Reilly (2003) provided evidence for a private sector premium in Serbia for male employees aged between 18 and 64. The results of this study are rather inconclusive. Indeed, Reilly (2003) pointed that the estimated gap behaved erratically during the 1990s. In particular, applying quantile regression analysis of hourly wages and controlling for a large set of workers' characteristics (education, labour force experience, nationality, industry, occupation, settlement type, region and marital status), Reilly (2003) reported zero private sector premium at the 10th percentile and 65% at the 90th percentile of the wage distribution in 1995, but no significant premia across the distribution in 1996. In 1997, a 20% private sector premium was estimated for the 10th percentile but no significant pay gap was found at the 90th percentile. In 1998, around a 20% premium was found across the wage distribution. In 1999 premium was significant at both ends of the distribution whereas in 2000 workers in the middle of the distribution were estimated to obtain the greatest premia. Hence, Reilly (2003) commented that the movements displayed by private sector premium do not appear to have developed a settled pattern over the years considered.

In addition, Reilly (2003) estimated the average private sector premium to be 32.7% by pooling 1995-2000 data. The quantile regression estimates obtained in this study suggested a 17% premium for workers at the 25th percentile and almost a 70% premium for workers at 90th percentile while workers at other percentiles of the wage distribution obtained no significant 'premiums' compared to their private sector counterparts.

From reading the Reilly (2003)'s paper it is not clear whether the earnings definition relates to regular wage only or expands the definition of the wage with some or all non-wage

benefits recorded by the survey (such as meal and travel allowances, union help, vacation bonuses and other supplements) which remember, are disproportionately prevalent in the public sector. Reilly (2003) writes: "The earnings measure available within the YLFS is based on the main job only" (p.7.), and gives no other detail how earnings were actually created.

Finally, Jovanović and Lokshin (2003) employed YLFS data for both male and female employees from 15 to 64 years old but only examined the year 2000. In addition, this study used the sample for the Federal Republic of Yugoslavia (i.e. Serbia and Montenegro) rather than only for Serbia (as used by Reilly (2003)).

Jovanović and Lokshin (2003) acknowledged the importance of non-wage benefits in comparisons of earnings between public and private sectors. The authors write: " Our wage definition is based on main job earnings only, which includes the regular wage and all additional wage payments (transportation subsidies, payments in kind, and such)", (Jovanović and Lokshin, 2003, p. 8).

Furthermore, this study attempted to correct for sector selection by using marital status and number of job holders in a household to obtain selectivity corrected wage estimates. Jovanović and Lokshin (2003) found that the private sector premium after controlling for squared labour force experience, education, industry and region was on average 9.4% for men and 4% for women in 2000, using an endogenous switching regression model.

Relative to the average estimate reported for male employees by Reilly (2003) the self-selection corrected private sector pay premia estimated by Jovanović and Lokshin (2003) is lower by 22 percentage points. A difference in estimates obtained by these two studies is quite substantial and may indicate: (1) differences in the samples for the Federal Republic of Yugoslavia and Serbia (2) differences due to earnings definitions used and/or (3) the importance of the self-selection bias in the cross-sectional estimates.

Nevertheless, the effect of the instruments used for self-selection by Jovanović and Lokshin (2003) is rather dubious for two reasons. First, a positive relationship between marital status and wages is a common finding in the literature (e.g. Dustmann and Van Soest, 1998). Second, the number of job holders in a household arguably picks up a tendency towards job security. Moreover, it is found to have a significant effect on the sector choice of females but not of males.

In order to test the findings of some of the previous studies and extend the estimation period over the major phase of economic transition in Serbia which started after 2000 the chapter proceeds with econometric analysis of public-private sector earnings differentials from 1995 until 2008.

4.5 Econometric analysis

4.5.1 Data definitions

The empirical analysis is based on LFS and LSMS data sources for Serbia[23]. The working samples are restricted to male and female employees between 15 and 64 years old who reported non-zero monthly wages and non-zero hours of work for their main job only.

We make a distinction between two main sectors: public and private. In LFS 1995-2003 the public sector is set to include all ownership types other than private. The same distinction between sectors is used in other studies that measured public-private sector pay differentials in Serbia (e.g. Jovanović and Lokshin (2003) and Reilly (2003)). In particular, LFS 1995-2000 records four ownership types: social, private, cooperative and mixed. From 2001 the state and unknown property categories are also distinguished. From 2008 the registered and unregistered employers are distinguished within the private sector and apart from social and state ownership there is a category 'other' ownership types (cooperative, mixed and unknown). The LSMS 2002-2003 distinguishes among private (registered and unregistered), state/social, mixed and cooperative ownership types. To make samples compatible the public sector in LSMS 2002-2003 and LFS 2004-2008 includes only state and social ownership types whereas other properties (cooperative, mixed and unknown) are excluded. In addition, the private sector in LFS 2008 and LSMS 2002-2003 includes private registered and non-registered firms because this distinction is made only in these surveys.

Table 4.4 provides information on the timing of the surveys and of working sample sizes, by gender and ownership type. In contrast to the 1995-2003 period, the sizes of the

[23] Respondents from Kosovo and Montenegro are excluded due to the lack of consistent responses over the full period considered.

private and public sector samples became similar during 2004-2008 and we restrict our analysis in LSMS 2002-2003 and LFS 2004-2008 to full-time employees only.

Table 4.4: Timing of surveys and number of observations used in analysis

Data	Reference Year and a Month	Number of Males		Number of Females		Total
		Public	Private	Public	Private	
LFS	March-95	1,399	80	930	107	2,516
	May-96	1,375	93	925	96	2,489
	Oct-97	1,372	116	954	117	2,559
	Oct-98	1,327	159	956	159	2,601
	Oct-99	1,290	173	919	178	2,560
	Oct-00	1,421	213	1,008	225	2,867
	Oct-01	1,329	273	947	233	2,782
	Oct-02	1,272	284	910	251	2,717
	Oct-03	1,164	381	792	332	2,669
LSMS	June-02	1,605	518	1,162	462	3,747
	June-03	530	260	392	199	1,381
LFS	Oct-04	1,472	935	1,091	721	4,219
	Oct-05	1,314	1,123	1,002	729	4,168
	Oct-06	1,186	1,186	966	797	4,135
	Oct-07	1,059	1,261	881	894	4,095
	Oct-08	959	1,423	832	958	4,172

Data Source: LFS successive years from 1995 to 2008 and LSMS in 2002 and 2003

The earnings measure relates to pay received for the reference month and any arrears owed to the worker may be reflected in the monthly pay measure. It is not possible to distinguish between employees who failed to report their earnings and those who did not received earnings in the reference month. Furthermore, all data sets collect information on earnings excluding taxes, pensions and any payments by the worker into welfare plans. In contrast to the LSMS, in LFS (except in year 2008), there is no information as to whether the employee has paid insurance for pension and health or not. The share of workers without paid insurance is 4% in LSMS 2002-2003 sample while in the LFS 2008 sample about 6.5% of individuals are not entitled to pension or health insurance (6.3% in the private sector and 0.2% in the public sector).

The greater share of workers not entitled to pension or health insurance in the private rather than in the public sector will tend to overestimate the public sector penalty and, conversely, underestimate the public sector premium. Although we acknowledge this problem

there is no reasonable way to resolve it due to data limitations. Another common problem for researchers using self-reported data is the possibility that individuals under-report their earnings. If this is more likely for private sector workers then this will affect the public sector pay gap in the opposite direction of the effect of social insurance entitlements.

An advantage of the LFS 1995-2003 and LSMS 2002-2003 datasets is that they provide detailed information on the wage and non-wage benefits from the main job. In particular, the LFS 1995-2003 records separately six categories of monthly earnings from the main job: (1) the regular wage (2) meal and transportation allowances (3) union assistance (4) in-kind benefits (5) credits from the firm (not from the bank) and (6) all other benefits from the main job. Hence, the hourly earnings from the main job are defined to include regular wage and all non-wage benefits. Our earnings definition is consistent with Jovanović and Lokshin (2003). As mentioned earlier, the importance of these various components of total remuneration changed radically over the period.

Table 4.5: Average Annual Share of Wages and Hot Meal and Transport Allowances in Earnings by Ownership Type and Gender in Serbia, 1995-2003

	Male				Female			
	Public		Private		Public		Private	
Year	Wage	Hot Meal and Transport Allowances	Wage	Hot Meal and Transport Allowances	Wage	Hot Meal and Transport Allowances	Wage	Hot Meal and Transport Allowances
1995	85%	14%	94%	6%	82%	16%	92%	7%
1996	84%	15%	92%	8%	81%	17%	92%	8%
1997	84%	15%	93%	7%	83%	15%	91%	6%
1998	85%	13%	95%	5%	82%	16%	94%	6%
1999	85%	15%	94%	6%	82%	17%	94%	6%
2000	84%	16%	95%	4%	81%	19%	94%	6%
2001	96%	3%	99%	1%	96%	4%	98%	1%
2002	97%	2%	99%	0%	98%	2%	99%	0%
2003	98%	2%	99%	0%	98%	1%	99%	0%

Data Source: Authors calculations from LFS successive years from 1995 to 2003

Table 4.5 shows the different components of total remuneration for both public and private sector employees during the 1995-2003 period. Before the fiscal reform in 2001, about 85% of the total earnings received by public sector workers were regular payments (i.e. wage), and approximately 15% were subsidies on transportation and meals (i.e. non-wage payments). In the private sector, only about 4% of the total earnings came from such subsidies, and 96%

came from regular wages. Payments in kind, credits from employers, and other kinds of non-wage payments constituted less than 1% of total earnings in the private sector.

The motive for different components of total remuneration across sectors was that additional (non-wage) payments to earnings, such as meal and transportation allowances etc., were non-taxable before the fiscal reform in June 2001. Consequently, for the employees in the formal sector, dominated by the public sector work-force, non-wage payments comprised an important part of income during the 1990s. After the fiscal reform in June 2001 these additional benefits became a part of a regular wage and thereby, differentially affected the trajectory of public and private sector wages.

For this reason, in the LFS 1995-2003 and LSMS 2002-2003 samples, all non-wage components are added to the regular wage of the individual. This total remuneration from the main job is denoted as 'earnings' in our study. As explained, the difference between total remuneration and the regular wage diminished after 2001. LFS 2004-2008 does not record non-wage benefits as separate categories.

Finally, the earnings definition used in our analysis is based on the hourly earnings of the main job. In LFS 1995-2003 the hourly pay is computed from monthly pay divided by actual number of hours worked in the previous month. Since the survey reference period for actual hours worked was a week prior to the interview, we multiply the reported total hours worked in the previous week by the average number of weeks in a month (i.e. 4.25) and assume that the number of hours worked was uniform in the month prior to the interview. In addition to the actual number of hours worked in the last week, the LFS 2004-2008 provides information on the usual numbers of hours worked per week. The latter is found to have lower standard deviation and is used for hourly pay calculation in this data set. In LSMS 2002-2003 the information on working hours in the last month is available and hence the last month's pay is divided by last month's working hours to calculate the hourly pay. The hourly pay in all data sets is deflated by using the consumer price index (CPI) that relates to the month in which the various surveys were conducted. The CPI is recalculated using October 2005 as the base.

4.5.2 Variables used in empirical analysis

The variables used in the empirical analysis are described in Table A4.1 in the Appendix. The dependent variable is an individual worker's log hourly real after tax earnings. The explanatory variables include: labour force experience, educational qualification, nationality, marital status, occupation, geographical location by region and settlement type, industry branch and employers' ownership type.

All explanatory variables are categorical variables. Specifically, the binary regressor takes the value one if a certain variable can be attached to the employee based on the answer provided in the survey questionnaire and zero otherwise.

The wage earners are grouped into five categories according to the labour force experience: less than 5 years, between 5 and 10 years, between 10 and 20 years, between 20 and 30 years and more than 30 years of experience. Three marital status (single, married and other (divorced or widow)) and nationality types (Serbian, Montenegrin and other nationalities) are formed. The educational information in the datasets allows for the differentiation of five education groups: less than primary school, primary school, secondary school, college and university degree and above.

Although the industry branch code system changed from 2001 and the occupational code system changed from 2004, we are able to form consistent industry branches and occupations categorical (dummy) variables for the whole observed period. Each of the nine regressors are created based on detailed classifications of industries and occupations provided by the Statistical Office of the Republic of Serbia. The industry branch variable consists of the following categorical (dummy) variables: agriculture; industry and mining; construction; transport; trade; catering and tourism; financial and other services; government administration and social security; education, culture and health. The occupation variable consists of the following categorical (dummy) variables: farmer; miner or worker in industry or similar; worker in trade; worker in services; welfare worker; worker in administration (clerk); manager; professional or artist and other. Three regional dummies are created according to individual geographical location: Belgrade (Serbian capital and suburbs) and Central Serbia and Vojvodina (the provinces). In addition we distinguish across two settlement types: urban and rural.

4.5.3 Econometric methods and methodological issues

In general, the public and private sector earnings equations can be estimated conditional on the set of worker and job characteristics in the following 'double equation' model:

Private sector: $$\ln w_i^{NP} = \alpha^{NP} + \beta'^{NP} x_i + \varepsilon_i^{NP} \quad (4.1)$$

Public sector: $$\ln w^P{}_i = \alpha^P + \beta'^{P} x_i + \varepsilon_i^P \quad (4.2)$$

where NP and P denote non-public (i.e. private) and public sectors respectively. Therefore, $\ln w_i^j$ is the log of real hourly earnings for the ith individual if he/she works in the j sector which is explained by x_i set of observed worker and job characteristics such as labour force experience, educational qualification, marital status, nationality, settlement type, region, industry branch and occupational affiliation with the sector-specific parameter vector β^j and ε s are error terms constructed to be uncorrelated with x.

Cross sectional differences (i.e. those estimated by ordinary least squares (OLS)) in earnings between public and private sector employees with similar characteristics can be obtained by pooling both sectors' data together in an earnings regression with a dummy variable P_i taking the value one if ith employee works in the public sector and zero otherwise. This 'dummy variable' model is given by:

$$\ln w_i = \alpha + \beta' x_i + \gamma P_i + \varepsilon_i \quad (4.3)$$

where $\hat{\gamma}$ is the 'average' estimate of the public sector pay gap equivalent to an intercept shift. The 'dummy variable' approach given by (4.3) does not allow for inter-sectoral differences in the returns to skill or any other worker and job characteristic since it assumes that $\hat{\beta} = \hat{\beta}^P = \hat{\beta}^{NP}$ which may or may not be true.

In order to test whether the 'returns' to any characteristics x differ statistically significantly between sectors the xs can be interacted with the public sector dummy variable, P. In this case a public sector pay gap as such is not estimated but only the inter-sectoral differences for any characteristics. The fully interacted model takes the following form:

$$\ln w_i = \alpha + \beta' x_i + \gamma' x_i P_i + \varepsilon_i \qquad (4.4)$$

where $\hat{\beta}$ is the private sector effect of any variable in x (i.e. $\hat{\beta}^{NP}$) and $\hat{\beta} + \hat{\gamma}$ is the public sector effect of any variable in x (i.e. $= \hat{\beta}^{P}$) whereas $\hat{\gamma}$ is the inter-sectoral difference for any variable in x.

Furthermore, a decomposition method is a way of using the split sample model to estimate the returns to characteristics and the returns to coefficients separately. This method decomposes the pay differential into a component that is due to difference in the mean values of characteristics and a componenent that is due to difference in the returns to characteristics (i.e. coefficients). Following Oaxaca (1973) a decomposition model can be written as:

$$\ln \overline{w}^{P} - \ln \overline{w}^{NP} = (\overline{x}^{P} - \overline{x}^{NP})\hat{\beta}^{NP} + [\ (\alpha^{P} - \alpha^{NP}) + \overline{x}^{P}(\hat{\beta}^{P} - \hat{\beta}^{NP})\ ] \qquad (4.5)$$

where the first bracket represents the effect of differences in characteristics and the second bracket represents the effect of differences in coefficients (could be interpreted as public sector earnings premium or penalty).

Away from the conditional means all these models ('double equation', 'dummy variable' and decomposition models) can be estimated for the conditional quantiles of the earnings distribution. While the conditional mean is estimated by ordinary least squares (OLS) regression which predicts the average (mean) earnings by minimising the sum of squared errors, the quantile regressions predict the quantiles of the earnings distribution by minimising the absolute sums of the errors (i.e. the estimator is known as Least Absolute Deviations (LAD)).

Formally, this means that OLS (i.e. the conditional mean $E(\ln w_i \mid x_i)$) solves:

$$\min \sum_{i=1}^{n} (\ln w_i - \beta' x_i - \gamma P_i)^2 \qquad (4.6)$$

and LAD (i.e. the conditional median $Med(\ln w_i \mid x_i)$) solves:

$$\min \sum_{i=1}^{n} |\ln w_i - \beta' x_i - \gamma P_i| \qquad (4.7)$$

where $\sum_{i=1}^{n} |\ln w_i - \beta' x_i - \gamma P_i| = \sum_{i=1}^{n} (\ln w_i - \beta' x_i - \gamma P_i)\mathrm{sgn}(\ln w_i - \beta' x_i - \gamma P_i)$ where $\mathrm{sgn}(a)$ is the sign of a: 1 if a is positive and -1 if a is negative or zero.

Since the linear quantile regression model can also be estimated on quantiles other than median the general model can be formulated as in Koenker and Basset (1978):

$$\ln w_i = \beta'_{\vartheta} x_i + \gamma_{\vartheta} P_i + \varepsilon_{i\vartheta} \qquad \text{for } i = 1,...,n \qquad (4.8)$$

with $Quant_{\vartheta}(\ln w_i \mid x_i, P_i) = \beta'_{\vartheta} x_i + \gamma_{\vartheta} P_i$ and $Quant_{\vartheta}(\varepsilon_{i\vartheta} \mid x_i, P_i) = 0$ where ϑ^{th} is the regression quantile, $0 < \vartheta < 1$, computed by:

$$\min_{\beta \in R^k} \left\{ \sum_{i:\ln w_i \geq \beta'_{\vartheta} x_i + \gamma_{\vartheta} P_i} \vartheta \left| \ln w_i - \beta'_{\vartheta} x_i - \gamma_{\vartheta} P_i \right| + \sum_{i:\ln w_i < \beta'_{\vartheta} x_i + \gamma_{\vartheta} P_i} (1-\vartheta) \left| \ln w_i - \beta'_{\vartheta} x_i - \gamma_{\vartheta} P_i \right| \right\} \quad (4.9)$$

If $\hat{\gamma}_{\vartheta}$ is positive, then public sector workers at ϑ^{th} conditional quantile of $\ln w_i$ earn a premium. If $\hat{\gamma}_{\vartheta}$ is negative, then public sector workers at ϑ^{th} conditional quantile of $\ln w_i$ earn a penalty. Therefore, estimating (4.8) the public sector pay effect can be traced over the entire conditional distribution of $\ln w$ by increasing ϑ continuously from 0 to 1.

The quantile regression method provides a richer understanding of the data due to a more complete picture than OLS. In addition this method is less sensitive to outliers and provides a more robust estimator in terms of heteroskedasticity and departures from normality than OLS. However, while LAD helps to guard against outliers the estimators are justified only asymptotically (Wooldridge, 2003).

A decomposition of differences in distribution into a part explained by coefficients and a part explained by characteristics using quantile regression method can be formulated as proposed by Melly (2006)[24]. In Melly (2006) the consistent and asymptotically normally distributed estimators are obtained in two steps. In the first step the conditional distribution is estimated by traditional quantile regressions in each sector for each selected quantile. In the second step the conditional distribution is integrated over the range of the covariates to estimate the unconditional distribution. This approach is semiparametric since the conditional quantiles are assumed to satisfy a parametric restriction but distributional assumption is not required and the covariates can influence the whole conditional distribution.

[24] The estimation procedure proposed by Melly (2006) is extended version of Machado and Mata (2005) and Gosling, Machin and Meghir (2000). The estimation procedure is less restrictive than Juhn, Murphy and Pierce (1993) since it accounts for heteroskedasticity. In the literature the differences in distributions are analysed by different assumptions as proposed by Dinardo, Fortin, and Lemieux (1996); Donald, Green, and Paarsch (2000); Fortin and Lemieux (1998).

The counterfactual distributions are estimated by replacing either the estimated coefficients or the distribution of characteristics in one sector by the other sector's estimated coefficients or the distribution of characteristics (Melly (2006), p. 111). A decomposition of differences in unconditional distribution at each quantile into a part explained by coefficients and a part explained by characteristics can be written as:

$$\vartheta(x^{P},\hat{\beta}^{P})-\vartheta(x^{NP},\hat{\beta}^{NP})=\left[\vartheta(x^{P},\hat{\beta}^{P})-\vartheta(x^{P},\hat{\beta}^{NP})\right]+\left[\vartheta(x^{P},\hat{\beta}^{NP})-\vartheta(x^{NP},\hat{\beta}^{NP})\right] \quad (4.10)$$

where the first bracket represents the effect of differences in coefficients (could be interpreted as public sector earnings premium or penalty) and the second bracket represents the effect of differences in the distribution of characteristics.

The sectoral status (P), conditional on x, is assumed to be uncorrelated with the error term up to this point. This may not be true due to potential unobserved earnings determining characteristics that are related to a public sector status. In policy-evaluation terms this is a missing data problem: we are not able to observe the earnings of public sector workers had they been employed in the same capacity in the private sector and *vice versa*. In addition, the public sector status recorded by individual level data may simply be mismeasured. The measurement error problem has a similar statistical structure to the omitted variable problem.

If the sector of employment is considered to be endogenous either due to unobserved workers' heterogeneity or due to measurement error, instruments that influence sectoral attachment but are uncorrelated with earnings are required to correct for the bias in cross-sectional estimates. This can be written as:

$$P_i=\delta' z_i+v_i \text{ and } E(\varepsilon_i \mid z_i)=0,\ \delta\neq 0 \quad (4.11)$$

where z_i are characteristics (i.e. instruments) that indicate sectoral attachment but should not have a direct effect on earnings. They will be correlated with earnings, but only via their association with P and δ is the parameter vector. (4.11) is typically used in the first stage of a Heckman selection model (Heckman, 1979) or assuming $\hat{\beta}=\hat{\beta}^{P}=\hat{\beta}^{NP}$ in (4.3) in a linear probability model in the first step of a two stage least squares instrumental variable procedure.

The main weakness of instrumental variable approaches is the absence of suitable instruments. In this chapter we propose an instrument that exploits the variation in the public sector status during the period of large-scale privatisations.

4.6 Regression analysis

4.6.1 Overview of Goals

The empirical analysis has five goals. First, we want to test whether there was a public-private sector earnings differential and how it changed during the fourteen year long period of economic transition. For this purpose, a 'dummy variable' model is initially estimated by OLS to obtain an estimate of the public sector pay gap at the unconditional and conditional mean for each year of the observed period from 1995 until 2008. In this context we also want to test whether personal and job characteristics of the workers affect the sectoral pay gap. So, in the regression analysis we use a large set of personal and job characteristics of the workers as conditioning variables and test for their potential impact.

Our second goal is to test whether the public sector pay effect for workers with similar characteristics varies across the earnings distribution. Hence, quantile regressions are estimated at selected percentiles of the earnings distribution conditional on the same set of covariates as in the mean regression.

Our third goal is to compare the obtained estimates with the results of previous studies. So, we replicate a study that covered the initial period of economic transition by using the same methods and data sets.

Our fourth goal is to test whether a 'dummy variable' approach is too restrictive. Hence, in order to reveal whether the returns to characteristics differ across sectors a 'double equation' model is estimated at the conditional mean and at the conditional selected percentiles of the earnings distribution. Finally, the estimated public sector pay effects across the conditional earnings distribution are re-estimated by a decomposition method.

Our fifth goal is to test whether there is any measurement error in the public sector status resulting from workers confusion and/or ambigous ownership types during the period of large-scale privatisations. For this purpose, an instrument is constructed from employer-provided aggregated data and is matched to self-reported individual level data. The proposed instrument is also argued to be suitable to control for endogeneity in the public sector status arising from large-scale privatisations. The public sector pay effects are then estimated for

groups of workers according to their educational qualification by using two stage least squares and treatment effects instrumental variable procedures.

Since each of the goals are accomplished for male and female employees separately we are able to investigate wheather the public sector sector pay differential behaved differently between these two groups of workers during the period of economic transition.

4.6.2 Empirical Results

The empirical analysis is based on annual as well as on pooled data estimates. The pooled estimates are obtained for the periods given by data conveniences and different stages of economic transition in Serbia. In particular, due to the break in data methodology the LFS annual data can be pooled over two separate periods: 1995-2003 and 2004-2008. These periods also correlate broadly to two different stages of economic transition in Serbia. As explained, during the 1990s the private sector mainly consisted of a large number of small firms (in terms of employment) and entrepreneurships. Systematic economic reforms and large-scale privatisation programs were launched from 2001. In order to consistently follow changes during the period of structural reforms we employ an additional source of individual level data, LSMS for 2002-2003 and show changes in the public sector pay gap relative to LFS 2004-2008. In this way we show that the periods analysed relate to a change in sign of the estimated public sector pay gap which we argue is caused mainly by privatisation. At the final point of analysis, employer-provided administrative data from official statistics are explored as a third source of data for the purpose of instrumental variable creation. This corrects for the possibility of measurement error in the LFS recorded public sector status arising from the large-scale privatisations (as suggested by Disney and Gosling, 2003).

(i) Annual Mean Estimates

Public-private sector earnings differentials[25] may be largely determined by the different nature of jobs and skills in the two sectors. In order to obtain unconditional and conditional average public-private sector pay differentials for each year from 1995 until 2008

[25] expressed in log percentage points throughout the chapter

for men and women, separately we use a 'dummy variable' approach. Tables 4.6 and 4.7 present the OLS regressions estimation results.

The unconditional public sector pay gap estimates are raw differences in mean log real hourly earnings between public and private sectors. The conditional public sector pay gap estimates are the differences in the mean log real hourly earnings between the public and private sectors after controlling for workers' labour force experience, educational qualification, marital status, nationality, settlement type, regional allocation, industry branch and occupational affiliation.[26] Tables 4.6 and 4.7 present only the returns to education over the period of economic transition in Serbia from 1995 until 2008. The full conditional estimation specifications are presented in Tables A4.4 and A4.5 in the Appendix.

The fit of the hourly earnings equations augmented by additional 'control' variables, using the R-squared, is reasonably good and improves over the years. The overall explanatory power of the variance of mean log hourly pay in the augmented regression in 1995 for men is 0.30 and 0.43 in 2008 and for women 0.31 in 1995 and 0.63 in 2008. The F statistics confirms that all the regressors are jointly statistically significant. The Breusch-Pagan test for heteroskedasticity is performed by regressing the residuals from an OLS regression on the same set of covariates and showed heteroskedastic errors at most cases. A common way of estimating variance of coefficients in the presence of heteroskedasticity is to use robust or White (1980) standard errors to calculate 95% confidence intervals.

Table 4.6 shows that the raw average difference in earnings between the two sectors was not statistically significant during most of the years from 1995 until 2003 for male workers. But adjusting for worker and job characteristics, the estimates show statistically that public sector ownership significantly penalised male workers from 1997 until 2002. Similarly, for female workers a statistically significant raw public sector pay premium becomes a penalty (statistically significant from 1998 until 2002) after controlling for differences in the nature of jobs and skills in the two sectors.

[26] It should be acknowledged that firm size is not one of the control variables because it is more subject to measurement error given that the data are self-reported and that the survey only contains a question on number of persons who work with the individual in the local unit. Moreover, chapter 5 uses the employer survey data on firm size in the empirical specification but the results are not materially altered when firm size control variables are excluded.

Table 4.6: Estimation of main job hourly earnings in Serbia, 1995-2003

	1995		1996		1997		1998		1999		2000		2001		2002		2003	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Unconditional Model:																		
Public Sector:	0.044	0.100	0.024	0.254	0.022	0.269	-0.074	0.097	-0.004	0.081	-0.090	-0.005	-0.041	0.156	-0.026	0.070	0.032	0.160
	(0.67)	(1.91)	(0.33)	(4.48)**	(0.40)	(5.05)**	(-1.52)	(2.16)*	(-0.09)	(1.85)	(-2.14)*	(-0.16)	(-1.14)	(4.67)**	(-0.77)	(1.91)	(1.11)	(5.10)**
Conditional Model:																		
Education:																		
No qualific.	-0.043	-0.272	-0.171	-0.167	-0.084	-0.018	-0.097	-0.147	-0.181	-0.130	-0.087	-0.018	-0.053	0.024	0.016	-0.056	0.052	0.041
	(-0.54)	(-2.57)*	(-2.11)*	(-1.56)	(-1.09)	(-0.19)	(-1.10)	(-1.92)	(-2.20)*	(-1.47)	(-0.96)	(-0.13)	(-0.72)	(0.17)	(0.22)	(-0.69)	(0.58)	(0.27)
Primary	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Secondary	0.110	0.138	0.054	0.122	0.075	0.125	0.090	0.084	0.032	0.090	0.013	0.127	0.121	0.245	0.181	0.225	0.178	0.190
	(3.13)**	(2.50)*	(1.37)	(2.47)*	(1.91)	(2.89)**	(2.27)*	(1.94)	(0.86)	(2.10)*	(0.35)	(3.51)**	(3.44)**	(5.90)**	(5.74)**	(5.78)**	(5.26)**	(4.79)**
College	0.266	0.298	0.153	0.169	0.264	0.217	0.192	0.190	0.210	0.218	0.150	0.260	0.351	0.420	0.311	0.347	0.321	0.372
	(5.16)**	(4.32)**	(2.71)**	(2.53)*	(4.52)**	(3.73)**	(3.20)**	(3.19)**	(3.58)**	(3.78)**	(2.79)**	(5.43)**	(6.56)**	(8.19)**	(5.51)**	(6.76)**	(5.74)**	(6.80)**
University	0.427	0.466	0.409	0.364	0.401	0.420	0.426	0.345	0.413	0.415	0.316	0.447	0.617	0.669	0.570	0.615	0.594	0.63
	(6.89)**	(6.51)**	(6.03)**	(5.59)**	(5.97)**	(6.84)**	(6.72)**	(5.34)**	(6.24)**	(7.22)**	(4.66)**	(9.24)**	(10.66)**	(12.49)**	(10.43)**	(12.04)**	(10.41)**	(12.31)**
Public Sector:	-0.087	-0.144	-0.127	-0.075	-0.156	-0.058	-0.234	-0.183	-0.144	-0.165	-0.245	-0.182	-0.118	-0.087	-0.100	-0.143	-0.051	-0.062
	(-1.34)	(-2.22)*	(-1.61)	(-1.15)	(-2.73)**	(-0.90)	(-4.95)**	(-3.76)**	(-2.44)**	(-3.67)**	(-5.26)**	(-4.84)**	(-3.18)**	(-2.31)*	(-3.09)**	(-4.60)**	(-1.77)	(-1.65)
Constant	3.717	3.824	3.783	3.448	4.333	3.933	4.206	3.802	4.051	3.574	4.008	3.748	3.998	3.941	4.191	4.004	4.149	3.893
	(28.80)**	(24.70)**	(29.68)**	(23.51)**	(36.12)**	(26.78)**	(36.38)**	(33.30)**	(36.13)**	(29.40)**	(38.70)**	(31.18)**	(43.92)**	(36.21)**	(46.06)**	(39.40)**	(42.31)**	(31.70)**
Adj. R-sq	0.30	0.31	0.31	0.42	0.32	0.43	0.30	0.40	0.28	0.38	0.23	0.35	0.30	0.40	0.33	0.48	0.30	0.44
Reg. st.error	0.46	0.49	0.50	0.45	0.51	0.44	0.48	0.44	0.47	0.42	0.47	0.38	0.43	0.40	0.42	0.36	0.42	0.36
Breusch Pagan test	34.86	81.12	48.40	76.83	21.32	49.63	25.80	17.33	31.59	39.44	14.03	39.09	44.67	68.25	16.39	22.41	47.74	44.93
Observations	1479	1037	1468	1021	1488	1071	1486	1115	1464	1097	1634	1233	1602	1180	1556	1161	1545	1124

Notes to Table 4.6:

a) The depended variable is the log of real hourly earnings. Earnings are net of taxes, pensions and welfare benefits. They include payments for meals, transport, union benefits, credits from the firm and payment in kind. They relate to earnings received on the main job only and are expressed in October 2005 Serbian dinars.

b) All explanatory variables are categorical. All specifications include a set of labour force experience, marital status, nationality, settlement type, region, industry branch and occupational dummies. Full results given in Table A4.4 in the Appendix.

c) The estimation procedure for the mean regression is OLS and White (1980) estimated standard errors are used to calculate 95% confidence interval. Breusch-Pagan / Cook-Weisberg test for heteroskedasticity rejects the null hypothesis of constant variance in each case. Robust *t* statistics reported in parentheses. OLS regression analysis reported used STATA 8.0: ** and * denote statistical significance at the 0.01 and 0.05 level respectively using two-tailed test. *f* denotes category omitted in estimation.

Data Source: Labour Force Survey 1995-2003

Table 4.7: Estimation of main job hourly earnings in Serbia, 2004-2008

	2004		2005		2006		2007		2008	
Variables	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Unconditional Model:										
Public Sector:	0.239	0.335	0.274	0.347	0.231	0.316	0.358	0.400	0.350	0.500
	(9.93)**	(12.66)**	(12.19)**	(13.37)**	(11.12)**	(12.93)**	(16.49)**	(16.70)**	(17.51)**	(21.76)**
Conditional Model:										
Education:										
No qualification	-0.049	-0.154	-0.095	-0.129	-0.014	-0.059	-0.113	-0.213	-0.043	-0.061
	(-0.63)	(-1.68)	(-1.13)	(-1.41)	(-0.21)	(-0.61)	(-1.45)	(-1.45)	(-0.56)	(-0.54)
Primary	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Secondary	0.122	0.134	0.102	0.157	0.161	0.116	0.076	0.221	0.131	0.159
	(3.58)**	(3.49)**	(3.09)**	(4.16)**	(5.72)**	(3.41)**	(2.42)*	(7.40)**	(4.73)**	(5.63)**
College	0.277	0.297	0.271	0.375	0.34	0.274	0.195	0.361	0.27	0.309
	(5.47)**	(5.88)**	(5.59)**	(8.06)**	(7.39)**	(6.41)**	(4.37)**	(8.31)**	(6.42)**	(7.98)**
University	0.55	0.509	0.509	0.575	0.617	0.534	0.453	0.649	0.538	0.64
	(11.06)**	(10.03)**	(10.16)**	(11.74)**	(14.87)**	(12.46)**	(9.44)**	(15.88)**	(12.47)**	(16.27)**
Master degree	0.522	0.726	0.504	0.635	0.341	0.797	0.489	1.004	0.811	0.812
	(3.45)**	(6.54)**	(4.38)**	(6.51)**	(2.01)*	(6.24)**	(2.03)*	(5.46)**	(6.71)**	(6.90)**
PhD degree	0.82	0.873	0.753	1.103	1.178	0.621	0.939	0.778	1.149	1.007
	(9.22)**	(5.23)**	(7.06)**	(4.75)**	(9.80)**	(10.12)**	(6.46)**	(15.69)**	(10.31)**	(14.04)**
Public Sector:	0.030	-0.028	0.087	0.012	0.089	-0.021	0.189	0.078	0.191	0.122
	(1.16)	(-0.93)	(3.62)**	(0.37)	(4.12)**	(-0.69)	(8.09)**	(2.72)**	(8.81)**	(3.72)**
Constant	4.042	3.837	3.954	3.814	4.237	3.763	4.298	3.972	4.547	4.096
	(42.59)**	(35.26)**	(39.52)**	(29.25)**	(47.79)**	(33.56)**	(42.10)**	(31.01)**	(50.23)**	(46.26)**
Adj. R-squared	0.30	0.47	0.33	0.47	0.39	0.56	0.39	0.54	0.43	0.63
Regression st. error	0.49	0.41	0.46	0.40	0.41	0.35	0.44	0.37	0.39	0.33
Breusch Pagan test	15.44	14.84	40.90	8.89	27.02	32.08	23.55	0.19	14.37	0.31
Observations	2407	1812	2437	1731	2372	1763	2320	1775	2382	1790

Notes to Table 4.7: See notes to Table 4.6. Full results given in Table A4.5 in the Appendix.

Data Source: Labour Force Survey 2004-2008

Table 4.7 shows that the unconditional public sector pay premia was statistically significant during the 2004-2008 period for both men and women whereas the conditional sectoral gap was statistically significantly different from zero from 2005 for men and from 2007 for women.

A further insight into time trends of estimated unconditional and conditional public sector pay gap (i.e. $\hat{\gamma}$) is given by Figures 4.10 and 4.11. These Figures plot the unconditional and conditional public sector pay gap with a 95% confidence interval for men and women, respectively.

Figures 4.10 and 4.11 show that the conditional results in general lower the measured public sector pay effect. However, for male workers the 95% confidence intervals of unconditional and conditional estimates during the 1995-2003 period intersect suggesting that the unconditional and conditional estimates can not be separated for every year. This is not the case for female workers. Furthermore, the 95% confidence intervals during the 2004-2008 period are tighter relative to the previous period suggesting a greater importance of observable characteristics in explaining wages. Nevertheless, the 95% confidence intervals indicate again that differences in observed characteristics between sectors are more important for female than for male workers. Finally, the estimates conditioned on controls do not follow the same time trend as the unconditional estimates (let alone level). This may reflect a change in the composition of public sector workers over time. For example, during the 2004-2008 period the difference between the raw differential and estimated premium declines for men and increases for women. These changes are likely to capture a pay-workforce quality trade-off indicating higher quality female and lower quality male workforce in the public sector.

Summarising the results for both men and women Figures 4.10 and 4.11 show that the conditional average annual public sector pay gap was negative during the 1995-2003 period but positive during the 2004-2008 period.

In this context, it is important to point out that during the 1990s most workers were still in the public sector. The private sector mainly consisted of small firms and entrepreneurships. Systematic economic reforms and large-scale privatisations programs were launched from 2001. Indeed, in the LFS 1995-2003 sample the public sector is almost seven times larger for men and almost five times larger for women than the private sector whereas during 2004-2008 the public and private sector samples became of almost equal sizes. This implies that the gap is related to stages of economic transition and hence to public sector size in terms of employment (as suggested by chapter 3).

Figure 4.10: Public sector pay relative to private sector pay: conditional and unconditional differences in hourly pay for men in period 1995-2003 with 95% confidence interval

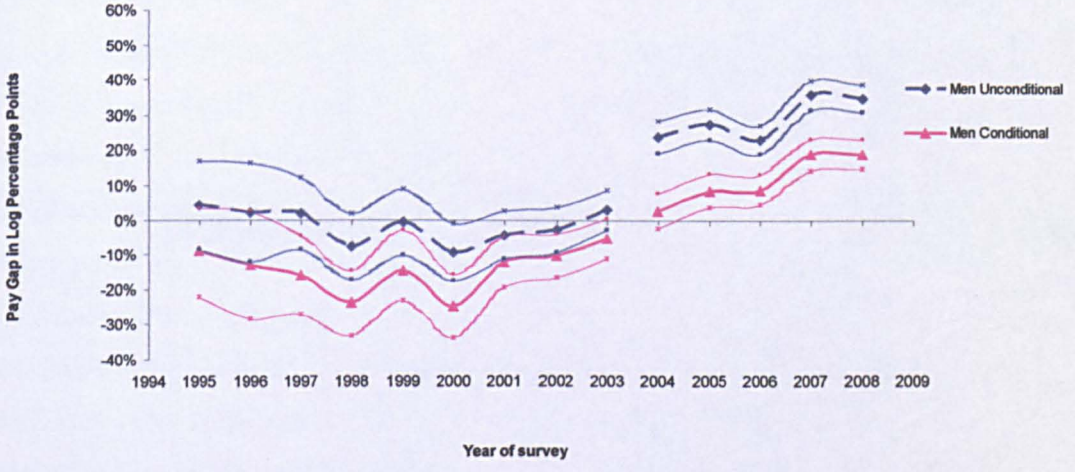
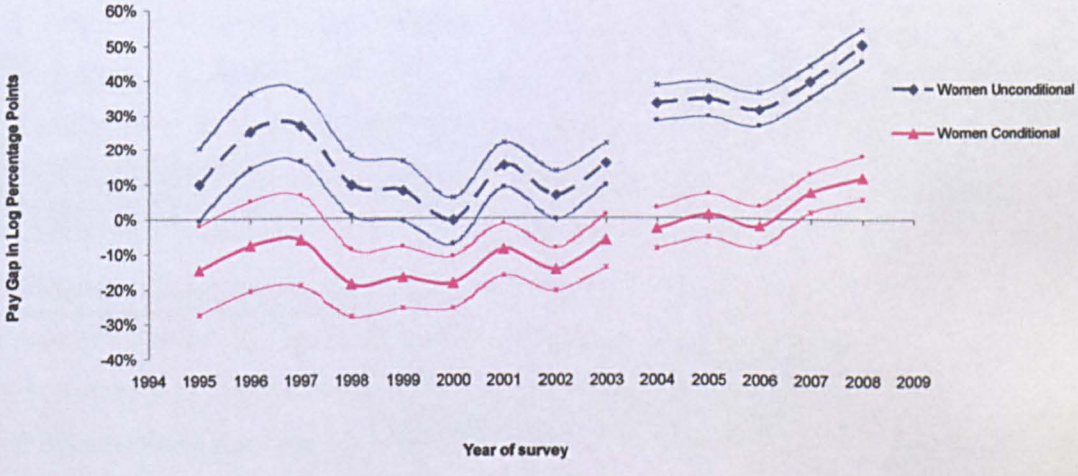


Figure 4.11: Public sector pay relative to private sector pay: conditional and unconditional differences in hourly pay for women in period 1995-2003 with 95% confidence interval



Notes to Tables 4.10 and 4.11: White (1980) estimated standard errors are used to compute the 95% confidence intervals. The break in data methodology between 1995-2003 and 2004-2008.

Data Source: Calculated by author from successive Labour Force Surveys 1995-2008

In addition, Tables 4.6 and 4.7 present the returns to education over the period of economic transition in Serbia from 1995 until 2008. In contrast to other transition economies, returns to all educational levels higher than primary school education were contracting from 1995 to 2000. For example, Table 4.6 shows that male workers with a university degree saw a decline in returns from 43% in 1995 to 32% in 2000. On the other hand, Munich, Svejnar and Terrell (2002) reported that the wage differential between university educated males and those with only a junior high school education in the Czech Republic increased from 28% at the end of the 1980s to 72% by 1996. Keane and Prasad (2001) also found that the returns to a college degree relative to primary school increased from 37% in 1986 to 53% in 1992 and 68% in 1996 in Poland. Hence, Serbia lagged behind in labour market reforms when compared with other transitional countries due to sluggish transition and political and economic turbulences during the 1990s.

Nevertheless, the point estimates presented in Table 4.6 indicate that the returns to education started to increase from 2001 when the systematic economic reforms were initiated. Furthermore, Table 4.7 shows that the returns to education in Serbia increased to the levels observed in other transition economies during the 2004-2008 period. For example, the university educated male and female workers enjoyed around a 60% pay 'mark-up' relative to workers educated to primary school level.

Returns to other characteristics from the full regression specifications presented in Tables A4.4 and A4.5 in the Appendix are summarised as follows. Labour force experience effects were poorly determined in the real hourly earnings specifications. This is consistent with findings in other transitional countries where experience obtained under the communist regime was not valued by the new market system (Flanagan (1995) for Czech Republic, Adamchik and Bedi (2000) for Poland, Jovanović and Lokshin (2004) for Moscow).

Workers in financial and other services, government administration and education and health enjoyed a pay 'mark-up' relative to a number of other industry branch activities. The set of occupational level variables shows on average lower wages for farmers, miners/industrial and trade workers. Managers and professionals earned significant earnings premia relative to other occupational categories. Residing in the Serbian capital Belgrade provides significant premium relative to residing in northern province Vojvodina and even more compared to Central Serbia.

Finally, the annual average public sector hourly pay gap estimates presented in this sub-section can be compared with other studies. Sector pay gap estimates reported by Reilly

(2003) for male employees in Serbia from 1995 until 2000 show the same pattern and sign over the years but are a bit larger for most of the years considered. Since the estimates reported in Reilly (2003) are obtained in the specifications including a number of interactive variables a comparison with our estimates will be discussed in greater depth later.

In contrast to Reilly (2003), Jovanović and Lokshin (2003) estimated for male and female employees in year 2000 a much lower pay gap than our estimate. In particular, whereas the OLS estimates for 2000 in Table 4.6 are -24.5% for men and -18.2% for women, Jovanović and Lokshin (2003) reported -9.4% public sector pay gap for men and -4% for women in 2000. However, the regression analysis in this sub-section differs from Jovanović and Lokshin (2003)'s for several reasons: first, they used the data for the Federal Republic of Yugoslavia[27] rather than only for Serbia; second, they included fewer controls in the regression analysis and third the estimates reported are obtained by applying the endogenous switching regression approach.

In particular, Jovanović and Lokshin (2003) included age and its squared term, a dummy for a single person, the number of jobholders in the household, educational and regional dummies in the sector choice equation. In the wage equation they included labour force experience and its squared term, educational, regional and industry branch dummies. The number of job holders in the household, argued to be an instrument for risk-aversion, is found to be insignificant for male workers but significant for female workers. Finally, their results imply that workers in the public sector have lower unbserved earning potentials than workers in the private sector.

Although their results indicated that the OLS estimates should be taken with caution, a lack of strong instruments suggests that the 'true' public sector pay gap is not convincingly estimated by using an endogenous switching regression approach. We acknowledge that correcting for non-random selection is important, but as pointed by Dustmann and Van Soest (1998) it is only useful when meaningful instrumental variables that play a role in the selection mechanism but which can be excluded from the wage equation are available.

[27] Confederation of Serbia and Montenegro. Montenegro became an independent state in 2006 and is not covered by our analysis.

(ii) Annual Quantile Regression Estimates

In the further analysis we examine the public-private sector earnings differentials at different points in the earnings distribution. Annual quantile regressions are estimated by using the specification identical to that employed in estimating the mean annual regressions.

Conditional annual public sector pay gap at the selected percentiles of the earnings distribution by gender is presented in Figure 4.12 using LFS 1995-2003 and in Figure 4.13 using LSMS 2002-2003 and LFS 2004-2008. Standard errors are obtained by the bootstrapping procedure (Hahn, 1995) with 1000 replications in all cases. The estimates presented on Figures 4.12 and 4.13 can be found in Table A4.6 in Appendix.

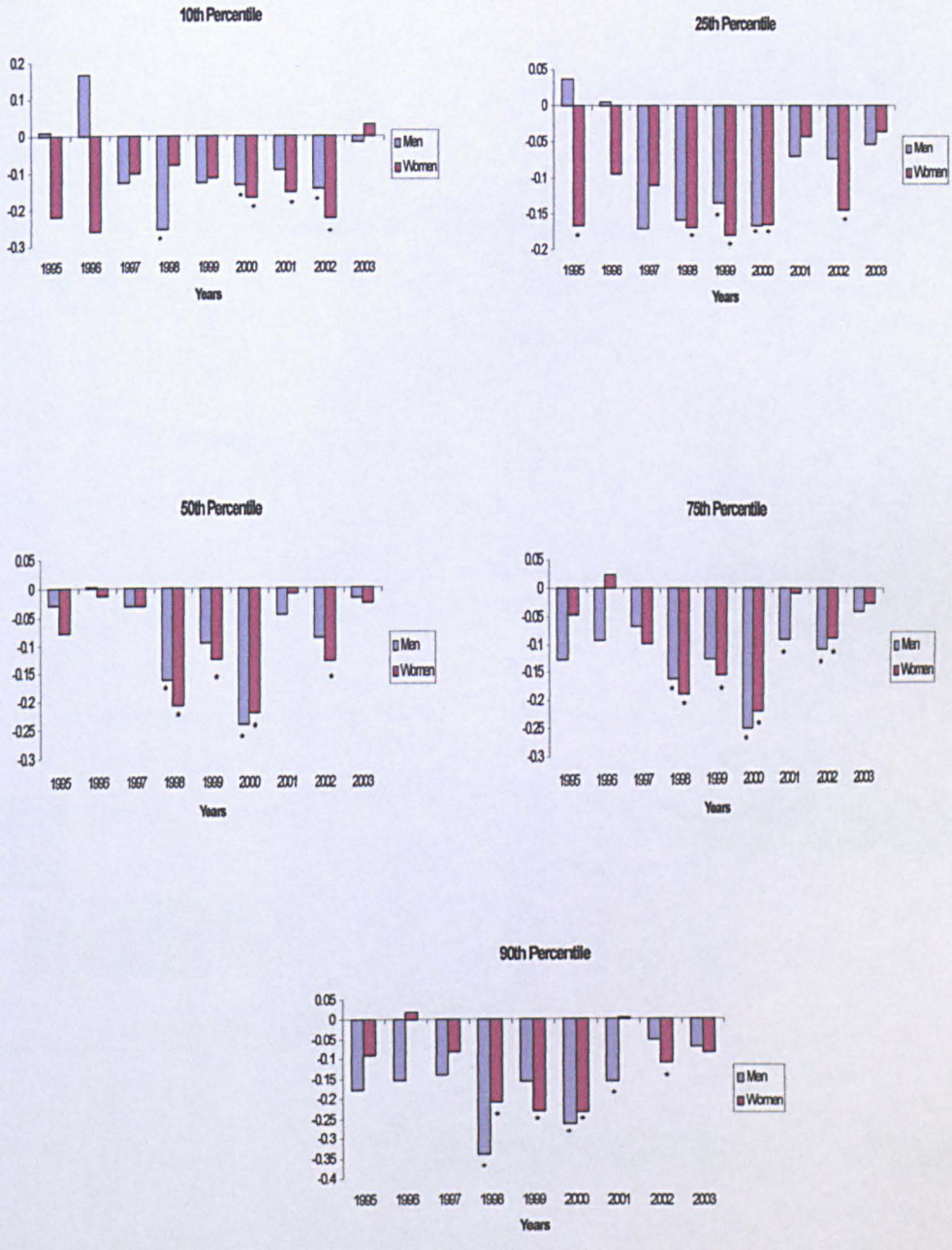
Two main conclusions can be drawn from Figures 4.12 and 4.13. First, the public sector pay gap estimates proved sensitive to stages of economic transition. Second, the public sector pay gap is related to a worker's position in the earnings distribution.

With respect to first conclusion, the sign of the public sector pay gap at most of the percentiles was negative until 2003 and positive afterwards. Looking at annual changes in the size of the public sector pay gap, the public sector workers at all the percentiles saw a deterioration of their financial position until 2000 and improvements in the following years relative to their private sector counterparts. Hence, there is a clear evidence of increasing public sector pay penalty over the period of economic recession (i.e. 1995-2000) and its decline when the systematic economic reforms started from 2001.[28] Furthermore, during the period of large-scale privatisations the public sector pay gap became positive from 2004 with an increasing trend for both men and women until 2008.

With respect to the second conclusion, the quantile regression estimates provide a richer insight into the public sector pay effects than the OLS estimates. For example, the quantile regressions reveal that during the period 1995-2003 the public sector pay penalty was statistically significant only in 1998 and 2000 across the whole male earnings distribution. This finding is contrary to Reilly (2003) who finds evidence of a statistically significant pay gap at some points in the earnings distribution in 1995, 1997 and 1999. This will be a subject of further investigation later in the section.

[28] Periods of recession and recovery are also supported by year estimates in the pooled specifications presented in Tables A4.7-A4.12 in the Appendix which show that the public sector earnings had declined until 2000 and increased afterwards.

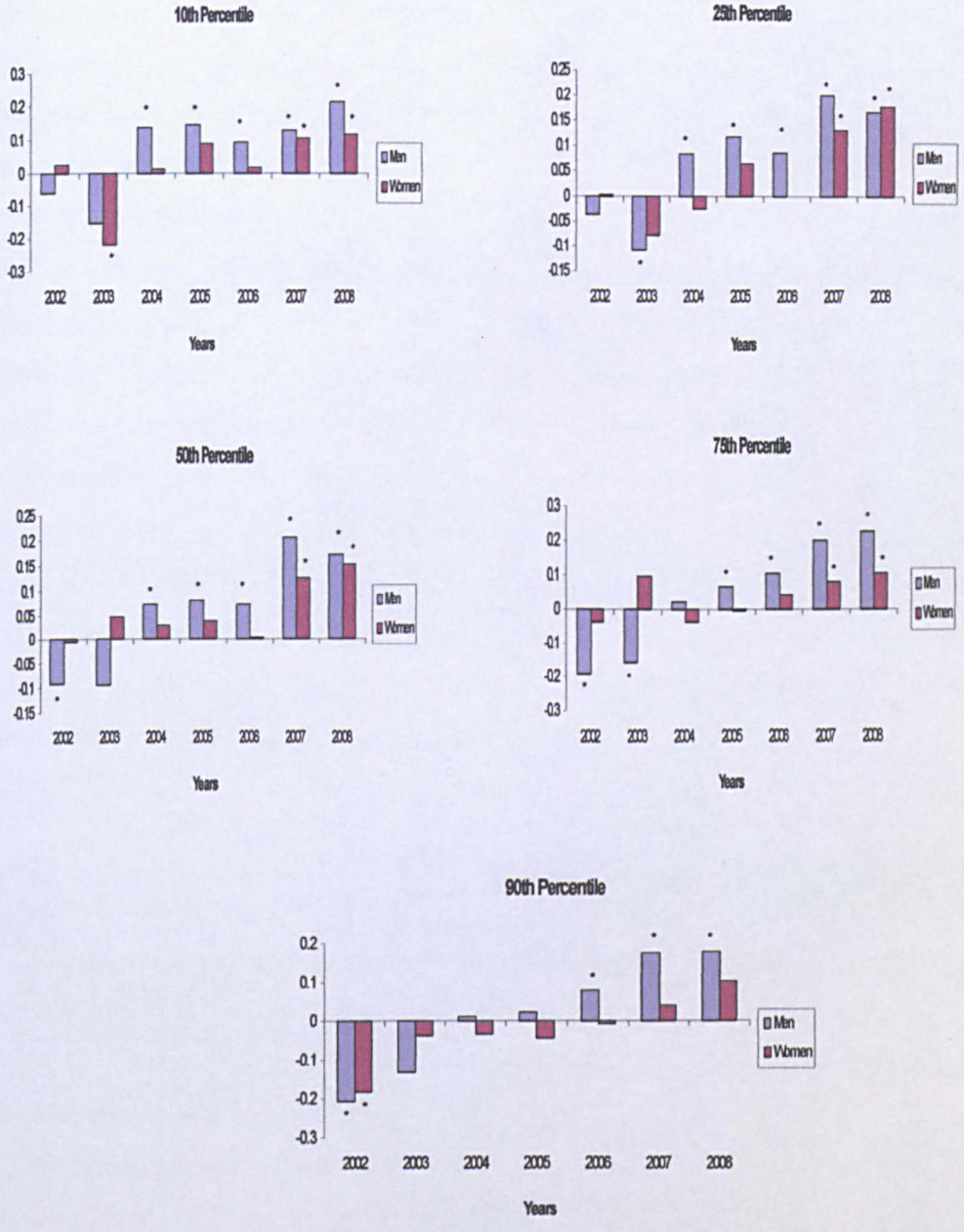
Figure 4.12: Evolution of public sector pay gap for each of the percentiles of the earnings distribution by gender in period the 1995-2003



Notes to Figure 4.12: Bootstrapped quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles conditional on the following set of categorical (dummy) variables: labour force experience, educational qualifications, marital status, nationality, settlement type, region, industry branch, occupation. * denotes that estimates are significantly different from zero at the 0.05 significance level based on estimated standard errors obtained by the bootstrapping procedure with 1000 replications in all cases.

Data Source: LFS 1995-2003

Figure 4.13: Evolution of public sector pay gap for each of the percentiles of the pay distribution by gender in Serbia in the period 2002-2008



Notes to Figure 4.13: Bootstrapped quantile regression procedures are used to obtain the public sector coefficient estimates for the selected percentiles conditional on the following set of categorical (dummy) variables: labour force experience, educational qualifications, marital status, nationality (except in LSMS), settlement type, region, industry branch, occupation (except in LSMS). * denotes that estimates are significantly different from zero at the 0.05 significance level based on estimated standard errors obtained by the bootstrapping procedure with 1000 replications in all cases.

Data Source: LSMS 2002-2003 and LFS 2004-2008

Furthermore, in 2001 the gap was statistically significant for male workers above the median and in 2002 at both ends of the earnings distribution whereas there was no statistically significant gap at any of the percentiles in 2003. On the other hand, with the exception of 2001, the public sector penalty for female workers was statistically significant across all the percentiles from 1998 until 2002.

Finally, although there was no statistically significant gap at the conditional mean in 2004 as estimated by OLS, the quantile regressions reveal that male workers collected statistically significant public sector pay 'mark-up' at and below the median. In 2005 the public sector premium is estimated at all percentiles except at the 90^{th} and the mean estimate was almost identical to the median estimate. During the last three years male workers at all the percentiles gained from a public sector status. On the other hand, female workers at all the percentiles fared the same across sectors until 2007 and 2008 when statistically significant public sector premium is estimated across the whole earnings distribution except at the 90^{th} percentile. These results showed improvement in the financial position of public sector workers over time at all the percentiles but indicated that relative to the private sector the public sector earnings distribution remained more compressed.

(iii) Pooled Mean and Quantile Regression Estimates

Aggregating the annual data together, as presented in Table 4.8, the estimates are obtained on the conditional mean and selected percentiles of the earnings distribution for the periods given by data convience. Moreover, these periods also correlate broadly to different stages of economic transition and hence to the different signs of the estimted public sector pay gap. The pooled estimates presented in Table 4.8 are obtained in the same specification as used in annual regressions but adding the year dummies to account for the aggregate time effect.

The results indicate that the public sector compressed earnings during the whole period of economic transition in Serbia. For example, the inequality-reducing effect for public sector male workers appears similar during 1995-2003 and 2004-2008 but the whole distribution of differentials is shifted upwards from penalties to premia. In particular, for the period 1995-2003 the public sector pay penalty for male workers increases as one moves towards the top-end of the earnings distribution. The LSMS 2002-2003 estimates show no statistically significant difference in earnings at the lower part of the earnings distribution but statistically significant negative public sector pay gap at the median and above. During the

2004-2008 period the public sector pay premia is inversely related to the percentiles of the earnings distribution. This means that the estimated public sector 'mark-up' declines as one moves towards the top-end of the earnings distribution. These patterns are similar for women. It is important to stress that the reported estimates are obtained under the assumption that the selection into the public sector conditional on control variables is random.

Table 4.8: Public sector pay penalty by different periods and data sources

	LFS 1995-2003		LSMS 2002-2003		LFS 2004-2008	
	Men	Women	Men	Women	Men	Women
Mean	-0.138	-0.130	-0.130	-0.050	0.110	0.030
	(-9.41)**	(-8.59)**	(-4.90)**	(-1.43)	(10.65)**	(2.32)**
10th	-0.092	-0.168	-0.055	-0.045	0.153	0.071
	(-3.60)**	(-5.22)**	(-0.99)	(-0.73)	(7.74)**	(3.15)**
25th	-0.096	-0.116	-0.050	-0.002	0.131	0.053
	(-5.06)**	(-5.78)**	(-1.63)	(-0.06)	(8.93)**	(3.04)**
50th	-0.091	-0.096	-0.070	-0.007	0.119	0.072
	(-4.98)**	(-7.48)**	(-2.16)*	(-0.25)	(9.99)**	(5.79)**
75th	-0.116	-0.097	-0.170	-0.039	0.127	0.039
	(-6.36)**	(-6.20)**	(-5.35)**	(-0.95)	(9.44)**	(2.38)*
90th	-0.152	-0.126	-0.202	-0.144	0.091	-0.012
	(-5.49)**	(-6.13)**	(-4.22)**	(-2.10)*	(5.02)**	(-0.50)

Notes to Table 4.8: a) Each regression specification includes a set of dummies for: labour force experience, educational qualification, marital status, settlement type, region, nationality (except in LSMS), industry branch, occupational affiliation (except in LSMS) and year as well as dummy for the public sector status.

b) The estimation procedure for the mean robust regression is OLS and *t* test reported in parentheses is calculated based on White (1980) estimated standard errors. Bootstrapped quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}). The *t* test reported in parentheses for the quantile regressions is calculated based on standard errors estimated by the bootstrapping procedure with 1000 replications in all cases. ** and * denote significance at the 0.01 and 0.05 level respectively.

Data Source: LFS 1995-2003, LSMS 2002-2003 and LFS 2004-2008

A single empirical study that estimated public-private sector pay differentials across the pay distribution for male workers in Serbia was accomplished by Reilly (2003). This study applied the same empirical method as here but using LFS data for male employees, aged between 18 and 64, from 1995 until 2000. Reilly (2003) provides evidence for a public sector pay penalty as presented in the first column in Table 4.9. The conditional estimates are obtained in the regression specification controlling for the same set of characteristics as in Table 4.8 but expanded by a number of interaction terms designed to capture variation in sector pay effects. The interactive variables consist of the sector status and workers who have no educational qualification, live in the city, work in construction or finances and other

services and are farmers. In addition to these five interaction terms the full set of year interaction terms is included in each regression specification.

An important issue, discussed shortly, is measurement error, especially in relation to the definition of the hourly wage, thereby biassing the estimates of the conditional public sector wage gap. In particular we use total pay compensation. This is the sum of six components of monthly earnings from the main job as recorded separately in the LFS: (1) the regular wage (2) meal and transportation allowances (3) union assistance (4) in-kind benefits (5) credits from the firm (not from the bank) and (6) all other receiving from the main job. But, from reading Reilly (2003) it is not clear how the earnings measurement is created. We suspect that not all non-wage benefits recorded by LFS are added to a regular wage since our replication using the same econometric specification and data set showed lower estimates of public sector pay gap.

As presented in the second column in Table 4.9 we find no statistically significant public sector pay penalty at and below the median but significant pay penalty above the median during 1995-2000 period. Reilly (2003) however, finds significant penalty on the 25th and 90th percentiles only. Moreover, the public sector pay penalty for male workers at the top of the earnings distribution is about one third lower than the Reilly (2003)'s estimate.

At the mean our estimate is about 14% lower than the Reilly (2003)'s estimate. This difference in the mean sector pay gap estimates fits broadly with the difference in non-wage components of total remuneration between public and private sector employees. As pointed earlier, before the fiscal reform in 2001, about 85% of the total earnings received by public sector workers were regular payments (i.e. wage) and approximately 15% were subsidies on transportation and meals (i.e. non-wage payments). In the private sector, only about 4% of the total earnings came from such subsidies, and 96% came from regular wages. Hence, correcting for differences in components of total remuneration the estimated public sector pay penalty declines.

Table 4.9: Public sector pay gap comparison with previous study

Dependent Variable		
	(Reilly, 2003)	Total Pay Compensation (Earnings=Wage+ All Non-Wage Benefits recorded by LFS)
LFS	1995-2000 [1]	1995-2000 [2]
	Men	Men
Mean	-0.3268 (-3.80)**	-0.1855 (-3.40)**
10th	-0.1732 (-1.45)	-0.1452 (-1.65)
25th	-0.1714 (-2.03)*	-0.0858 (-1.92)
50th	-0.1787 (-1.85)	-0.0598 (-1.17)
75th	-0.2272 (-1.88)	-0.218 (-2.14)*
90th	-0.6933 (-3.17)**	-0.4478 (-3.16)**

Notes to Table 4.9: a) [1] and [2] the samples used relate to male employees, aged between 18 and 64, who reported non-zero main job earnings. In addition, in order to replicate sample used by Reilly (2003), the 1995 LFS from September is used. The reference months of the surveys in other years are same as presented in Table 4.4.

b) Each regression specification includes a set of dummies for: labour force experience, educational qualification, marital status, settlement type, region, nationality industry branch, occupational affiliation, private sector status and year. In addition, the private sector dummy variable is interacted with: dummy for individuals with no formal educational qualification, dummy for individuals whose occupation is farmer, dummy for individuals whose industry branch is construction, dummy for individuals whose industry branch is finances and other services, dummy for individuals who live in the city plus a full set of year dummy interactions.

c) The estimation procedure for the mean robust regression is OLS and *t* test reported in parentheses is calculated based on White (1980) estimated standard errors. Bootstrapped quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles. The *t* test reported in parentheses for the quantile regressions is calculated from estimated standard errors based on the bootstrapping procedure with 1000 replications in all cases. The estimates obtained on the private sector dummy are transformed to reflect the public sector pay differential. ** and * denote significance at the 0.01 and 0.05 level respectively.

Data Source: Pooled LFS 1995-2000: [1] Reilly (2003) Table 3, p. 26; [2] author calculation

Finally, in the specification used by Reilly (2003) (given in Table 4.9) a number of interactive variables are included to capture variation in the sector pay gap effects. These interactive terms indicated some differences between public and private sector pay at selected occupational, educational and industry level.

In order to reveal whether the returns to characteristics differ between sectors at different points in the distribution of the covariates, naturally, the next step in our analysis is to estimate conditional earnings equations at the mean and selected percentiles for public and private sectors separately. The results are obtained by pooling LFS 1995-2003, LSMS 2002-2003 and LFS 2004-2008 data separately. The detailed regression results are reported in

Tables from A4.7 to A4.12 in the Appendix. The text focuses on the results of general interest.

For the period 1995-2003 the R-squared reported in Tables A4.7 and A4.8 in the Appendix shows that the explanatory variables capture earnings variation better in the public than in the private sector. Men received greater returns to labour force experience but lower returns to education attainment in the private than in the public sector. This result implies that the private sector rewarded more specific (as measured by labour force experience) than general (as measured by education attainment) human capital. This finding is consistent with Jovanović and Lokshin (2003) who found the effect of education insignificant and the effect of age negative and significant on the probability of being employed in the private sector in Serbia in 2000. Similar results are found by Adamchik and Bedi (2000) for Poland in 1996. Both Jovanović and Lokshin (2003) and Adamchik and Bedi (2000) argued that the quality rather than the quantity of education may be more important in private sector wage determination.

On the other hand, women in the public sector were rewarded more for both specific and general human capital than in the private sector. The regional differences were significant in both sectors but greater in the private than in the public sector. Correlation between macroeconomic shocks and earnings was more pronounced in the public than in the private sector as captured by year dummies indicating a fall in earnings until 2000 across all the percentiles. Point year estimates from 2001 (i.e. when economic reforms started) show that the growth of earnings was statistically significant and similar across sectors.

The estimates obtained by using LSMS 2002-2003 data presented in Tables A4.9 and A4.10 in Appendix are quite similar to the LFS 1995-2003 estimates. Conversely, in 2004-2008 period, the private sector estimates presented in Tables A4.11 and A4.12 in the Appendix show statistically significant differences in returns across industry branches and occupational affiliations which were greater than in the public sector for both men and women. The increase in the private sector earnings variation captured by industry and occupational variables resulted from large-scale privatisations during this period. In addition, the returns to education increased statistically significantly with each educational level in both sectors but were lower in private than in the public sector. Year dummies show faster earnings growth in the public sector than in the private sector especially at the upper end of the earnings distribution. These results may be related to public sector wage reforms which aimed to improve the financial position of skilled professions.

(iv) Decomposition of differences in distribution

We now re-estimate the pooled quantile regression models by using a decomposition method. This method is based on aggregating differences in the distribution into a part explained by differences in returns to characteristics and into a part explained by differences in characteristics.

A decomposition is obtained by following a version of the approach developed by Melly (2006). As in Melly (2006) the consistent and asymptotically normally distributed estimators are obtained in the following way: in the first step the conditional distribution is estimated by 100 quantile regressions in each sector for each selected quantile and integrated over the range of the covariates in the second step. The counterfactual distributions are then estimated by replacing either the estimated coefficients or the distribution of characteristics in one sector by the other sectors' estimated coefficients or the distribution of characteristics (Melly (2006), p. 111).

The full decomposition results are ploted in Figures A4.1-A4.3 and summarised in Table A4.13 in the Appendix. The part of the total (i.e. unconditional) earnings differential explained by differences in returns to (observed) characteristics (interpreted as the sector pay gap) is presented in Table 4.10. For each period and gender these results are similar to the results obtained using a 'dummy variable' approach in Table 4.8.

Table 4.10: Decomposition of public-private sector earnings differential at different percentiles: differences in returns to characteristics

	LFS 1995-2003		LSMS 2002-2003		LFS 2004-2008	
Percentile:	Men	Women	Men	Women	Men	Women
10th	-0.078 (-4.21) **	-0.043 (-2.23)*	0.043 (1.09)	-0.072 (-2.37)*	0.170 (11.57) **	0.122 (18.98) **
30th	-0.066 (-3.66) **	-0.037 (-2.28)*	-0.016 (-0.62)	-0.013 (-0.52)	0.131 (13.85) **	0.158 (21.88) **
50th	-0.063 (-3.67) **	-0.058 (-3.83) **	-0.062 (-2.78) **	0.014 (0.66)	0.103 (11.69) **	0.118 (19.94) **
70th	-0.092 (-4.97) **	-0.109 (-8.53) **	-0.079 (-3.64) **	-0.044 (-1.93)	0.076 (7.83) **	0.052 (7.51) **
90th	-0.153 (-6.42) **	-0.188 (-9.25) **	-0.130 (-3.37) **	-0.259 (-4.70) **	-0.000 (-0.02)	-0.059 (-5.33) **

Notes to Table 4.10: Decomposition estimation procedure implemented by estimating 100 quantile regressions in each sector accounting for: labour force experience, educational qualification, marital status, settlement type, region, nationality (except in LSMS), industry branch, occupational affiliation (except in LSMS) and year. The variance has been estimated by bootstrapping the results 100 times. Coefficients component contribution to the log difference in real hourly earnings between the public and private sectors are presented. The *t* test reported in parentheses. ** and * denote significance at the 0.01 and 0.05 level respectively. The full decomposition results are presented in Figures A4.1, A4.2 and A4.3 and in Table A4.13 in the Appendix.

Data Source: LFS 1995-2003, LSMS 2002-2003 and LFS 2004-2008

In particular, removing differences in characteristics, Table 4.10 shows that during the 1995-2003 period, the public sector workers received statistically significantly lower earnings than workers in the private sector. The public sector pay penalty increased for higher percentiles.

The part of the total earnings differential accounted by differences in coefficients obtained by pooling LSMS 2002-2003 data show no statistically significant public sector pay gap for male workers below the median but a significantly negative gap for workers at and above the median. The estimates for public sector female workers during 2002-2003 were statistically significant only at both ends of the earnings distribution but the gap was three times larger at the top-end than at the bottom-end.

During 2004-2008 most public sector workers received higher earnings than workers in the private sector. The public sector pay premium for both men and women decreased monotonically from the bottom-end to the top-end of the earnings distribution. The public sector pay premia are statistically significantly different from zero at all the percentiles except at the top-end percentile for male workers whereas at the top-end percentile for female workers the premium translates into a statistically significant penalty.

Hence, the results from the decompositions of differences in distribution reinforce the previous finding that workers at the upper-end of the earnings distribution tended to lose more during 1995-2003 and to gain less during the 2004-2008 period. However, caution is required when interpreting these estimates. As pointed by Lucifora and Meurs (2004) although the earnings differential due to coefficients is usually referred to as the 'unexplained' part with respect to what is explained by characteristics, decomposition may also over or under estimate the residual depending on whether omitted variables are positively or negatively correlated with productivity as well as depending on the distribution of the omitted variables across sectors. We therefore now consider the public sector as endogenous explanatory variable.

(v) Public Sector as Endogenous Explanatory Variable

The public-private sector earnings gap is estimated to this point by methods which assumed random selection into the public sector conditional on control variables. The problem is that the P might be endogenous i.e. correlated with the error. In particular, the estimates produced in the previous sub-section may not single out the true effect of public sector status on pay given that the workers may self-select on the basis of their unobserved characteristics such as tastes and productivities. In policy-evaluation terms this relates to a missing data

problem: we are not able to observe the earnings of public sector workers had they been employed in the same capacity in the private sector and *vice versa.*

As pointed by Brainerd (2002) one can argue that worker self-selection during the large-scale privatisation in a transition economy is likely to be negligible at least because of limited worker mobility in the short run. However, another related issue is measurement error. In particular, public sector status may be mismeasured given that the data is self-reported. In her study on public-private sector earnings differentials in Russia, Brainerd (2002) suggested that the OLS estimates may actually be biased downward due to the probable measurement error in ownership status reported by workers. This is likely given the workers' confusion due to rapidity of the mass privatisation program or due to the ambiguous ownership status of their firms. A similar argument was made concerning contracted-out workers in the UK by Disney and Gosling (2003).

In this section we primarily attempt to control for the measurement error in cross-sectional estimates of the public sector pay gap. The measurement error problem has a similar statistical structure to the omitted variable problem. If we start from the OLS regression model:

$$\ln w_i = \alpha + \beta' x_i + \gamma P^*_i + \varepsilon_i \qquad (4.12)$$

where P_i^* is a non-observed true public sector status instead of which we have a measure P_i then the measurement error is given by: $u_i = P_i - P^*_i$. Hence, the (4.12) can be re-written as:

$$\ln w_i = \alpha + \beta' x_i + \gamma P_i + (\varepsilon_i - \gamma u_i) \qquad (4.13)$$

Under the classical errors-in-variables (CEV) assumption the measurement error is uncorrelated with x_i and the unobserved explanatory variable P_i^* but correlated with P_i since $P_i = P^*_i + u_i$. If CEV holds the OLS estimator $\hat{\gamma}$ in the equation (4.13) will be biased towards zero.

We can use an instrumental variable (IV) procedure to correct for a measurement error problem. In order to do that we need an IV for P_i. Such an IV must be correlated with P_i, uncorrelated with ε and uncorrelated with the measurement error u. Hence, both P_i and IV mismeasure P_i^* but their measurement errors are assumed to be uncorrelated while they are correlated throught their dependence on P_i^* (Wooldridge, 2003).

We assume that a variable $\bar{x}_j$ for the jth worker's characteristic (for example occupation or industry branch affiliation) which is the proportion of people with this characteristic who are in the public sector satisfies these conditions. In particular, it is reasonable to assume that the greater the proportion of people with jth characteristic in the public sector the higher the likehood that an individual with the jth characteristic works in the public sector. If we calculate these variable means from administrative data supplied by employers the 'noise' should be orthogonal to the difference between reported and actual public sector status.

Since administrative data contain the information on employers' ownership type, industry branch and the number of employees by skill qualification, we use the industry branch proportions of the public sector employees as an IV. We argue that changes in the proportions among industry branches in the public sector are caused mainly by privatisation. A similar approach is proposed by Disney and Gosling (2003). They used the proportion of each occupation in the public sector from employer-provided data (i.e. NES) matched into individual reported data (i.e. BHPS) to correct for a measurement error in estimating changes in the public sector pay effects resulting from privatisations (i.e. competitive tendering (CCT) and contracting out) in the UK during 1990s.

Moreover, workers who remain in the public sector subsequent to privatisations might not be a random sample of workers. Hence, we argue that changes in the proportions among industry branches in the public sector can be a suitable instrument to control for measurement error as well as endogeneity in the public sector status arising from the large-scale privatisations given that these changes capture the effect of privatisation.

Acknowledging that the public sector effect may vary with a worker's skill level we apply the IV procedure on groups of workers according to their educational qualification and gender. Therefore, first, we calculate the industry branch proportions in the public sector for each skill group by gender from administrative data. The LFS data is then divided into three skill groups for each gender separately. The high skilled group includes workers with college and university degrees and above. The skilled group includes workers with high school educational level. The unskilled group includes workers with primary school or less. In each of the six groups (i.e. by gender and skill), based on reported industry branch an individual is assigned the proportion of its industry branch in the public sector calculated from

administrative data. This imputed variable z is then used in two stage least squares (2SLS) instrumental variable procedure as an IV to correct for the measurement error.

Formally the 2SLS can be written in a form of two OLS equations which are estimated by a two step procedure. In the first step we estimate:

$$P_i = \pi + \eta' x_i + \delta z_i + v_i \tag{4.14}$$

where z_i is a constructed IV, x_i is a set of workers' characteristics, π is a constant and v_i is an error term. In a second stage we estimate:

$$\ln w_i = \alpha + \beta' x_i + \gamma \hat{P}_i + \varepsilon_i \tag{4.15}$$

We can also test whether P_i is an exogenous variable in which case there is no need to instrument. In particular, since z_i is uncorrelated with ε, P_i is uncorrelated with ε if and only if v is uncorrelated with u. In order to test this we estimate:

$$\ln w_i = \alpha + \beta' x_i + \gamma P_i + \lambda \hat{v} + \varepsilon_i \tag{4.16}$$

and test the zero hypothesis (H0) on the fitted residual: $\lambda = 0$ using a t statistic. If we reject H0 at a 0.05 significance level we conclude that P_i is endogenous because v and u are correlated (Wooldridge, 2003).

An alternative approach to 2SLS adds more structure to account for the binary nature of the public sector status P_i by estimating the first-stage model in (4.14) as a latent-variable model similar to the probit model using the maximum likelihood method. Hence, the unobserved latent variable P_i^* determines whether P_i=1 or 0. The models (4.14) and (4.15) become:

$$\ln w_i = \alpha + \beta' x_i + \gamma \hat{P}_i + \varepsilon_i \tag{4.17}$$

$$P_i^* = \pi + \eta' x_i + \delta z_i + v_i$$

$$P_i = \begin{cases} 1 \ \text{if} \ P_i^* > 0 \\ 0 \quad \text{otherwise.} \end{cases}$$

The errors (ε, v) are assumed to be correlated bivariate normal with $Var(\varepsilon_i) = \sigma^2$, $Var(v_i) = 1$ and $Cov(\varepsilon_i, v_i) = \rho\sigma^2$ (Cameron and Trivedi, 2009). The model (4.17) is usually referred to as the treatment effects model because the binary endogenous regressor P_i can be viewed as a treatment indicator (Cameron and Trivedi, 2009).

The data limitation for a measurement error exercise is that the Statistical Office has not recorded industry branch structure by ownership sector before 2003. For this reason, we are able to construct and impute the IV from administrative data only in the LFS 2004-2008. Nevertheless, given that the 2004-2008 period correlates to large-scale privatisations this period is reasonably assumed to be the most affected by possible measurement error in the public sector status. In addition, for the 1995-2003 period we construct the IV from LFS data base. Finally, for the 2004-2008 period we also obtain estimates by using the IV from LFS data base to reveal differences in IV effects between administrative data IV and LFS data IV.

The results of these models are presented in Tables 4.11 and 4.12 for male and female employees separately. For each period and each group of employees each model is estimated including the year dummy variables to allow for aggregate time effects. The results of these models are presented in the first columns of each group in Tables 4.11 and 4.12. Furthermore, the models are expanded for labour force dummy variables. Labour force experience is less subject to error. The estimates from models including both year and labour force experience dummy variables are presented in the second columns of each group in Tables 4.11 and 4.12. The statistically significant coefficients are in bold. The standard errors are given in parentheses in italics. Since the individuals are clustered according to their industry branch affiliation, heteroskedasticity robust standard errors are adjusted for clustering on instrument. Controlling for clustering increases reported standard errors (Cameron and Trivedi, 2009).

Tables 4.11 and 4.12 show that the IV which is constructed from administrative data and used in LFS 2004-2008 in 2SLS models satisfies the first assumption of statistically significant correlation with the public sector status net of time period dummy variables for high skilled and skilled men and for all skills female groups. When the model is expanded to include labour force experience dummy variables the IV is not statistically significant for both skilled and unskilled male workers but remains significant for high skilled male and all skills female groups. Similar results are reported using treatment effects models.

Table 4.11: IV estimates for men

	Instrument constructed from: Administrative data 2004-2008 and used in Labour Force Survey 2004-2008						Instrument constructed from: Labour Force Survey data 1995-2003 and used in Labour Force Survey 1995-2003						Instrument constructed from: Labour Force Survey data 2004-2008 and used in Labour Force Survey 2004-2008					
	High skilled		Skilled		Unskilled		High skilled		Skilled		Unskilled		High skilled		Skilled		Unskilled	
Year dummies included	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Experience dummies included	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
2SLS First stage:																		
Dependent variable: Public Sector																		
Instrument: Industry share	**1.11**	**1.05**	**0.11**	0.01	0.09	0.02	**0.52**	**0.52**	**0.27**	**0.22**	**0.13**	**0.09**	**1.90**	**1.83**	**0.39**	**0.29**	**0.30**	**0.21**
	(0.07)	*0.06*	*(0.03)*	*(0.03)*	*(0.06)*	*0.07*	*(0.04)*	*(0.05)*	*(0.20)*	*(0.02)*	*(0.03)*	*(0.03)*	*(0.08)*	*(0.08)*	*(0.04)*	*(0.04)*	*(0.07)*	*(0.08)*
2SLS Second stage:																		
Dependent variable: Log hourly earnings																		
Public Sector	**0.27**	**0.24**	0.96	4.87	2.07	6.91	-0.44	-0.44	-0.49	-0.61	0.38	0.42	**0.27**	**0.24**	**0.61**	0.63	**1.00**	1.27
	(0.10)	*(0.10)*	*(1.06)*	*(70.30)*	*(3.08)*	*(39.18)*	*(0.25)*	*(0.23)*	*(0.28)*	*(0.34)*	*(0.55)*	*(0.80)*	*(0.08)*	*0.08)*	*(0.23)*	*(0.33)*	*(0.47)*	*(0.76)*
Exogeneity tests																		
H0: public sector exogenous: F test (fitted residual=0)	4.43	1.66	6.56	0.24	9.97	3.95	7.95	2.83	19.81	4.49	2.45	0.95	8.48	3.30	20.19	13.08	10.99	5.50
p value	0.03	0.20	0.01	0.63	0.00	0.05	0.00	0.10	0.00	0.04	0.12	0.33	0.00	0.08	0.00	0.00	0.00	0.02
H0: weak instrument: F test (instrument=0)	250	288	11	0	2	0	146	117	202	152	20	9	566	535	170	67	16	8
Treatment Effects Model: MLE																		
Dependent variable: Public Sector																		
Instrument: Industry share	**3.89**	**3.80**	0.40	0.00	0.45	0.06	**4.88**	**5.00**	**1.26**	**1.16**	**0.78**	**0.70**	**6.35**	**6.32**	**0.99**	**0.82**	**0.95**	**0.83**
	(0.74)	*(0.75)*	*(0.30)*	*(0.00)*	*(0.28)*	*(0.48)*	*(0.71)*	*(0.73)*	*(0.21)*	*(0.24)*	*(0.18)*	*(0.20)*	*(0.80)*	*(0.83)*	*(0.34)*	*(0.35)*	*(0.30)*	*(0.33)*
Dependent variable: Log hourly earnings																		
Public Sector	**0.21**	**0.18**	**0.83**	0.13	**0.79**	0.16	-0.13	-0.18	**-0.18**	-0.08	-0.16	-0.16	**0.21**	**0.17**	**0.83**	**0.79**	**0.80**	**0.72**
	(0.07)	*(0.07)*	*(0.07)*	*(0.26)*	*(0.17)*	*(0.29)*	*(0.08)*	*(0.09)*	*(0.06)*	*(0.22)*	*(0.33)*	*(0.36)*	*(0.67)*	*(0.07)*	*(0.09)*	*(0.09)*	*(0.15)*	*(0.18)*
LR test of independent equations (rho=0): chi2(1)	2.11	1.58	41.43	1.45	11.58	0.00	2.95	0.74	7.60	0.02	0.03	0.10	2.82	1.98	34.21	33.42	14.87	8.02
p value	0.15	0.21	0.00	0.23	0.00	0.97	0.10	0.39	0.01	0.90	0.87	0.75	0.09	0.16	0.00	0.00	0.00	0.00
OLS																		
Public Sector	**0.14**	**0.11**	**0.21**	**0.19**	**0.16**	**0.15**	-0.02	-0.08	-0.02	**-0.05**	**-0.22**	**-0.28**	**0.14**	**0.11**	**0.21**	**0.19**	**0.16**	**0.15**
	(0.03)	*(0.03)*	*(0.01)*	*(0.01)*	*(0.02)*	*(0.03)*	*(0.04)*	*(0.04)*	*(0.02)*	*(0.02)*	*(0.04)*	*(0.04)*	*(0.03)*	*(0.03)*	*(0.01)*	*(0.01)*	*(0.02)*	*(0.03)*
Number of Observations:	2272		8351		1913		2596		8497		2628		2272		8351		1913	

Notes to Table 4.11: Administrative data 2004-2008 IV from: Semiannual Survey data on Employees and Salaries and Wages. Standard errors reported in parenthesis: 2SLS standard errors are heteroskedasticity-robust and adjusted for clustering on industry share instrument. Standard errors in Treatment effects MLE model are adjusted for clustering on industry share instrument. OLS standard errors are heteroskedasticity-robust. Coefficients in bold are statistically significant at 0.05 level. Critical value H0: instruments are weak is 16.38. *Data Source:* LFS 1995-2008

Table 4.12: IV estimates for women

	Instrument constructed from: Administrative data 2004-2008 and used in Labour Force Survey 2004-2008						**Instrument constructed from: Labour Force Survey data 1995-2003 and used in Labour Force Survey 1995-2003**						**Instrument constructed from: Labour Force Survey data 2004-2008 and used in Labour Force Survey 2004-2008**					
	High skilled		**Skilled**		**Unskilled**		**High skilled**		**Skilled**		**Unskilled**		**High skilled**		**Skilled**		**Unskilled**	
Year dummies included	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Experience dummies included	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
2SLS First stage:																		
Dependent variable: Public Sector																		
Instrument: Industry share	**0.79**	**0.75**	**1.70**	**1.53**	**0.76**	**0.61**	**0.26**	**0.26**	**0.41**	**0.32**	**0.18**	**0.15**	**0.81**	**0.77**	**1.70**	**1.54**	**1.45**	**1.34**
	(0.03)	*(0.03)*	*(0.05)*	*(0.04)*	*(0.09)*	*(0.10)*	*(0.02)*	*(0.02)*	*(0.05)*	*(0.04)*	*(0.04)*	*(0.04)*	*(0.03)*	*(0.03)*	*(0.05)*	*(0.04)*	*(0.08)*	*(0.08)*
2SLS Second stage:																		
Dependent variable: Log hourly earnings																		
Public Sector	0.14	0.09	**0.38**	**0.33**	**0.62**	**0.67**	-0.01	-0.03	-0.09	-1.18	**-1.17**	**-1.38**	0.14	0.09	**0.38**	**0.34**	**0.32**	**0.30**
	(0.08)	*(0.08)*	*(0.05)*	*(0.06)*	*(0.24)*	*(0.30)*	*(0.12)*	*(0.19)*	*(0.62)*	*(0.78)*	*(0.48)*	*(0.55)*	*(0.07)*	*(0.08)*	*(0.05)*	*(0.06)*	*(0.08)*	*(0.01)*
Exogeneity tests																		
H0: public sector exogenous: F test: fitted residual=0	1.34	0.53	19.72	2.46	17.93	6.28	0.52	0.14	40.69	5.51	10.25	8.10	1.46	0.63	19.52	3.24	12.49	10.4
p value	0.25	0.47	0.00	0.12	0.00	0.02	0.47	0.71	0.00	0.02	0.00	0.01	0.23	0.43	0.00	0.08	0.00	0.00
H0: weak instrument: F test (instrument=0)	796	671	1254	1324	71	34	163	168	67	57	20	13	729	698	1156	1936	353	295
Treatment Effects Model: MLE																		
Dependent variable: Public Sector																		
Instrument: Industry share	**3.48**	**3.49**	**4.89**	**4.64**	**1.81**	**1.62**	**3.15**	**3.36**	**1.72**	**1.51**	**0.98**	**0.87**	**3.60**	**3.6**	**5.25**	**5.06**	**4.32**	**4.12**
	(0.25)	*(0.25)*	*(0.09)*	*(0.90)*	*(0.84)*	*(0.79)*	*(0.43)*	*(0.47)*	*(0.47)*	*(0.49)*	*(0.29)*	*(0.34)*	*(0.28)*	*(0.29)*	*(0.68)*	*(0.69)*	*(0.78)*	*(0.80*
Dependent variable: Log hourly earnings																		
Public Sector	**0.19**	**0.16**	**0.38**	**0.31**	**0.70**	**0.68**	0.09	0.04	**-0.19**	**-0.31**	**-0.34**	-0.27	**0.19**	**0.16**	**0.37**	**0.31**	**0.29**	**0.27**
	(0.05)	*(0.05)*	*(0.05)*	*(0.06)*	*(0.19)*	*(0.16)*	*(0.07)*	*(0.07)*	*(0.07)*	*(0.08)*	*(0.10)*	*(0.16)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.07)*	(0.07)
LR test of independent equations (rho=0): chi2(1)	0.23	2.89	4.68	2.54	7.05	8.91	0.26	4.85	22.33	15.59	4.87	0.28	0.33	1.74	4.16	3.02	3.77	3.74
p value	0.63	1.48	0.03	0.11	0.00	*0.00*	0.61	0.03	0.00	0.00	0.03	0.60	0.56	0.19	0.04	0.08	0.05	0.05
OLS																		
Public Sector	**0.18**	**0.13**	**0.29**	**0.23**	**0.17**	**0.14**	0.08	0.03	**0.09**	0.02	**-0.13**	**-0.19**	**0.18**	**0.13**	**0.29**	**0.23**	**0.17**	**0.14**
	(0.03)	*(0.03)*	*(0.01)*	*(0.01)*	*(0.03)*	*(0.03)*	*(0.04)*	*(0.04)*	*(0.02)*	*(0.02)*	*(0.04)*	*(0.04)*	*(0.03)*	*(0.03)*	*(0.01)*	*(0.01)*	*(0.03)*	*(0.03)*
Number of Observations:	2414		5588		1188		2333		6101		1605		2414		5588		1188	

Notes to Table 4.12: See Notes to Table 4.11.

Data Source: LFS 1995-2008

As expected, for most of the groups where the IV is statistically significant the 2SLS estimator of the public sector pay gap is larger than the OLS estimator. This confirms that the classical errors-in-variables (CEV) assumption holds. However, the standard error is also larger. Therefore, a 95% confidence interval using OLS is much tighter than that using the IV. In fact the 95% confidence interval actually includes the OLS estimator in most cases. For this reason we also test whether the difference between 2SLS and OLS is statistically significant. This is done by performing an exogeneity test of statistical significance of the fitted residuals as given by equation (4.16). The robust Durbin-Wu-Hausman (DHW) F test and p values are reported in Tables 4.11 and 4.12.

The exogeneity test shows no statistically significant difference between the 2SLS and OLS estimates for male high skilled and female skilled workers when the model is expanded for labour force experience dummies. The same is confirmed by the treatment effects model. Similarly, for high-skilled female workers, the F test of the fitted residual suggests that the public sector is exogenous and hence the OLS estimator is more efficient than the 2SLS estimator. If we compare the 2SLS and treatment effects models for high skilled men, and high skilled and skilled women obtained by administrative IV and LFS IV the results are identical.

The difference between estimates obtained by administrative IV and LFS IV becomes visible only for skilled and unskilled men, and unskilled women. In particular, for skilled and unskilled male workers the IV constructed from LFS data is positive and statistically significant. The 2SLS public sector estimated premia are large but statistically insignificant after controlling for labour force experience due to an increase in standard errors for both skilled and unskilled men. In addition, the F test on an instrument (which is simply the square of the t statistics) is lower than the rule of thumb value of 10 for the unskilled men indicating a weak instrument problem (Cameron and Trivedi, 2009)[29].

The coefficients estimated by the treatment effects model are similar in magnitude and sign to 2SLS but the standard errors are considerably lower. Hence, by imposing more structure the treatment effects models suggest a statistically significant public sector pay

[29] or then 16.38 which is the 2SLS size of nominal 5% Wald test critical value suggested by Stock and Yogo (2005), (Cameron and Trivedi, 2009).

'mark-up' for both skilled and unskilled male workers which is about four times greater than the OLS estimates. Moreover, similarly to F test of the fitted residual in 2SLS the LR test of independent equations in treatment effects models rejects the null hypothesis that the error correlation is zero indicating that the OLS estimates for skilled and unskilled male workers may be biased towards zero.

Similar conclusion holds for unskilled female workers for whom the public sector pay premium estimated in 2SLS and treatment effects models using both administrative and LFS IV is greater than the OLS estimators. But the premium estimated using an administrative IV is about twice as great as that estimated using the LFS IV.

Finally, and opposite to that shown for the 2004-2008 period, the public sector pay effects using a 1995-2003 LFS IV have in most cases negative signs. In particular, the 2SLS estimates for high skilled and skilled male groups are much larger than the OLS estimates but the standard errors are also large so that the coefficients are statistically insignificant. Both male and female unskilled groups indicate the weak instrument problem.

Summarising the results, it can be concluded that both 2SLS and treatment effects instrumental variable procedures confirmed the OLS predictions about a negative public sector pay gap during 1995-2003 and a positive gap during the 2004-2008 period in most cases. Moreover, the 2SLS and treatment effects public sector pay gap estimates are not only of similar sign but of a similar size, too. In particular, both IV methods suggested that the OLS estimates may be biased towards zero and hence indicated that the classical errors-in-variables (CEV) assumption holds, but in most of the cases the public sector regressor is not found to be endogenous.

At this point it is important to emphasise that the self-reported datasets do not contain instruments that would provide rational exclusion restrictions when identifying the individual worker's sector choice. In this context we argue that the application of proxies for unobserved 'innate ability' is by no means justifiable when the invalid proxies are used. For example, even if we had parental background characteristics (as suggested by Dustmann and Soest (1998)) at our disposal these would not be of much help. As explained at the beginning of this chapter, the transition changed the institutional setting fundamentally from the world in which parents of the individuals covered by the analysis worked. Indeed observed workers in Serbia

not only participate in a different labour market but live in a different country from the one in which their parents lived.

Furthermore, in the study on the public-private sector pay differentials in Serbia, Jovanović and Lokshin (2003) tested potential instruments from LFS data to correct for sector self-selection. They tried to use the number of unemployed in the household, the number of pensioners in the household and the proportion of non-wage income in total individual income as variables. However, they found all these variables insignificantly different from zero in the selection equation. Faced with the lack of the instruments they used marital status and the number of jobholders in the household as identification of the public sector status. Nevertheless, Jovanović and Lokshin (2003) found that the number of jobholders in the household had a significant effect on sector choice of females but not of males. We argue that the number of jobholders in the household may pick up partially a tendency towards job security and associated benefits when the formal and informal sectors co-existed but these were not likely to be decisive during the major period of large-scale privatisations of the public sector.

Indeed, the large-scale privatisations imply sectoral changes of jobs when majority of people actually does not move jobs. However, in these cases the measurement error may loom large. In addition, those who remain in the public sector subsequent to privatisations might not be a random sample of workers (as pointed by Disney and Gosling, 2003). Hence, we argue that the effect of privatisation captured by changes in public sector industry proportions can be a suitable instrument to control for endogeneity as well as measurement error. In this context, the results of the chapter for the period of large-scale privatisations indicated that workers in the public sector have lower unobserved earning potential than workers in the private sector given that the 2SLS estimator is larger than the OLS estimator.

In the related empirical literature on 'union' effect researchers suggested that although we are not certain about the true size of the OLS bias we can still have an idea about it. For example, Chowdhury and Nickell (1982) found that the cross-sectional estimate is of a right magnitude given that the measurement error bias offsets the omitted quality variables bias. Lewis (1983) and Freeman (1984) suggested that the OLS estimates provide an upper bound whereas the longitudinal estimates provide a lower bound of the 'true' effect.

Nevertheless, Disney and Gosling (2003) showed that this may not be the case when estimating changes in the public sector pay effects resulting from privatisations. In particular, Disney and Gosling (2003) estimated changes in the public sector pay effects caused by competitive tendering (CCT) and contracting out in the UK during 1990s by educational level and gender. They found that college educated men are negatively selected into the public sector and hence the negative cross-sectional (i.e. OLS) premium translates into the positive after controling for selection (i.e. first differences estimator). They found that the longitudinal estimates are actually the preferred ones since the differential is biased downward by measurement error and upward by endogenous job moves. However, the lack of the panel data constraints this kind of estimation in this chapter and is hence left for the future research.

4.6.3 Summary of the Results from Regression Analysis

The empirical anaysis in this chapter had five goals. First, we tested whether there was a public-private sector earnings differential on average and how it changed during the fourteen year long period of economic transition, from 1995 until 2008. The OLS results showed that the public sector pay gap was negative but grew to positive during the mature period of economic transition. In particular, the conditional public sector pay effect was statistically significantly negative from 1997 until 2002 for men and from 1998 until 2002 for women. This effect became statistically significantly positive from 2005 until 2008 for men and from 2007 until 2008 for women.

In addition, we tested for the role of personal and job characteristics of workers. Labour force experience effects were poorly determined in the real hourly earnings specifications during 1990s. This is consistent with findings in other transitional countries where experience obtained under the communist regime was not valued by the new market system (for example Flanagan (1995) for Czech Republic, Adamchik and Bedi (2000) for Poland, Jovanović and Lokshin (2004) for Moscow). However, in contrast to other transition economies, returns to all educational levels higher than primary school education were contracting from 1995 to 2000 in Serbia. This is not surprising given the economic recession during 1990s. The returns to education started to increase from 2001 and 'catch-up' the levels

observed in other transitional economies during the period of structural reforms and large-scale privatisations (i.e. 2004-2008).

Our second goal was to test whether the public sector pay effect for workers with similar characteristics varied across the earnings distribution. The pooled quantile regressions showed: first, that the public sector pay gap proved sensitive to stages of economic transition at all selected percentiles of the earnings distribution and second, that the public sector pay gap correlated to a worker's position in the earnings distribution. With respect to the first conclusion, the sign of the conditional public sector pay gap at most of the percentiles was negative during 1995-2003 period and positive during 2004-2008 period. With respect to second conclusion, the results indicated that the public sector compressed earnings during the whole period of economic transition in Serbia. In particular, the inequality-reducing effect for public sector male workers appeared similar during 1995-2003 and 2004-2008 but the whole distribution of differentials had been shifed upwards from penalties to premia.

Our third goal was to compare the obtained estimates with the results of the previous study that used the OLS and quantile regression methods on the same data sets but from 1995 until 2000 for male employees, aged between 18 and 64. This study was accomplished by Reilly (2003) and showed no settled pattern in sector pay gap estimates over the years and across the earnings distribution. Our replication of this study indicated a possible measurement error in relation to the definition of the hourly wage, thereby biasing the estimates of the conditional public sector wage gap. In particular, our estimator obtained by using a total pay compensation (regular wage plus non-wage benefits) is found to be lower by 14% on average. This fits broadly to the difference in the non-wage benefits share in total remuneration between the public and private sectors.

Our fourth goal was to test the robustness of the quantile regression estimates obtained from a 'dummy variable' approach. So, the public sector pay effects across the conditional earnings distribution are re-estimated by a decomposition method. Removing the differences in characteristics the results from the decompositions reinforced the previous finding that the public sector workers received statistically significantly: lower earnings during the 1995-2003 period and higher earnings during the 2004-2008 period than workers in the private sector. Moreover, this method also suggested that the public sector pay penalty increased for higher

percentiles during 1995-2003 and that the public sector pay premium decreased monotonically from the bottom-end to the top-end of the earnings distribution during 2004-2008 for both men and women.

Our fifth goal was to test whether there was a measurement error in the public sector status resulting from workers confusion and/or ambigous ownership types during the period of large-scale privatisations. For this purpose, an instrument constructed from an employer-provided aggregated data was matched into a self-reported individual level data. The instrument was based on the changes in the proportions among industry branches in the public sector. We argued that these changes were caused mainly by privatisation and hence can also be a suitable instrument for the endogeneity. The public sector pay effects are then estimated for groups of workers according to their educational qualification by using two stage least squares (2SLS) and treatment effects instrumental variable procedures. The public sector pay gap estimated by both 2SLS and treatment effects confirmed the OLS predictions about the sign of the public sector pay gap. Furthermore, both IV methods indicated that the public sector pay gap during the large-scale privatisations (i.e. 2004-2008 period) declined with the higher educational qualification.

Finally, 2SLS and treatment effects methods suggested that the OLS estimates of the public sector pay gap during the large-scale privatisations (i.e. 2004-2008 period) may be biased toward zero. If the results are interpreted in the context of measurement error both IV methods indicated that the classical errors-in-variables (CEV) assumption holds. In addition, if the results are interpreted in the context of endogeneity both IV methods indicated that workers in the public sector have lower unobserved earning potential than workers in the private sector.

4.7 Conclusion

This chapter has examined the public-private sector earnings differentials in Serbia over the period of economic transition from 1995 to 2008. The economic transition in Serbia can be divided into two stages, prior and after 2000. During the 1990s the private sector mainly consisted of large number of small firms and entrepreneurships emerging in small but

profitable segments of the market. Systematic economic reforms and large-scale privatisations programs were launched from 2001.

Given the stages of economic transition and break in LFS data methodology in 2004 we analysed the public sector pay effects by using LFS 1995-2003 and 2004-2008 separately. The LSMS data is used as an additional source of individual level data for 2002 and 2003 to show changes in the public sector pay gap relative to 2004-2008. At the final point of the analysis employer-provided administrative data from official statistics are explored as a third source of data for the purpose of instrumental variable creation which corrected for a measurement error as well as endogeneity in the public sector status arising from the large-scale privatisations.

The chapter presented the public sector pay effects based on four analyses: OLS, quantile regressions, decompositions of differences in distribution, 2SLS and treatment effects instrumental variable procedures which all confirm: first, a negative public sector pay gap during the 1995-2003 period; second, a positive public sector pay gap during the 2004-2008 period and third, a public sector inequality reducing effect relative to the private sector.

The results obtained in this chapter are consistent with the predictions of the public sector monopsony model. In particular, theory laid out in chapter 3 suggested the negative public sector pay gap relative to the competitive private sector given that the public sector exerts its monopsony power. The model predicts that the gap will increase initially but the whole-sale privatisation of public sector activities is expected to decrease the gap due to adjustments in the public sector wage-employment setting to competitive environment.

Indeed, the empirical results showed that the public sector pay penalty first increased and later closed down. Moreover, the decline in the public sector pay penalty was found to correlate to the size of the public sector in terms of employment. In particular, the chapter found that the public sector pay penalty transferred into a premium with the launch of large-scale privatisations. Finally, the public sector monopsony model suggested that the earnings distribution is expected to be more compressed in the public sector than in the private sector. Theory predicts that public sector exerts more power over skilled than over unskilled workers which should result in more negative or less positive public sector pay gap at the upper end of the earnings distribution which is also confirmed by the empirical results.

4.8 Appendix

Table A4.1: Description of Variables Used in the Analysis

Variable name	Variable Description
	Demographic Variables
Married	=1 if the individual is married; otherwise 0.
Single	=1 if the individual is single; otherwise 0.
Divorced/Widowed[1]	=1 if the individual is divorced or widowed; otherwise 0.
Serbian	=1 if the individual's nationality is Serbian; otherwise 0.
Montenegrin	=1 if the individual's nationality is Montenegrian; otherwise 0.
Other[1]	=1 if the individual's nationality is some other; otherwise 0.
	Region and Location Variables
Belgrade	=1 if the individual lives in capital Belgrade; otherwise 0.
Central Serbia	=1 if the individual lives in Central Serbia; otherwise 0.
Vojvodina[1]	=1 if the individual lives in Vojvodina; otherwise 0.
Rural[1]	=1 if the individual lives in the village; otherwise 0.
Urban (City)	=1 if the individual lives in the city; otherwise 0.
	Education Level and Labour Force Experience Variables
No Education	=1 if the individual has no education or has incomplete primary education; otherwise 0.
Primary[1]	=1 if the individual has primary education; otherwise 0.
Secondary	=1 if the individual has secondary education; otherwise 0.
College	=1 if the individual has high education; otherwise 0.
University	=1 if the individual has university education; otherwise 0.
Master	=1 if the individual has master degree; otherwise 0.
PhD	=1 if the individual has PhD degree; otherwise 0.
Labour Force Experience <=5 years[1]	=1 if the individual has less or five years of working experience; otherwise 0.
5<Labour Force Experience<=10 years	=1 if the individual has more than five and less or ten years of working experience; otherwise 0.
10<Labour Force Experience<=20 years	=1 if the individual has more than ten and less or twenty years of working experience; otherwise 0.
20<Labour Force Experience<=30 years	=1 if the individual has more than twenty and less or thirty years of working experience; otherwise 0.
Labour Force Experience>30 years	=1 if the individual has more than thirty years of working experience; otherwise 0.
Labour Force Experience^2 (Years/100)	Labour Force Experience squared of individual in years (divided by 100)
	Worker Occupation Variables
Farmer	=1 if the individual is a farmer; otherwise 0.
Miner, Worker in Industry or Similar	=1 if the individual is a miner, industrial or similar worker; otherwise 0.
Worker in Trade	=1 if the individual is worker in trade; otherwise 0.
Worker in Service Sector[1]	=1 if the individual is worker in the service sector; otherwise 0.
Welfare Worker	=1 if the individual is welfare worker; otherwise 0.
Worker in Administration (Clerk)	=1 if the individual is worker in government institution or administration; otherwise 0.
Manager	=1 if the individual is manager; otherwise 0.
Professional or Artist	=1 if the individual is professional or artist; otherwise 0.
Worker in Other Occupation	=1 if individual works in some other occupation; otherwise 0.
	Industry Branch Variables
Agriculture[1]	=1 if the individual works in agriculture and forestry; otherwise 0.
Industry and Mining	=1 if the individual works in industry sector; otherwise 0.
Construction	=1 if the individual works in construction; otherwise 0.
Trade	=1 if the individual works in trade; otherwise 0.
Catering and Tourism	=1 if the individual works in catering and tourism; otherwise 0.
Transport	=1 if the individual works in transport and communication; otherwise 0.
Financial and Other Services	=1 if the individual works in financial and other services; otherwise 0.
Government Administration	=1 if the individual works in government administration and social insurance; otherwise 0.
Education, Culture and Health	=1 if the individual works in education, culture, health and social work; otherwise 0.
	Ownership Sector Variable
Public[1]	=1 if the individual works in non privately owned enterprise; otherwise 0.
Private	=1 if the individual works in the privately owned enterprise; otherwise 0.
	Hours and Wages Variables

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Main Job Monthly Hours (natural log)	The natural logarithm of the monthly hours worked by the individual in their main job.
Main Job Monthly Wage (natural log)	The natural logarithm of the main job monthly regular wage
Main Job Monthly Earnings (natural log)	The natural logarithm of the main job monthly earnings which includes beside regular wage all additional payn
Main Job Hourly Wage (natural log)	The natural logarithm of the hourly regular wage worked by the individual in their main job.
Main Job Hourly Earnings (natural log)	The natural logarithm of the main job hourly earnings which includes beside regular wage all additional payme

Notes to Table A4.1: [1] - denotes variable omitted in estimation. *Data Sources:* Labour Force Surveys (LFS) 1995-2008 and Living Standard Measurement Surveys (LSMS) 2002-2003

Table A4.2: Proportions and Means of Variables used in Analysis from LFS and LSMS - Men

	LFS 1995-2003			LSMS 2002-2003			LFS 2004-2008		
Variables	PUBLIC	PRIVATE	z score	PUBLIC	PRIVATE	z score	PUBLIC	PRIVATE	z score
Log Monthly Earnings (din)	9.18	9.35	-11.48	9.38	9.45	-2.94			
Log Monthly Wage (din)	9.05	9.32	-17.31	9.37	9.44	-3.03	9.80	9.65	12.40
Log Monthly Hours	5.15	5.21	-15.59	5.15	5.19	-2.47	5.17	5.27	-13.56
Log Hourly Earnings (din)	4.03	4.14	-7.58	4.23	4.26	-1.32			
Log Hourly Wage (din)	3.89	4.11	-13.56	4.22	4.26	-1.42	4.63	4.38	18.50
Age (years)	43.47	35.81	27.86	42.40	37.01	14.32	43.40	38.75	22.67
Labour Force Experience <=5	0.10	0.39	-24.29	0.15	0.43	-16.87	0.11	0.26	-19.79
5<Lfe<=10 years	0.10	0.16	-7.51	0.11	0.14	-3.10	0.12	0.17	-6.04
10<Lfe<=20 years	0.30	0.20	9.40	0.28	0.21	4.24	0.26	0.24	2.35
20<Lfe<=30 years	0.35	0.19	15.92	0.31	0.17	9.48	0.31	0.22	11.12
Labour Force Experience>30	0.15	0.05	15.76	0.16	0.05	11.90	0.19	0.10	13.08
No Education	0.03	0.02	4.45	0.02	0.03	-1.04	0.01	0.02	-4.88
Primary	0.16	0.13	3.61	0.15	0.16	-1.00	0.11	0.16	-5.06
Secondary	0.60	0.74	-12.27	0.60	0.66	-3.65	0.62	0.71	-7.96
College	0.09	0.05	7.54	0.11	0.08	2.85	0.09	0.05	7.85
University	0.11	0.06	7.60	0.11	0.06	5.77	0.15	0.06	13.08
Master				0.01	0.00	1.04	0.01	0.00	4.72
PhD				0.00	0.00	1.90	0.01	0.00	4.26
Urban (City)	0.35	0.31	3.83	0.60	0.59	0.64	0.62	0.58	4.19
Rural	0.65	0.69	-3.83	0.40	0.41	-0.64	0.38	0.42	-4.19
Single	0.17	0.42	-20.60	0.17	0.29	-7.47	0.77	0.64	13.51
Married	0.78	0.53	20.28	0.79	0.69	6.80	0.19	0.31	-13.44
Divorced/Widowed	0.05	0.05	-0.09	0.03	0.03	1.16	0.04	0.05	-1.49
Belgrade	0.22	0.29	-5.93	0.19	0.21	-1.48	0.26	0.21	4.42
Central Serbia	0.51	0.44	5.85	0.26	0.28	-0.95	0.53	0.48	5.93
Vojvodina	0.26	0.27	-0.56	0.55	0.51	2.03	0.22	0.31	-10.72
Serbian	0.87	0.86	1.37				0.92	0.87	6.61
Montenegrin	0.02	0.01	1.44						
Other	0.11	0.13	-1.94				0.08	0.13	-6.54
Agriculture	0.09	0.03	13.15	0.08	0.09	-1.45	0.04	0.07	-7.91
Industry and Mining	0.43	0.27	14.12	0.41	0.16	16.49	0.32	0.37	-0.94
Construction	0.07	0.13	-7.72	0.05	0.13	-6.83	0.04	0.15	-14.91
Trade	0.06	0.32	-22.29	0.04	0.22	-14.15	0.03	0.22	-24.27
Catering and Tourism	0.02	0.09	-10.55	0.02	0.06	-6.18	0.01	0.04	-8.97
Transport	0.10	0.07	4.40	0.09	0.07	2.68	0.13	0.06	8.73
Financial and Other Services	0.05	0.07	-2.44	0.05	0.14	-8.00	0.10	0.08	4.27
Government Administration	0.08	0.00	27.66	0.10	0.00	16.08	0.19	0.00	29.17
Education, Culture and Health	0.10	0.02	16.75	0.08	0.01	9.94	0.14	0.01	21.43
Farmer	0.04	0.02	5.99				0.01	0.03	-10.95
Miner, Worker in Industry	0.40	0.28	10.46				0.33	0.48	-9.53
Worker in Trade	0.05	0.24	-17.89				0.01	0.09	-14.43
Worker in Service Sector	0.13	0.28	-13.62				0.09	0.05	4.81

Welfare Worker	0.05	0.01	14.47				0.03	0.00	11.02
Worker in Administration	0.13	0.07	8.72				0.09	0.06	6.49
Manager	0.06	0.02	9.31				0.03	0.03	0.59
Professional or Artist	0.10	0.05	7.87				0.32	0.16	15.98
Worker in Other Occupation	0.04	0.03	2.47				0.09	0.10	-3.10
1995	0.12	0.05	12.52						
1996	0.12	0.05	10.35						
1997	0.11	0.07	7.52						
1998	0.11	0.09	2.89						
1999	0.11	0.10	1.36						
2000	0.12	0.12	-0.15						
2001	0.11	0.15	-4.73						
2002	0.11	0.16	-5.87	0.75	0.66	5.60			
2003	0.10	0.22	-11.61	0.25	0.34	-5.60			
2004							0.25	0.16	12.04
2005							0.22	0.19	4.05
2006							0.20	0.20	-0.28
2007							0.18	0.21	-4.96
2008							0.16	0.24	-10.97
Observations	11949	1772		2135	778		5990	5928	

Notes to Table A4.2: The z-score is testing for the statistical differences between means and proportions across the public and private sectors. The critical value at the 0.05 level is ±1.96.

Data Source: LFS 1995-2008 and LSMS 2002-2003

Table A4.3: Proportions and Means of Variables used in Analysis from LFS and LSMS - Women

	LFS 1995-2003			LSMS 2002-2003			LFS 2004-2008		
Variables	PUBLIC	PRIVATE	z score	PUBLIC	PRIVATE	z score	PUBLIC	PRIVATE	z score
Log Monthly Earnings (din)	9.11	9.12	-0.34	9.30	9.18	4.80			
Log Monthly Wage (din)	8.95	9.07	-7.64	9.29	9.17	4.62	9.74	9.47	19.81
Log Monthly Hours	5.14	5.19	-16.48	5.11	5.11	-0.42	5.14	5.23	-11.53
Log Hourly Earnings (din)	3.97	3.93	3.15	4.19	4.06	4.49			
Log Hourly Wage (din)	3.81	3.88	-4.17	4.18	4.06	4.33	4.60	4.25	23.99
Age (years)	42.58	35.67	25.62	41.37	35.17	15.72	43.30	38.23	22.24
Labour Force Experience <=5y	0.11	0.43	-25.64	0.16	0.48	-16.51	0.11	0.31	-20.96
5<Lfe<=10 years	0.11	0.16	-6.00	0.13	0.16	-1.66	0.14	0.19	-4.45
10<Lfe<=20 years	0.36	0.21	13.79	0.33	0.23	5.83	0.31	0.25	6.01
20<Lfe<=30 years	0.35	0.17	17.97	0.32	0.12	12.30	0.34	0.20	14.55
Labour Force Experience>30	0.07	0.03	7.35	0.06	0.01	6.85	0.11	0.05	7.69
No Education	0.02	0.01	3.30	0.01	0.02	-1.20	0.01	0.03	-7.73
Primary	0.15	0.10	5.20	0.12	0.12	0.11	0.11	0.12	-2.62
Secondary	0.57	0.78	-17.89	0.53	0.66	-6.80	0.52	0.71	-12.35
College	0.11	0.05	9.97	0.15	0.11	3.04	0.13	0.06	9.49
University	0.15	0.06	12.96	0.17	0.08	7.52	0.22	0.08	15.12
Master				0.01	0.00	2.48	0.01	0.00	4.18
PhD				0.00	0.00	1.05	0.00	0.00	1.74
Urban (City)	0.34	0.37	-1.98	0.76	0.68	3.91	0.73	0.66	6.54
Rural	0.66	0.63	1.98	0.24	0.32	-3.91	0.27	0.34	-6.54
Single	0.12	0.32	-17.19	0.13	0.27	-7.90	0.75	0.67	-10.73
Married	0.76	0.59	13.36	0.74	0.65	4.76	0.14	0.24	-7.00
Divorced/Widowed	0.12	0.09	4.17	0.13	0.08	3.55	0.11	0.09	3.54
Belgrade	0.29	0.28	0.42	0.25	0.23	0.88	0.29	0.25	4.23

Central Serbia	0.45	0.42	2.54	0.25	0.30	-2.59	0.47	0.46	0.81
Vojvodina	0.26	0.30	-3.18	0.50	0.47	1.59	0.24	0.29	-5.11
Serbian	0.88	0.86	1.56				0.92	0.89	4.96
Montenegrin	0.01	0.01	0.44						
Other	0.11	0.12	-2.01				0.08	0.11	-4.94
Agriculture	0.04	0.01	7.96	0.03	0.06	-3.78	0.01	0.05	-10.36
Industry and Mining	0.29	0.20	8.83	0.27	0.12	9.39	0.14	0.30	-9.12
Construction	0.02	0.02	-0.95	0.02	0.02	-0.60	0.01	0.02	-0.07
Transport	0.11	0.57	-37.02	0.08	0.43	-19.62	0.04	0.40	-32.87
Trade	0.04	0.08	-6.63	0.02	0.07	-4.93	0.02	0.06	-7.48
Catering and Tourism	0.04	0.02	4.73	0.04	0.01	4.64	0.05	0.02	6.00
Financial and Other Services	0.08	0.07	2.18	0.05	0.16	-7.96	0.09	0.13	-3.79
Government Administration	0.07	0.00	24.27	0.09	0.00	12.07	0.13	0.00	19.45
Education, Culture and Health	0.31	0.02	46.04	0.33	0.04	22.64	0.50	0.02	49.67
Farmer	0.02	0.00	5.46				0.00	0.03	-11.41
Miner, Worker in Industry or Similar	0.18	0.11	9.10				0.04	0.15	-10.57
Worker in Trade	0.09	0.50	-32.95				0.02	0.32	-29.62
Worker in Service Sector	0.13	0.17	-4.42				0.05	0.07	-4.26
Welfare Worker	0.03	0.00	11.05				0.00	0.00	-1.41
Worker in Administration	0.30	0.14	15.67				0.11	0.07	6.64
Manager	0.03	0.01	6.75				0.02	0.02	0.37
Professional or Artist	0.17	0.04	21.84				0.61	0.24	31.00
Worker in Other Occupation	0.06	0.03	6.50				0.14	0.10	4.39
1995	0.11	0.06	7.10						
1996	0.11	0.06	8.27						
1997	0.11	0.07	6.43						
1998	0.11	0.09	2.66						
1999	0.11	0.10	0.65						
2000	0.12	0.13	-1.30						
2001	0.11	0.14	-2.62						
2002	0.11	0.15	-4.18	0.74	0.69	2.83			
2003	0.09	0.20	-9.91	0.26	0.31	-2.83			
2004							0.23	0.18	6.15
2005							0.21	0.18	3.81
2006							0.20	0.19	0.94
2007							0.18	0.22	-3.63
2008							0.17	0.23	-6.96
Observations	8341	1698		1554	661		4772	4099	

Notes to Table A 4.3: See notes to Table A4.2.

Data Source: LFS 1995-2008 and LSMS 2002-2003

Table A4.4: Estimation of main job hourly earnings in Serbia, 1995-2003

	1995		1996		1997		1998		1999		2000		2001		2002		2003	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
								Unconditional Model:										
Public Sector:	0.044	0.100	0.024	0.254	0.022	0.269	-0.074	0.097	-0.004	0.081	-0.090	-0.005	-0.041	0.156	-0.026	0.070	0.032	0.160
	(0.67)	(1.91)	(0.33)	(4.48)**	(0.40)	(5.05)**	(-1.52)	(2.16)*	(-0.09)	(1.85)	(-2.14)*	(-0.16)	(-1.14)	(4.67)**	(-0.77)	(1.91)	(1.11)	(5.10)**
								Conditional Model:										
Experience:																		
<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
5< Years<=10	-0.040	-0.051	-0.065	0.080	-0.016	0.054	0.068	0.070	-0.010	0.091	0.044	0.056	0.101	0.009	0.089	0.133	0.078	0.097
	(-0.79)	(-0.88)	(-1.07)	(1.40)	(-0.29)	(0.97)	(1.24)	(1.32)	(-0.16)	(1.65)	(0.85)	(1.12)	(2.21)*	(0.20)	(2.18)*	(3.36)**	(1.84)	(2.42)*
10< Years<=20	0.036	-0.021	0.021	0.033	0.045	0.070	0.022	0.084	0.011	0.101	0.021	0.017	0.067	0.064	0.032	0.176	0.053	0.156
	(0.65)	(-0.34)	(0.36)	(0.55)	(0.81)	(1.22)	(0.38)	(1.48)	(0.19)	(1.84)	(0.43)	(0.37)	(1.46)	(1.30)	(0.64)	(4.06)**	(1.17)	(3.30)**
20< Years<=30	0.031	0.027	-0.010	-0.060	0.018	0.107	0.002	0.019	0.012	0.174	0.069	-0.011	0.093	0.105	0.061	0.254	0.051	0.266
	(0.36)	(0.25)	(-0.11)	(-0.57)	(0.21)	(1.07)	(0.02)	(0.19)	(0.15)	(2.02)*	(0.88)	(-0.15)	(1.24)	(1.31)	(0.83)	(3.53)**	(0.68)	(3.39)**
> 30 Years	-0.033	0.176	-0.027	-0.136	0.012	0.161	-0.012	-0.039	0.013	0.253	-0.014	-0.001	0.150	0.052	0.107	0.347	0.044	0.271
	(-0.24)	(0.96)	(-0.19)	(-0.76)	(0.09)	(0.97)	(-0.09)	(-0.24)	(0.10)	(1.88)	(-0.11)	(-0.01)	(1.27)	(0.37)	(0.94)	(2.86)**	(0.38)	(2.24)*
Education:																		
No qualification	-0.043	-0.272	-0.171	-0.167	-0.084	-0.018	-0.097	-0.147	-0.181	-0.130	-0.087	-0.018	-0.053	0.024	0.016	-0.056	0.052	0.041
	(-0.54)	(-2.57)*	(-2.11)*	(-1.56)	(-1.09)	(-0.19)	(-1.10)	(-1.92)	(-2.20)*	(-1.47)	(-0.96)	(-0.13)	(-0.72)	(0.17)	(0.22)	(-0.69)	(0.58)	(0.27)
Primary																		
Secondary	0.110	0.138	0.054	0.122	0.075	0.125	0.090	0.084	0.032	0.090	0.013	0.127	0.121	0.245	0.181	0.225	0.178	0.190
	(3.13)**	(2.50)*	(1.37)	(2.47)*	(1.91)	(2.89)**	(2.27)*	(1.94)	(0.86)	(2.10)*	(0.35)	(3.51)**	(3.44)**	(5.90)**	(5.74)**	(5.78)**	(5.26)**	(4.79)**
College	0.266	0.298	0.153	0.169	0.264	0.217	0.192	0.190	0.210	0.218	0.150	0.260	0.351	0.420	0.311	0.347	0.321	0.372
	(5.16)**	(4.32)**	(2.71)**	(2.53)*	(4.52)**	(3.73)**	(3.20)**	(3.19)**	(3.58)**	(3.78)**	(2.79)**	(5.43)**	(6.56)**	(8.19)**	(5.51)**	(6.76)**	(5.74)**	(6.80)**
University	0.427	0.466	0.409	0.364	0.401	0.420	0.426	0.345	0.413	0.415	0.316	0.447	0.617	0.669	0.570	0.615	0.594	0.630
	(6.89)**	(6.51)**	(6.03)**	(5.59)**	(5.97)**	(6.84)**	(6.72)**	(5.34)**	(6.24)**	(7.22)**	(4.66)**	(9.24)**	(10.66)**	(12.49)**	(10.43)**	(12.04)**	(10.41)**	(12.31)**
Industry Branch:																		
Agriculture	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Industry & Mining	0.201	0.167	0.155	0.321	0.127	0.230	0.046	0.112	-0.017	-0.011	0.111	0.072	0.109	0.035	0.098	0.152	-0.026	0.072
	(3.20)**	(1.34)	(2.44)*	(3.02)**	(1.97)*	(1.93)	(0.74)	(1.44)	(-0.30)	(-0.11)	(2.18)*	(0.80)	(1.99)*	(0.45)	(1.70)	(1.97)*	(-0.44)	(0.67)
Construction	0.045	0.030	0.165	0.322	-0.014	0.074	-0.026	0.195	-0.027	-0.027	0.147	0.206	0.081	0.088	0.126	0.147	0.061	0.017
	(0.63)	(0.20)	(2.00)*	(2.81)**	(-0.17)	(0.45)	(-0.33)	(1.61)	(-0.36)	(-0.23)	(1.93)	(1.78)	(1.19)	(0.93)	(1.95)	(1.59)	(0.88)	(0.13)
Trade	-0.027	-0.010	0.062	0.171	-0.100	0.041	-0.112	-0.019	-0.099	-0.055	-0.069	-0.009	0.051	-0.102	0.085	0.062	0.006	0.152
	(-0.22)	(-0.07)	(0.60)	(1.33)	(-0.97)	(0.29)	(-1.23)	(-0.19)	(-1.11)	(-0.49)	(-0.89)	(-0.09)	(0.69)	(-1.24)	(1.13)	(0.73)	(0.08)	(1.52)
Catering&Tourism	0.163	0.112	0.060	0.288	-0.015	0.305	-0.204	-0.007	-0.121	0.042	-0.047	0.067	-0.030	-0.051	0.082	0.086	0.022	0.093
	(1.74)	(0.77)	(0.66)	(2.16)*	(-0.17)	(2.23)*	(-2.37)*	(-0.08)	(-1.25)	(0.35)	(-0.58)	(0.59)	(-0.31)	(-0.54)	(0.86)	(0.95)	(0.22)	(0.80)
Transport	0.314	0.271	0.384	0.540	0.221	0.574	0.211	0.442	0.115	0.251	0.152	0.199	0.269	0.097	0.288	0.293	0.150	0.180
	(4.70)**	(1.88)	(5.68)**	(4.38)**	(3.00)**	(4.47)**	(2.94)**	(4.37)**	(1.76)	(2.13)*	(2.70)**	(1.76)	(4.48)**	(1.12)	(4.72)**	(3.26)**	(2.31)*	(1.66)
Financial Services	0.257	0.256	0.385	0.587	0.360	0.523	0.302	0.303	0.094	0.263	0.134	0.232	0.196	0.041	0.230	0.185	0.130	0.196
	(3.33)**	(1.93)	(5.38)**	(5.38)**	(5.15)**	(4.31)**	(4.03)**	(3.31)**	(1.16)	(2.52)*	(2.14)*	(2.53)*	(3.24)**	(0.52)	(3.53)**	(2.27)*	(1.86)	(1.92)
Govern't Admin.	0.314	0.224	0.423	0.488	0.333	0.480	0.213	0.210	0.134	0.118	0.109	0.065	0.277	0.180	0.185	0.255	0.108	0.252

	(4.84)**	(1.66)	(6.47)**	(4.58)**	(4.88)**	(3.99)**	(3.11)**	(2.58)*	(1.98)*	(1.12)	(1.81)	(0.68)	(4.21)**	(2.40)*	(3.16)**	(3.23)**	(1.69)	(2.48)*
Education&Health	0.185	0.151	0.273	0.375	0.213	0.396	0.087	0.237	-0.073	0.114	-0.045	0.038	0.127	0.096	0.115	0.197	0.088	0.215
	(2.74)**	(1.20)	(4.16)**	(3.65)**	(3.20)**	(3.39)**	(1.25)	(2.94)**	(-1.04)	(1.14)	(-0.78)	(0.42)	(2.10)*	(1.35)	(1.90)	(2.55)*	(1.4)	(2.19)*
Occupations:																		
Farmer	0.075	-0.083	-0.130	-0.061	-0.195	-0.112	-0.079	-0.171	-0.096	-0.288	-0.128	-0.402	-0.036	-0.097	-0.007	0.133	-0.134	0.002
	(0.87)	(-0.39)	(-1.24)	(-0.38)	(-2.07)*	(-0.69)	(-0.84)	(-1.13)	(-1.05)	(-1.41)	(-1.68)	(-2.7)**	(-0.48)	(-0.90)	(-0.09)	(1.00)	(-1.42)	(0.01)
Industrial Worker	0.033	-0.046	0.080	-0.102	0.015	0.011	0.049	-0.065	0.011	0.092	0.017	0.013	0.087	-0.100	0.008	-0.078	-0.016	0.005
	(0.74)	(-0.65)	(1.54)	(-1.45)	(0.28)	(0.19)	(0.99)	(-1.04)	(0.24)	(1.41)	(0.39)	(0.22)	(2.20)*	(-1.58)	(0.22)	(-1.40)	(-0.38)	(-0.09)
Trade Worker	0.121	-0.100	0.009	-0.110	0.062	-0.015	-0.063	-0.129	-0.069	0.026	0.055	-0.102	-0.052	-0.026	-0.186	-0.036	-0.108	-0.184
	(1.05)	(-0.99)	(0.09)	(-1.14)	(0.57)	(-0.14)	(-0.75)	(-1.48)	(-0.83)	(0.31)	(0.74)	(-1.42)	(-0.79)	(-0.41)	(-2.90)**	(-0.57)	(-1.73)	(-3.71)**
Service Worker	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Welfare Worker	0.113	0.388	0.086	0.146	0.043	0.203	0.232	0.132	0.182	0.205	0.248	0.220	0.023	0.233	0.042	0.183	0.047	0.111
	(1.81)	(4.15)**	(1.38)	(1.79)	(0.51)	(2.69)**	(3.53)**	(1.98)*	(2.56)*	(2.51)*	(3.91)**	(2.53)*	(0.32)	(4.28)**	(0.65)	(2.81)**	(0.91)	(1.76)
Clerk	0.071	0.104	0.122	0.125	0.126	0.173	0.108	0.190	0.071	0.238	0.136	0.131	0.019	0.128	0.119	0.127	0.091	0.109
	(1.45)	(1.84)	(2.36)*	(2.22)*	(2.30)*	(3.33)**	(2.16)*	(3.52)**	(1.32)	(4.26)**	(2.80)**	(2.70)**	(0.48)	(3.11)**	(3.06)**	(3.17)**	(2.21)*	(2.74)**
Manager	0.275	0.440	0.446	0.565	0.292	0.455	0.303	0.460	0.245	0.450	0.341	0.320	0.143	0.180	0.225	0.392	0.227	0.254
	(3.98)**	(5.29)**	(5.70)**	(5.06)**	(3.08)**	(3.38)**	(3.88)**	(4.89)**	(2.86)**	(5.42)**	(4.64)**	(3.91)**	(2.09)*	(1.94)	(3.72)**	(6.60)**	(3.40)**	(4.00)**
Professional	0.209	0.186	0.229	0.28	0.203	0.250	0.163	0.235	0.161	0.268	0.196	0.161	0.059	0.110	0.144	0.194	0.111	0.135
	(3.77)**	(2.89)**	(3.49)**	(4.63)**	(2.98)**	(4.18)**	(2.61)**	(3.59)**	(2.53)*	(4.58)**	(3.19)**	(3.11)**	(1.15)	(2.29)*	(2.28)*	(3.65)**	(1.79)	(2.91)**
Region:																		
Belgrade	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Central Serbia	-0.405	-0.336	-0.396	-0.382	-0.450	-0.400	-0.407	-0.313	-0.411	-0.339	-0.314	-0.255	-0.329	-0.351	-0.345	-0.398	-0.246	-0.253
	(-13)**	(-8.2)**	(-11)**	(-10)**	(-13)**	(-11)**	(-12)**	(-9.0)**	(-12)**	(-11)**	(-10)**	(-8.9)**	(-11.7)**	(-11.4)**	(-11.7)**	(-13.5)**	(-8.3)**	(-7.9)**
Vojvodina	-0.263	-0.159	-0.273	-0.224	-0.289	-0.257	-0.268	-0.226	-0.225	-0.248	-0.151	-0.154	-0.162	-0.254	-0.226	-0.329	-0.179	-0.16
	(-6)**	(-3)**	(-6)**	(-5)**	(-6)**	(-6)**	(-6)**	(-5)**	(-5)**	(-5)**	(-3)**	(-4)**	(-4)**	(-5)**	(-6)**	(-9)**	(-4)**	(-4)**
Public Sector:	-0.087	-0.144	-0.127	-0.075	-0.156	-0.058	-0.234	-0.183	-0.144	-0.165	-0.245	-0.182	-0.118	-0.087	-0.100	-0.143	-0.051	-0.062
	(-1.34)	(-2.22)*	(-1.61)	(-1.15)	(-2.7)**	(-0.9)	(-4.9)**	(-3.8)**	(-2.6)**	(-3.7)**	(-5.3)**	(-4.8)**	(-3.18)**	(-2.31)*	(-3.09)**	(-4.60)**	(-1.77)	(-1.65)
Constant	3.717	3.824	3.783	3.448	4.333	3.933	4.206	3.802	4.051	3.574	4.008	3.748	3.998	3.941	4.191	4.004	4.149	3.893
	(28.8)**	(24.7)**	(29.7)**	(23.5)**	(36.1)**	(26.8)**	(36.4)**	(33.3)**	(36.1)**	(29.4)**	(38.7)**	(31.2)**	(43.9)**	(36.2)**	(46.1)**	(39.4)**	(42.3)**	(31.7)**
Adj. R-squared	0.30	0.31	0.31	0.42	0.32	0.43	0.30	0.40	0.28	0.38	0.23	0.35	0.30	0.40	0.33	0.48	0.30	0.44
Regression st.error	0.46	0.49	0.5	0.45	0.51	0.44	0.48	0.44	0.47	0.42	0.47	0.38	0.43	0.40	0.42	0.36	0.42	0.36
Breusch Pagan test	34.86	81.12	48.40	76.83	21.32	49.63	25.80	17.33	31.59	39.44	14.03	39.09	44.67	68.25	16.39	22.41	47.74	44.93
Observations	1479	1037	1468	1021	1488	1071	1486	1115	1464	1097	1634	1233	1602	1180	1556	1161	1545	1124

Notes to Table A4.4:

a) The depended variable is the log of real hourly earnings. Earnings are net of taxes, pensions and welfare benefits. They include payments for meals, transport, union benefits, credits from the firm and payment in kind. They relate to earnings received on the main job only and are expressed in October 2005 Serbian dinars.

b) All explanatory variables are categorical. All specifications include marital status, settlement type and nationality dummies.

c) The estimation procedure for the mean regression is OLS and White (1980) estimated standard errors are used to calculate 95% confidence interval. Breusch-Pagan / Cook-Weisberg test for heteroskedasticity rejects the null hypothesis of constant variance in each case. Robust *t* statistics reported beneath the coefficients. OLS regression analysis reported used STATA 8.0: ** and * denote statistical significance at the 0.01 and 0.05 level respectively using two-tailed test. *f* denotes category omitted in estimation. *Data Source*: Labour Force Survey of the Republic of Serbia 1995-2003

Table A4.5: Estimation of main job hourly earnings in Serbia, 2004-2008

	2004		2005		2006		2007		2008	
Variables	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
					Unconditional Model:					
Public Sector:	0.239	0.335	0.274	0.347	0.231	0.316	0.358	0.400	0.350	0.500
	(9.93)**	(12.66)**	(12.19)**	(13.37)**	(11.12)**	(12.93)**	(16.49)**	(16.70)**	(17.51)**	(21.76)**
					Conditional Model:					
Experience:										
<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
5< Years<=10	0.052	0.021	0.005	0.052	0.042	0.030	0.041	0.049	0.023	0.039
	(1.45)	(0.59)	(0.15)	(1.43)	(1.35)	(0.98)	(1.27)	(1.59)	(0.78)	(1.39)
10< Years<=20	0.062	0.097	0.015	0.083	0.101	0.040	0.066	0.095	0.039	0.124
	(1.63)	(2.90)**	(0.44)	(2.46)*	(3.44)**	(1.10)	(2.05)*	(2.79)**	(1.16)	(3.29)**
20< Years<=30	0.053	0.131	0.009	0.181	0.061	0.046	0.071	0.119	0.011	0.114
	(0.99)	(2.57)*	(0.15)	(3.61)**	(1.56)	(0.68)	(1.44)	(2.10)*	(0.21)	(1.51)
> 30 Years	0.109	0.059	0.048	0.219	-0.013	0.085	0.015	0.084	-0.046	0.139
	(1.26)	(0.74)	(0.51)	(2.96)**	(-0.22)	(0.78)	(0.19)	(0.98)	(-0.52)	(1.12)
Education:										
No qualification	-0.049	-0.154	-0.095	-0.129	-0.014	-0.059	-0.113	-0.213	-0.043	-0.061
	(-0.63)	(-1.68)	(-1.13)	(-1.41)	(-0.21)	(-0.61)	(-1.45)	(-1.45)	(-0.56)	(-0.54)
Primary	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Secondary	0.122	0.134	0.102	0.157	0.161	0.116	0.076	0.221	0.131	0.159
	(3.58)**	(3.49)**	(3.09)**	(4.16)**	(5.72)**	(3.41)**	(2.42)*	(7.40)**	(4.73)**	(5.63)**
College	0.277	0.297	0.271	0.375	0.34	0.274	0.195	0.361	0.27	0.309
	(5.47)**	(5.88)**	(5.59)**	(8.06)**	(7.39)**	(6.41)**	(4.37)**	(8.31)**	(6.42)**	(7.98)**
University	0.55	0.509	0.509	0.575	0.617	0.534	0.453	0.649	0.538	0.640
	(11.06)**	(10.03)**	(10.16)**	(11.74)**	(14.87)**	(12.46)**	(9.44)**	(15.88)**	(12.47)**	(16.27)**
Master degree	0.522	0.726	0.504	0.635	0.341	0.797	0.489	1.004	0.811	0.812
	(3.45)**	(6.54)**	(4.38)**	(6.51)**	(1.46)	(6.24)**	(2.03)*	(5.46)**	(6.71)**	(6.90)**
PhD degree	0.82	0.873	0.753	1.103	1.178	0.621	0.939	0.778	1.149	1.007
	(9.22)**	(5.23)**	(7.06)**	(4.75)**	(9.80)**	(10.12)**	(6.46)**	(15.69)**	(10.31)**	(14.04)**
Industry Branch:										
Agriculture	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Industry & Mining	0.131	0.065	0.339	0.173	0.259	0.259	0.323	0.134	0.170	0.180
	(2.40)*	(0.74)	(5.51)**	(1.59)	(4.67)**	(2.84)**	(4.74)**	(1.30)	(3.37)**	(2.88)**
Construction	0.130	-0.061	0.362	0.354	0.304	0.258	0.341	0.084	0.171	0.172
	(2.11)*	(-0.51)	(5.44)**	(2.44)*	(4.98)**	(2.21)*	(4.52)**	(0.59)	(3.03)**	(1.93)
Trade	-0.020	0.005	0.337	0.136	0.237	0.365	0.321	0.115	0.078	0.175
	(-0.30)	(0.06)	(5.09)**	(1.24)	(3.79)**	(3.84)**	(4.40)**	(1.07)	(1.41)	(2.82)**

Catering&Tourism	-0.111	0.015	0.098	0.104	0.045	0.273	0.240	0.066	0.121	0.121
	(-1.43)	(0.16)	(1.08)	(0.88)	(0.56)	(2.59)**	(2.70)**	(0.56)	(1.52)	(1.45)
Transport	0.205	0.208	0.392	0.317	0.267	0.394	0.322	0.233	0.120	0.151
	(3.60)**	(2.18)*	(5.94)**	(2.63)**	(4.44)**	(4.02)**	(4.35)**	(2.03)*	(2.18)*	(2.07)*
Financial &Other S	0.157	0.132	0.303	0.329	0.296	0.434	0.330	0.252	0.102	0.214
	(2.60)**	(1.49)	(4.28)**	(3.01)**	(4.92)**	(4.55)**	(4.41)**	(2.41)*	(1.83)	(3.36)**
Govern't Administr.	0.296	0.273	0.535	0.414	0.367	0.461	0.462	0.244	0.147	0.235
	(5.03)**	(3.21)**	(7.76)**	(3.78)**	(5.80)**	(4.89)**	(6.11)**	(2.32)*	(2.60)**	(3.43)**
Education&Health	0.103	0.147	0.303	0.250	0.227	0.373	0.262	0.240	0.075	0.219
	(1.71)	(1.78)	(4.57)**	(2.32)*	(3.88)**	(4.08)**	(3.35)**	(2.35)*	(1.32)	(3.45)**
Occupations:										
Farmer	-0.367	-0.160	-0.136	-0.033	-0.226	-0.228	-0.001	0.075	-0.215	0.017
	(-4.23)**	(-1.33)	(-1.54)	(-0.29)	(-2.10)*	(-1.74)	(-0.00)	(0.51)	(-1.51)	(0.12)
Industrial Worker	-0.058	-0.047	-0.007	-0.082	-0.073	-0.004	0.026	-0.020	0.024	-0.020
	(-1.37)	(-0.75)	(-0.16)	(-1.23)	(-1.68)	(-0.08)	(0.65)	(-0.33)	(0.64)	(-0.35)
Trade Worker	-0.093	-0.103	-0.210	-0.095	-0.271	-0.179	-0.125	-0.068	-0.073	-0.066
	(-1.31)	(-1.71)	(-3.11)**	(-1.45)	(-4.59)**	(-2.92)**	(-2.13)*	(-1.15)	(-1.37)	(-1.21)
Service Worker	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Welfare Worker	0.106	0.093	-0.021	0.000	0.025	0.000	0.033	0.000	0.303	0.000
	(1.48)	(0.54)	(-0.31)	(0.00)	0.39	(0.00)	0.61	(0.00)	(3.97)**	(0.00)
Clerk	-0.021	0.161	-0.002	0.123	-0.093	0.206	-0.028	0.166	0.041	0.279
	(-0.47)	(3.35)**	(-0.04)	(2.10)*	(-1.88)	(3.87)**	(-0.58)	(3.20)**	(0.96)	(5.21)**
Manager	0.270	0.507	0.359	0.294	0.272	0.475	0.373	0.324	0.383	0.424
	(3.68)**	(5.43)**	(4.44)**	(2.81)**	(3.29)**	(5.32)**	(6.02)**	(3.11)**	(6.04)**	(4.63)**
Professional	0.087	0.292	0.109	0.205	0.021	0.314	0.232	0.251	0.236	0.349
	(1.93)	(6.88)**	(2.31)*	(3.88)**	(0.46)	(6.48)**	(5.61)**	(5.19)**	(5.97)**	(7.04)**
Region:										
Belgrade	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Central Serbia	-0.225	-0.174	-0.241	-0.219	-0.339	-0.269	-0.305	-0.269	-0.285	-0.265
	(-8.12)**	(-7.22)**	(-10.26)**	(-9.11)**	(-16.67)**	(-13.42)**	(-12.91)**	(-13.00)**	(-13.47)**	(-13.14)**
Vojvodina	-0.088	-0.062	-0.176	-0.132	-0.204	-0.164	-0.218	-0.205	-0.180	-0.180
	(-2.84)**	(-2.16)*	(-6.23)**	(-4.52)**	(-8.31)**	(-6.67)**	(-7.77)**	(-7.69)**	(-7.26)**	(-7.62)**
Public Sector:	0.030	-0.028	0.087	0.012	0.089	-0.021	0.189	0.078	0.191	0.122
	(1.16)	(-0.93)	(3.62)**	(0.37)	(4.12)**	(-0.69)	(8.09)**	(2.72)**	(8.81)**	(3.72)**
Constant	4.042	3.837	3.954	3.814	4.237	3.763	4.298	3.972	4.547	4.096
	(42.59)**	(35.26)**	(39.52)**	(29.25)**	(47.79)**	(33.56)**	(42.10)**	(31.01)**	(50.23)**	(46.26)**
Adj. R-squared	0.30	0.47	0.33	0.47	0.39	0.56	0.39	0.54	0.43	0.63
Regression st. error	0.49	0.41	0.46	0.40	0.41	0.35	0.44	0.37	0.39	0.33
Breusch Pagan test	15.44	14.84	40.90	8.89	27.02	32.08	23.55	0.19	14.37	0.31
Observations	2407	1812	2437	1731	2372	1763	2320	1775	2382	1790

Notes to Table A4.5: See notes to Table A4.4. *Data Source*: Labour Force Survey of the Republic of Serbia 2004-2008

Table A4.6: Conditional annual public sector pay premia and penalties at the mean and selected percentiles in Serbia, 1995-2008

	Mean		10th		25th		50th		75th		90th	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
LFS												
1995	-0.087	-0.144	0.010	-0.219	0.036	-0.165	-0.028	-0.078	-0.128	-0.047	-0.178	-0.092
	(-1.34)	(-2.22)*	(0.11)	(-1.17)	(0.53)	(-2.01)*	(-0.33)	(-1.08)	(-1.20)	(-0.59)	(-1.15)	(-1.00)
1996	0.127	0.075	-0.167	0.259	-0.005	0.093	-0.001	0.014	0.092	-0.024	0.152	-0.017
	(1.61)	(1.15)	(-0.95)	(1.79)	(-0.04)	(0.98)	(-0.02)	(0.20)	(1.29)	(-0.33)	(0.60)	(-0.13)
1997	-0.156	-0.058	-0.124	-0.101	-0.170	-0.110	-0.031	-0.032	-0.068	-0.098	-0.138	-0.081
	(-2.7)**	(-0.90)	(-1.08)	(-0.63)	(-1.67)	(-1.23)	(-0.61)	(-0.72)	(-0.83)	(-1.63)	(-1.44)	(-1.64)
1998	-0.234	-0.183	-0.252	-0.078	-0.158	-0.169	-0.162	-0.208	-0.163	-0.188	-0.338	-0.210
	(-4.90)**	(-3.70)**	(-3.02)**	(-0.78)	(-1.93)	(-2.49)*	(-3.34)**	(-2.70)**	(-2.49)*	(-2.70)**	(-3.12)**	(-2.60)*
1999	-0.144	-0.165	-0.125	-0.114	-0.134	-0.179	-0.097	-0.125	-0.128	-0.156	-0.155	-0.232
	(-2.60)**	(-3.60)**	(-1.42)	(-1.09)	(-2.56)*	(-2.51)*	(-1.72)	(-3.10)**	(-1.59)	(-3.10)**	(-1.52)	(-3.30)**
2000	-0.245	-0.182	-0.132	-0.166	-0.166	-0.164	-0.241	-0.222	-0.252	-0.221	-0.262	-0.234
	(-5.20)**	(-4.80)**	(-2.01)*	(-2.10)*	(-3.51)**	(-2.48)*	(-4.64)**	(-7.20)**	(-4.08)**	(-5.40)**	(-4.63)**	(-3.20)**
2001	-0.118	-0.087	-0.09	-0.151	-0.070	-0.042	-0.047	-0.010	-0.092	-0.009	-0.155	0.003
	(-3.10)**	(-2.31)*	(-1.46)	(-2.10)*	(-1.00)	(-0.83)	(-1.08)	(-0.32)	(-2.82)**	(-0.17)	(-2.49)*	(0.07)
2002	-0.100	-0.143	-0.141	-0.222	-0.074	-0.144	-0.087	-0.129	-0.110	-0.091	-0.050	-0.109
	(-3.0)**	(-4.6)**	(-2.16)*	(-4.0)**	(-1.38)	(-2.6)**	(-1.87)	(-2.90)**	(-2.75)**	(-2.44)*	-0.96	(-2.20)*
2003	-0.051	-0.062	-0.016	0.030	-0.053	-0.036	-0.017	-0.026	-0.042	-0.027	-0.070	-0.084
	(-1.77)	(-1.65)	(-0.00)	(0.40)	(-1.52)	(-0.91)	(-0.57)	(-0.69)	(-1.31)	(-0.61)	(-1.33)	(-1.22)
2004	0.030	-0.028	0.138	0.012	0.083	-0.024	0.070	0.030	0.021	-0.039	0.010	-0.036
	(1.16)	(-0.93)	(3.99)**	(0.20)	(2.73)**	(-0.60)	(2.79)**	(1.29)	(0.99)	(-1.58)	(0.25)	(-0.71)
2005	0.087	0.012	0.145	0.084	0.118	0.064	0.08	0.037	0.067	-0.005	0.02	-0.044
	(3.62)**	(0.37)	(2.55)*	(1.83)	(3.13)**	(1.87)	(2.19)*	(1.01)	(2.96)**	(-0.11)	(0.41)	(-1.06)
2006	0.089	-0.021	0.091	0.015	0.086	-0.001	0.072	0.004	0.103	0.042	0.077	-0.008
	(4.12)**	(-0.69)	(1.99)*	(0.30)	(2.89)**	(-0.03)	(2.80)**	(0.11)	(4.30)**	(1.10)	(2.39)*	(-0.12)
2007	0.189	0.078	0.130	0.103	0.201	0.130	0.204	0.123	0.201	0.081	0.177	0.038
	(8.09)**	(2.72)**	(2.95)**	(2.43)*	(6.01)**	(2.72)**	(6.70)**	(3.31)**	(7.33)**	(2.37)*	(4.88)**	(0.92)
2008	0.191	0.122	0.21	0.117	0.166	0.177	0.173	0.151	0.227	0.106	0.180	0.101
	(8.81)**	(3.72)**	(5.31)**	(1.97)*	(5.44)**	(4.64)**	(5.34)**	(3.14)**	(10.23)**	(3.43)**	(5.61)**	(1.82)
LSMS												
2002	-0.131	-0.056	-0.062	0.024	-0.035	0.003	-0.092	-0.004	-0.190	-0.036	-0.207	-0.182
	(-4.00)**	(-1.26)	(-0.82)	(0.29)	(-0.86)	(0.05)	(-2.38)*	(-0.13)	(-3.44)**	(-0.74)	(-4.11)**	(-2.00)*
2003	-0.130	-0.011	-0.153	-0.220	-0.108	-0.079	-0.094	0.045	-0.160	0.095	-0.131	-0.039
	(-2.90)**	(-0.19)	(-1.60)	(-2.30)*	(-2.01)*	(-0.96)	(-1.89)	(0.55)	(-2.79)**	(1.21)	(-1.39)	(-0.39)

Notes toTable A4.6:

a) The dependent variable is the log of real hourly earnings. Earnings are net of taxes, pensions and welfare benefits expressed in October 2005 prices. From 1995 until 2003 earnings include regular wage and other non-wage benefits such as: payments for meals, transport, union benefits, credits from the firm and payment in kind and other receivings from the main job which were separately recorded by surveys. From 2004 to 2008 non-wage benefits became a part of the regular wage and are not recorded by surveys as separate categories.

b) All explanatory variables are categorical variables. The log hourly pay equations include the following regressors: public sector, labour force experience, educational qualification, marital status, settlement type, regional, nationality (except LSMS), industry branch and occupational dummies (except LSMS). The omitted categories are used according to the Table A4.1 denoted by ^{1}.

c) The estimation procedure for the mean regression is OLS and robust *t* statistics reported in parentheses computed on the basis of White (1980) standard errors. Bootstrapped quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) and the estimated *t* statistics reported in parentheses is based on the bootstrapping procedure with 1000 replications in all cases. OLS and bootstrapped quantile regression analysis reported used STATA 8.0: ** and * denote significance at the 0.01 and 0.05 level, respectively.

Data Source: Labour Force Survey of the Republic of Serbia (LFS) 1995-2008 and Living Standard Measurement Survey (LSMS) 2002-2003

Table A4.7: Estimation of main job hourly earnings in Serbia for men, 1995-2003

Public	Mean	10th	25th	50th	75th	90th	Private	Mean	10th	25th	50th	75th	90th
Experience:							**Experience:**						
<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*	<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*
5< Years<=10	-0.007	0.009	0.001	-0.015	-0.005	0.053	5< Years<=10	0.087	0.109	0.108	0.065	0.034	0.065
	(-0.35)	(0.34)	(0.04)	(-0.81)	(-0.21)	(1.65)		(2.60)**	(1.52)	(2.25)*	(1.84)	(0.74)	(1.51)
10< Years<=20	0.027	0.038	0.038	0.018	0.029	0.049	10< Years<=20	0.104	0.101	0.119	0.138	0.108	0.037
	(1.60)	(1.26)	(1.96)	(1.10)	(2.25)*	(2.17)*		(2.85)**	(1.48)	(2.28)*	(4.85)**	(2.89)**	(0.76)
20< Years<=30	0.054	0.064	0.060	0.030	0.038	0.088	20< Years<=30	0.155	0.207	0.171	0.141	0.113	0.123
	(3.16)**	(2.14)*	(2.47)*	(1.27)	(2.75)**	(3.83)**		(3.58)**	(3.13)**	(3.47)**	(3.26)**	(3.00)**	(1.79)
> 30 Years	0.080	0.080	0.061	0.047	0.084	0.122	> 30 Years	0.177	0.311	0.214	0.186	0.129	0.127
	(4.19)**	(2.77)**	(2.14)*	(1.94)	(3.83)**	(3.72)**		(3.05)**	(3.48)**	(3.16)**	(4.33)**	(2.21)*	(1.58)
Education:							**Education:**						
No qualification	-0.099	-0.132	-0.088	-0.118	-0.080	-0.077	No qualification	0.195	0.107	0.149	0.065	0.256	0.504
	(-3.59)**	(-3.00)**	(-2.88)**	(-3.53)**	(-1.78)	(-1.53)		(1.52)	(0.50)	(1.33)	(0.69)	(1.46)	(0.98)
Primary	*f*	*f*	*f*	*f*	*f*	*f*	Primary	*f*	*f*	*f*	*f*	*f*	*f*
Secondary	0.104	0.083	0.126	0.122	0.125	0.117	Secondary	0.021	-0.009	0.054	0.026	0.066	0.027
	(8.20)**	(3.06)**	(6.35)**	(8.01)**	(8.66)**	(5.70)**		(0.55)	(-0.11)	(1.13)	(0.57)	(1.50)	(0.35)
College	0.257	0.229	0.281	0.265	0.258	0.264	College	0.152	0.096	0.171	0.084	0.090	0.338
	(13.46)**	(6.09)**	(9.15)**	(13.88)**	(11.87)**	(9.68)**		(2.12)*	(0.65)	(1.54)	(1.00)	(0.90)	(2.12)*
University	0.472	0.456	0.494	0.471	0.497	0.503	University	0.374	0.311	0.414	0.370	0.298	0.361
	(22.07)**	(8.34)**	(23.28)**	(25.26)**	(23.68)**	(16.82)**		(5.05)**	(2.47)*	(3.90)**	(4.30)**	(3.96)**	(2.05)*
Settlement type:							**Settlement type:**						
Rural	*f*	*f*	*f*	*f*	*f*	*f*	Rural	*f*	*f*	*f*	*f*	*f*	*f*
City	0.062	0.062	0.061	0.055	0.065	0.074	City	-0.030	0.018	0.034	0.022	-0.007	-0.102
	(6.15)**	(3.16)**	(4.28)**	(4.34)**	(7.85)**	(4.95)**		(-1.04)	(0.40)	(0.82)	(0.91)	(-0.22)	(-1.77)
Marital Status:							**Marital Status:**						
Single	-0.034	-0.055	-0.029	-0.047	0.000	0.021	Single	0.032	0.003	0.005	-0.042	0.033	-0.028
	(-1.59)	(-1.47)	(-1.28)	(-1.87)	(0.02)	(0.62)		(0.63)	(0.04)	(0.07)	(-0.98)	(0.53)	(-0.41)
Married	0.016	-0.011	0.007	0.006	0.032	0.060	Married	0.036	-0.122	-0.064	-0.033	0.115	0.083
	(0.92)	(-0.35)	(0.41)	(0.28)	(1.53)	(1.90)		(0.78)	(-1.94)	(-1.09)	(-0.66)	(1.92)	(1.32)
Divorced/Widow	*f*	*f*	*f*	*f*	*f*	*f*	Divorced/Widow	*f*	*f*	*f*	*f*	*f*	*f*
Region:							**Region:**						
Belgrade	*f*	*f*	*f*	*f*	*f*	*f*	Belgrade	*f*	*f*	*f*	*f*	*f*	*f*
Central Serbia	-0.368	-0.467	-0.396	-0.341	-0.306	-0.281	Central Serbia	-0.369	-0.469	-0.444	-0.428	-0.391	-0.279
	(-32.91)**	(-33.1)**	(-30.1)**	(-40.2)**	(-24.7)**	(-15.8)**		(-12.0)**	(-10.4)**	(-8.21)**	(-16.4)**	(-14.0)**	(-4.84)**
Vojvodina	-0.213	-0.351	-0.270	-0.203	-0.142	-0.092	Vojvodina	-0.332	-0.533	-0.433	-0.351	-0.334	-0.254
	(-15.35)**	(-13.3)**	(-14.0)**	(-13.9)**	(-9.55)**	(-4.60)**		(-8.78)**	(-8.86)**	(-5.84)**	(-6.89)**	(-6.71)**	(-4.36)**
Nationality:							**Nationality:**						
Serbian	0.002	-0.001	-0.019	-0.004	0.000	0.035	Serbian	-0.031	-0.088	-0.049	0.023	0.021	-0.128
	(0.16)	(-0.03)	(-0.96)	(-0.24)	(0.01)	(2.68)**		(-0.71)	(-1.31)	(-0.91)	(0.43)	(0.41)	(-1.77)
Montenegrin	-0.056	-0.197	-0.158	-0.080	-0.005	0.032	Montenegrin	-0.047	-0.087	0.013	-0.028	0.080	-0.130
	(-1.33)	(-3.26)**	(-2.94)**	(-1.86)	(-0.11)	(0.40)		(-0.40)	(-0.53)	(0.07)	(-0.11)	(0.56)	(-0.81)

Other	*f*	*f*	*f*	*f*	*f*	*f*	Other	*f*	*f*	*f*	*f*	*f*	*f*
Industry Branch:							**Industry Branch:**						
Agriculture	*f*	*f*	*f*	*f*	*f*	*f*	Agriculture	*f*	*f*	*f*	*f*	*f*	*f*
Industry&Mining	0.091	0.020	0.040	0.073	0.120	0.161	Industry&Mining	0.096	0.443	0.110	0.204	0.162	0.089
	(4.48)**	(0.57)	(1.78)	(3.39)**	(4.45)**	(9.13)**		(0.85)	(1.27)	(0.95)	(1.98)*	(2.17)*	(0.30)
Construction	-0.004	-0.036	-0.045	-0.014	0.041	0.027	Construction	0.285	0.488	0.189	0.326	0.364	0.393
	(-0.16)	(-0.61)	(-1.40)	(-0.57)	(1.43)	(1.32)		(2.44)*	(1.40)	(1.54)	(3.08)**	(5.65)**	(1.32)
Trade	-0.031	-0.104	-0.124	-0.050	0.051	0.103	Trade	0.040	0.339	0.047	0.218	0.126	0.067
	(-0.90)	(-1.10)	(-2.86)**	(-1.39)	(1.61)	(2.12)*		(0.35)	(0.89)	(0.41)	(1.97)*	(1.56)	(0.22)
Catering&Tourism	-0:013	-0.028	-0.028	-0.043	-0.045	-0.020	Catering&Tourism	0.010	0.339	-0.037	0.139	0.103	0.138
	(-0.37)	(-0.33)	(-0.55)	(-1.19)	(-1.43)	(-0.40)		(0.08)	(0.95)	(-0.36)	(1.24)	(0.98)	(0.43)
Transport	0.242	0.298	0.263	0.220	0.205	0.188	Transport	0.098	0.401	0.052	0.243	0.141	0.202
	(10.90)**	(6.06)**	(8.54)**	(9.25)**	(7.91)**	(7.31)**		(0.81)	(1.12)	(0.47)	(1.96)	(1.77)	(0.59)
Financial Services	0.251	0.304	0.255	0.207	0.208	0.165	Financial Services	0.068	0.381	0.046	0.205	0.156	0.067
	(10.53)**	(5.88)**	(7.63)**	(6.02)**	(8.34)**	(4.88)**		(0.56)	(1.06)	(0.33)	(1.89)	(1.64)	(0.24)
Govern't Admin	0.239	0.350	0.263	0.188	0.154	0.128	Govern't Admin	0.002	0.498	0.050	0.293	0.044	-0.208
	(10.89)**	(8.82)**	(10.64)**	(8.48)**	(6.47)**	(4.95)**		(0.01)	(1.27)	(0.31)	(1.91)	(0.31)	(-0.77)
Education&Health	0.111	0.249	0.164	0.075	0.025	-0.032	Education&Health	0.091	0.300	-0.049	0.219	0.218	0.233
	(5.14)**	(5.38)**	(7.69)**	(4.85)**	(1.22)	(-1.25)		(0.61)	(0.86)	(-0.24)	(1.58)	(1.62)	(0.55)
Occupations:							**Occupations:**						
Farmer	-0.093	-0.152	-0.104	-0.083	-0.081	-0.094	Farmer	-0.135	0.168	-0.196	0.019	-0.078	-0.235
	(-3.06)**	(-2.18)*	(-2.64)**	(-2.54)*	(-1.58)	(-2.60)*		(-1.27)	(0.56)	(-1.21)	(0.14)	(-0.88)	(-1.62)
Industrial Worker	0.026	0.047	0.034	0.011	-0.004	0.015	Industrial Worker	0.036	0.034	-0.017	0.041	0.042	0.086
	(1.57)	(1.44)	(1.68)	(0.71)	(0.37)	(0.63)		(0.94)	(0.49)	(-0.33)	(1.22)	(0.66)	(1.74)
Trade Worker	-0.026	0.015	0.013	-0.028	-0.121	-0.155	Trade Worker	-0.040	0.101	-0.067	-0.112	-0.087	0.012
	(-0.76)	(0.19)	(0.37)	(-1.31)	(-3.04)**	(-2.4)*		(-0.84)	(0.80)	(-1.23)	(-1.52)	(-1.70)	(0.19)
Service Worker	*f*	*f*	*f*	*f*	*f*	*f*	Service Worker	*f*	*f*	*f*	*f*	*f*	*f*
Welfare Worker	0.102	0.073	0.136	0.132	0.101	0.066	Welfare Worker	0.298	0.355	0.205	0.141	0.494	0.289
	(4.55)**	(1.55)	(3.93)**	(6.88)**	(5.25)**	(2.20)*		(2.34)*	(2.42)*	(1.47)	(0.47)	(2.56)*	(1.57)
Clerk	0.084	0.128	0.101	0.076	0.040	0.011	Clerk	0.175	0.170	0.164	0.204	0.201	0.165
	(5.14)**	(3.98)**	(5.24)**	(4.15)**	(3.21)**	(0.63)		(3.57)**	(1.63)	(2.07)*	(2.82)**	(3.29)**	(2.34)*
Manager	0.273	0.332	0.266	0.278	0.232	0.223	Manager	0.200	0.368	0.107	0.239	0.239	0.315
	(10.79)**	(6.35)**	(10.12)**	(10.14)**	(10.95)**	(6.10)**		(2.07)*	(1.46)	(0.73)	(2.01)*	(2.26)*	(1.41)
Professional	0.152	0.183	0.154	0.145	0.114	0.110	Professional	0.227	0.308	0.228	0.204	0.326	0.273
	(7.19)**	(4.03)**	(5.51)**	(6.43)**	(5.54)**	(3.26)**		(3.21)**	(2.80)**	(2.91)**	(3.48)**	(4.62)**	(1.67)
Other	0.034	0.015	0.019	-0.001	-0.041	-0.007	Other	0.065	0.260	0.058	0.070	0.087	0.032
	(1:51)	(0.35)	(0.64)	(-0.07)	(-1.39)	(-0.16)		(0.90)	(2.22)*	(0.59)	(0.70)	(0.91)	(0.12)
Year:							**Year:**						
1995	*f*	*f*	*f*	*f*	*f*	*f*	1995	*f*	*f*	*f*	*f*	*f*	*f*
1996	-0.140	-0.164	-0.146	-0.124	-0.102	-0.100	1996	-0.118	-0.245	-0.149	-0.111	-0.160	-0.177
	(-7.82)**	(-3.77)**	(-6.31)**	(-5.17)**	(-5.05)**	(-3.61)**		(-1.32)	(-1.56)	(-1.45)	(-0.91)	(-1.93)	(-0.93)
1997	0.129	0.101	0.126	0.157	0.185	0.190	1997	0.155	0.149	0.199	0.178	0.156	0.068
	(7.01)**	(2.03)*	(4.52)**	(8.38)**	(10.32)**	(9.59)**		(2.07)*	(1.27)	(1.86)	(1.89)	(1.47)	(0.43)
1998	-0.007	-0.004	0.000	-0.022	0.015	0.032	1998	0.087	0.067	0.101	0.085	0.054	0.103

	(-0.41)	(-0.12)	(0.02)	(-0.97)	(0.74)	(1.38)		(1.19)	(0.52)	(1.06)	(0.77)	(0.49)	(0.56)
1999	-0.214	-0.209	-0.193	-0.240	-0.194	-0.196	1999	-0.161	-0.190	-0.157	-0.190	-0.143	-0.166
	(-12.09)**	(-8.79)**	(-10.7)**	(-14.3)**	(-10.3)**	(-8.06)**		(-2.16)*	(-1.32)	(-1.96)	(-1.71)	(-1.48)	(-1.10)
2000	-0.172	-0.174	-0.180	-0.217	-0.187	-0.140	2000	-0.031	-0.067	-0.025	-0.024	-0.054	-0.079
	(-9.84)**	(-4.15)**	(-8.24)**	(-12.8)**	(-10.3)**	(-4.38)**		(-0.44)	(-0.51)	(-0.36)	(-0.21)	(-0.67)	(-0.50)
2001	0.104	0.151	0.122	0.083	0.080	0.088	2001	0.147	0.161	0.200	0.141	0.087	0.060
	(6.16)**	(4.70)**	(5.35)**	(5.42)**	(3.06)**	(3.12)**		(2.15)*	(1.31)	(2.87)**	(1.45)	(0.97)	(0.37)
2002	0.295	0.355	0.311	0.260	0.271	0.281	2002	0.332	0.383	0.364	0.332	0.311	0.224
	(17.39)**	(10.76)**	(17.23)**	(15.31)**	(15.44)**	(10.41)**		(5.03)**	(3.87)**	(5.48)**	(3.19)**	(3.69)**	(1.50)
2003	0.343	0.358	0.348	0.340	0.337	0.311	2003	0.348	0.405	0.417	0.368	0.298	0.178
	(19.62)**	(9.62)**	(11.69)**	(16.53)**	(16.84)**	(13.88)**		(5.35)**	(3.76)**	(6.31)**	(3.73)**	(3.81)**	(1.21)
Constant:	3.903	3.466	3.694	3.984	4.134	4.236	**Constant:**	4.005	3.340	3.814	3.922	4.140	4.613
	(102.89)**	(43.16)**	(72.72)**	(92.72)**	(79.16)**	(101.8)**		(25.90)**	(9.20)**	(24.86)**	(38.35)**	(24.77)**	(13.30)**
Rsq/Pseudo Rsq:	0.37	0.20	0.23	0.24	0.24	0.23	**Rsq/Pseudo Rsq:**	0.32	0.23	0.22	0.22	0.21	0.20
Observations:	11949	11949	11949	11949	11949	11949	**Observations:**	1772	1772	1772	1772	1772	1772

Notes to Table 4.7:

a) Samples relate to employees aged 15 to 64 who reported non-zero main job earnings and hours of work. The public sector includes all sectors other than private.

b) The dependent variable is the log of real hourly earnings. Earnings are net of taxes, pensions and welfare benefits. They include payments for meals, transport, union benefits, credits from the firm and payment in kind. They relate to earnings received on the main job only and are expressed in October 2005 Serbian dinars.

c) All explanatory variables are categorical.

d) The estimation procedure for the mean robust regression is OLS and *t* test reported in parentheses is calculated based on White (1980) heteroskedasticity-robust estimated standard errors. Bootstrapped quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}). The *t* test reported in parentheses for the quantile regressions is calculated based on standard errors estimated by the bootstrapping procedure with 1000 replications in all cases. OLS and bootstrapped quantile regression analysis reported used STATA 8.0: ** and * denote significance at the 0.01 and 0.05 level respectively.

e) *f* denotes category omitted in estimation.

Data Source: Labour Force Survey of the Republic of Serbia 1995-2003

Table A4.8: Estimation of main job hourly earnings in Serbia for women, 1995-2003

Public	Mean	10th	25th	50th	75th	90th	Private	Mean	10th	25th	50th	75th	90th
Experience:							**Experience:**						
<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*	<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*
5< Years<=10	0.075	0.061	0.041	0.062	0.035	0.031	5< Years<=10	0.020	-0.041	0.009	0.059	0.045	0.006
	(3.78)**	(1.44)	(1.24)	(3.09)**	(2.21)*	(0.87)		(0.64)	(-0.74)	(0.21)	(1.56)	(1.08)	(0.10)
10< Years<=20	0.088	0.131	0.066	0.084	0.058	0.050	10< Years<=20	0.105	0.005	0.078	0.124	0.128	0.152
	(5.15)**	(3.10)**	(1.86)	(7.50)**	(3.97)**	(2.46)*		(3.32)**	(0.08)	(1.52)	(2.83)**	(3.95)**	(2.66)**
20< Years<=30	0.138	0.191	0.125	0.119	0.097	0.074	20< Years<=30	0.135	0.196	0.125	0.187	0.134	0.095
	(8.12)**	(5.30)**	(4.09)**	(9.88)**	(6.99)**	(4.11)**		(3.89)**	(2.83)**	(2.39)*	(6.00)**	(4.03)**	(1.38)
> 30 Years	0.175	0.218	0.114	0.151	0.153	0.183	> 30 Years	0.124	0.205	0.144	0.161	0.155	0.092
	(7.85)**	(3.49)**	(2.93)**	(9.04)**	(7.51)**	(4.90)**		(2.06)*	(1.26)	(1.82)	(2.47)*	(1.31)	(0.94)
Education:							**Education:**						
No qualification	-0.118	-0.156	-0.171	-0.089	-0.092	-0.082	No qualification	0.099	0.244	-0.011	0.030	0.163	0.347
	(-3.09)**	(-2.56)*	(-2.61)**	(-1.57)	(-2.31)*	(-1.33)		(0.64)	(1.76)	(-0.07)	(0.16)	(0.61)	(0.55)
Primary	*f*	*f*	*f*	*f*	*f*	*f*	Primary	*f*	*f*	*f*	*f*	*f*	*f*
Secondary	0.169	0.167	0.183	0.214	0.207	0.185	Secondary	0.076	0.076	0.142	0.174	0.095	0.037
	(10.87)**	(5.20)**	(10.94)**	(12.79)**	(10.78)**	(8.12)**		(1.91)	(1.29)	(3.16)**	(6.70)**	(2.28)*	(0.28)
College	0.298	0.293	0.307	0.335	0.312	0.305	College	0.201	0.219	0.304	0.378	0.245	0.130
	(14.99)**	(8.12)**	(15.54)**	(16.39)**	(17.01)**	(11.49)**		(3.15)**	(1.81)	(4.08)**	(5.57)**	(3.42)**	(0.79)
University	0.517	0.475	0.487	0.539	0.565	0.566	University	0.397	0.611	0.574	0.518	0.405	0.190
	(25.55)**	(8.85)**	(17.15)**	(25.89)**	(29.33)**	(17.59)**		(6.09)**	(3.57)**	(9.39)**	(9.18)**	(7.26)**	(1.37)
Settlement type:							**Settlement type:**						
Rural	*f*	*f*	*f*	*f*	*f*	*f*	Rural	*f*	*f*	*f*	*f*	*f*	*f*
City	0.018	-0.015	0.020	0.022	0.025	0.009	City	0.006	0.032	0.032	0.039	0.032	0.015
	(1.53)	(-0.60)	(1.35)	(2.10)*	(2.26)*	(0.61)		(0.25)	(0.93)	(1.08)	(1.51)	(0.86)	(0.32)
Marital Status:							**Marital status:**						
Single	-0.013	-0.026	-0.011	-0.011	-0.014	0.015	Single	-0.030	-0.017	-0.021	0.044	-0.007	-0.043
	(-0.75)	(-0.70)	(-0.33)	(-0.50)	(-0.90)	(0.49)		(-0.68)	(-0.20)	(-0.37)	(0.88)	(-0.16)	(-0.33)
Married	-0.030	-0.058	-0.033	-0.023	-0.025	0.014	Married	-0.043	-0.036	-0.005	0.007	-0.011	-0.042
	(-2.29)*	(-3.41)**	(-1.89)	(-1.74)	(-1.84)	(0.81)		(-1.02)	(-0.64)	(-0.08)	(0.15)	(-0.22)	(-0.42)
Divorced/Widow	*f*	*f*	*f*	*f*	*f*	*f*	Divorced/Widow	*f*	*f*	*f*	*f*	*f*	*f*
Region:							**Region:**						
Belgrade	*f*	*f*	*f*	*f*	*f*	*f*	Belgrade	*f*	*f*	*f*	*f*	*f*	*f*
Central Serbia	-0.318	-0.343	-0.318	-0.289	-0.274	-0.253	Central Serbia	-0.411	-0.472	-0.445	-0.444	-0.394	-0.383
	(-26.9)**	(-12.0)**	(-18.9)**	(-32.22)**	(-23.1)**	(-10.41)**		(-13.4)**	(-9.4)**	(-10.9)**	(-12.4)**	(-8.68)**	(-7.71)**
Vojvodina	-0.199	-0.239	-0.240	-0.199	-0.152	-0.092	Vojvodina	-0.373	-0.440	-0.419	-0.383	-0.351	-0.393
	(-13.6)**	(-7.04)**	(-12.6)**	(-12.47)**	(-11.9)**	(-3.75)**		(-11.5)**	(-7.6)**	(-9.58)**	(-11.7)**	(-6.89)**	(-8.77)**
Nationality:							**Nationality:**						
Serbian	-0.008	0.010	-0.037	-0.023	-0.006	-0.014	Serbian	-0.005	-0.027	-0.049	0.047	0.002	-0.122
	(-0.49)	(0.33)	(-1.55)	(-2.45)*	(-0.36)	(-0.72)		(-0.13)	(-0.41)	(-1.08)	(1.25)	(0.03)	(-2.14)*
Montenegrin	-0.023	-0.139	-0.122	-0.056	0.015	0.041	Montenegrin	-0.109	-0.074	-0.089	-0.115	-0.114	-0.340
	(-0.48)	(-1.53)	(-1.34)	(-1.55)	(0.41)	(0.71)		(-1.07)	(-0.22)	(-0.55)	(-1.08)	(-0.79)	(-1.86)

Other	*f*	*f*	*f*	*f*	*f*	*f*
Industry Branch:						
Agriculture	*f*	*f*	*f*	*f*	*f*	*f*
Industry&Mining	0.137	0.140	0.163	0.109	0.112	0.137
	(3.99)**	(1.94)	(3.57)**	(4.63)**	(2.26)*	(2.96)**
Construction	0.123	0.274	0.202	0.132	0.040	-0.003
	(2.75)**	(2.50)*	(2.97)**	(3.06)**	(0.70)	(-0.04)
Trade	-0.018	-0.004	0.100	-0.018	-0.008	-0.024
	(-0.42)	(-0.03)	(1.42)	(-0.66)	(-0.14)	(-0.61)
Catering&Tourism	0.073	0.207	0.122	0.015	0.001	0.018
	(1.75)	(2.36)*	(2.44)*	(0.34)	(0.01)	(0.34)
Transport	0.360	0.485	0.385	0.298	0.321	0.280
	(9.10)**	(5.84)**	(6.87)**	(7.89)**	(5.02)**	(5.42)**
Financial Services	0.315	0.529	0.419	0.272	0.221	0.205
	(8.82)**	(6.53)**	(8.81)**	(9.38)**	(4.43)**	(5.10)**
Govern't Admin	0.260	0.515	0.376	0.200	0.105	0.072
	(7.46)**	(7.25)**	(8.71)**	(8.78)**	(1.95)	(1.46)
Education&Health	0.201	0.469	0.347	0.153	0.036	-0.021
	(5.94)**	(6.43)**	(7.49)**	(5.87)**	(0.68)	(-0.41)
Occupations:						
Farmer	-0.172	-0.379	-0.108	-0.133	-0.073	-0.162
	(-2.98)**	(-1.82)	(-1.48)	(-1.95)	(-1.15)	(-2.20)*
Industrial Worker	-0.060	-0.065	-0.043	-0.068	-0.058	-0.046
	(-2.74)**	(-1.66)	(-1.48)	(-2.76)**	(-2.81)**	(-1.53)
Trade Worker	-0.120	-0.147	-0.199	-0.111	-0.120	-0.117
	(-3.59)**	(-1.16)	(-3.47)**	(-3.78)**	(-2.36)*	(-3.50)**
Service Worker	*f*	*f*	*f*	*f*	*f*	*f*
Welfare Worker	0.177	0.175	0.177	0.178	0.186	0.144
	(7.15)**	(4.40)**	(5.94)**	(6.14)**	(9.17)**	(3.76)**
Clerk	0.113	0.100	0.151	0.117	0.109	0.083
	(6.56)**	(2.34)*	(8.43)**	(6.13)**	(7.16)**	(3.99)**
Manager	0.352	0.392	0.392	0.357	0.301	0.253
	(11.68)**	(6.04)**	(7.22)**	(14.33)**	(11.18)**	(7.43)**
Professional	0.160	0.171	0.202	0.155	0.145	0.123
	(8.34)**	(3.06)**	(7.31)**	(5.88)**	(8.08)**	(4.66)**
Other	0.044	0.038	0.061	0.055	0.063	0.000
	(2.17)*	(0.80)	(2.62)**	(1.83)	(3.86)**	(0.01)
Year:						
1995	*f*	*f*	*f*	*f*	*f*	*f*
1996	-0.127	-0.175	-0.105	-0.100	-0.124	-0.139
	(-5.79)**	(-6.20)**	(-3.09)**	(-4.45)**	(-4.94)**	(-3.73)**
1997	0.160	0.147	0.194	0.176	0.166	0.122
	(7.37)**	(3.59)**	(5.81)**	(7.87)**	(7.33)**	(4.60)**
1998	-0.032	-0.008	-0.022	-0.025	-0.031	-0.069

Other	*f*	*f*	*f*	*f*	*f*	*f*
Industry Branch:						
Agriculture	*f*	*f*	*f*	*f*	*f*	*f*
Industry&Mining	0.133	0.506	0.122	0.010	0.209	-0.101
	(0.98)	(1.52)	(0.48)	(0.11)	(1.46)	(-0.36)
Construction	0.244	0.736	0.231	0.114	0.192	-0.185
	(1.65)	(2.34)*	(0.77)	(0.84)	(1.35)	(-0.61)
Trade	0.135	0.579	0.167	-0.016	0.108	-0.193
	(1.00)	(1.88)	(0.72)	(-0.18)	(0.71)	(-0.64)
Catering&Tourism	0.245	0.613	0.158	0.069	0.256	-0.051
	(1.74)	(1.98)*	(0.63)	(0.58)	(1.89)	(-0.16)
Transport	0.056	0.604	0.127	-0.066	0.063	-0.301
	(0.37)	(1.44)	(0.49)	(-0.70)	(0.42)	(-1.05)
Financial Services	0.134	0.541	0.185	0.028	0.136	-0.245
	(0.97)	(1.65)	(0.74)	(0.28)	(1.02)	(-0.78)
Govern't Admin	-0.052	0.148	-0.476	-0.653	0.176	-0.406
	(-0.13)	(0.27)	(-0.98)	(-1.46)	(0.41)	(-0.73)
Education&Health	0.337	0.912	0.468	0.184	0.206	-0.166
	(2.38)*	(3.00)**	(1.77)	(1.74)	(1.36)	(-0.52)
Occupations:						
Farmer	0.284	0.646	0.289	0.202	0.386	0.217
	(1.49)	(1.95)	(1.24)	(0.78)	(1.39)	(0.45)
Industrial Worker	0.095	0.092	0.086	0.121	0.082	-0.012
	(1.75)	(0.90)	(1.06)	(2.18)*	(0.95)	(-0.12)
Trade Worker	0.011	0.033	-0.014	0.018	0.066	-0.027
	(0.23)	(0.37)	(-0.31)	(0.27)	(0.93)	(-0.51)
Service Worker	*f*	*f*	*f*	*f*	*f*	*f*
Welfare Worker	-0.176	-0.253	-0.349	-0.143	-0.101	-0.066
	(-1.46)	(-2.24)*	(-2.52)*	(-0.72)	(-0.61)	(-0.21)
Clerk	0.254	0.184	0.214	0.236	0.353	0.300
	(5.82)**	(2.10)*	(3.88)**	(4.43)**	(5.83)**	(4.45)**
Manager	0.358	0.355	0.310	0.291	0.530	0.735
	(2.37)*	(0.67)	(2.04)*	(2.73)**	(2.29)*	(3.17)**
Professional	0.345	0.153	0.154	0.345	0.528	0.546
	(4.55)**	(0.93)	(2.19)*	(2.95)**	(6.98)**	(6.58)**
Other	0.083	-0.008	0.022	0.039	0.150	0.157
	(1.01)	(-0.07)	(0.26)	(0.45)	(1.17)	(0.69)
Year:						
1995	*f*	*f*	*f*	*f*	*f*	*f*
1996	-0.234	-0.361	-0.235	-0.155	-0.205	-0.301
	(-3.60)**	(-2.50)*	(-2.57)*	(-2.55)*	(-1.80)	(-2.10)*
1997	0.023	-0.049	0.027	0.106	0.140	-0.063
	(0.35)	(-0.36)	(0.28)	(1.41)	(1.34)	(-0.61)
1998	-0.057	-0.068	-0.079	-0.009	0.051	-0.184

	(-1.49)	(-0.23)	(-0.77)	(-1.20)	(-1.51)	(-2.30)*		(-1.02)	(-0.54)	(-0.93)	(-0.18)	(0.50)	(-2.01)*
1999	-0.262	-0.227	-0.232	-0.261	-0.280	-0.322	1999	-0.220	-0.248	-0.225	-0.149	-0.173	-0.238
	(-12.3)**	(-6.51)**	(-6.45)**	(-12.92)**	(-13.2)**	(-9.45)**		(-3.84)**	(-2.01)*	(-3.11)**	(-2.76)**	(-1.99)*	(-3.32)**
2000	-0.229	-0.240	-0.231	-0.268	-0.272	-0.332	2000	-0.129	-0.132	-0.097	-0.066	-0.141	-0.247
	(-11.2)**	(-9.64)**	(-7.58)**	(-15.59)**	(-14.6)**	(-9.52)**		(-2.48)*	(-1.21)	(-1.59)	(-1.23)	(-1.55)	(-3.08)**
2001	0.050	0.068	0.092	0.039	0.030	-0.016	2001	0.011	0.085	-0.016	0.017	0.069	-0.119
	(2.39)*	(2.10)*	(3.19)**	(2.67)**	(1.21)	(-0.52)		(0.22)	(0.80)	(-0.25)	(0.30)	(0.65)	(-1.52)
2002	0.240	0.290	0.253	0.221	0.221	0.187	2002	0.279	0.345	0.267	0.276	0.305	0.155
	(11.73)**	(10.80)**	(11.39)**	(12.28)**	(11.54)**	(5.49)**		(5.49)**	(3.48)**	(4.53)**	(5.36)**	(3.13)**	(2.19)*
2003	0.347	0.363	0.403	0.354	0.318	0.247	2003	0.305	0.322	0.285	0.326	0.351	0.157
	(17.02)**	(8.41)**	(16.35)**	(18.31)**	(17.56)**	(8.66)**		(6.02)**	(2.75)**	(4.12)**	(6.96)**	(3.67)**	(1.94)
Constant:	3.677	3.064	3.392	3.716	3.981	4.238	**Constant:**	3.836	2.966	3.603	3.747	3.917	4.892
	(80.92)**	(27.62)**	(45.32)**	(126.36)**	(65.06)**	(85.09)**		(24.44)**	(8.14)**	(12.14)**	(35.38)**	(20.90)**	(12.00)**
Rsq/Pseudo Rsq:	0.47	0.29	0.31	0.31	0.31	0.31	**Rsq/Pseudo Rsq:**	0.43	0.23	0.25	0.27	0.29	0.31
Observations:	8341	8341	8341	8341	8341	8341	**Observations:**	1698	1698	1698	1698	1698	1698

Notes to Table A4.8: See Notes to Table A4.7.

Data Source: Labour Force Survey of the Republic of Serbia 1995-2003

Table A4.9: Estimation of main job hourly earnings in Serbia for men, 2002-2003

Public	Mean	10th	25th	50th	75th	90th	Private	Mean	10th	25th	50th	75th	90th
Experience:							**Experience:**						
<= 5 Years	f	f	f	f	f	f	<=5 Years	f	f	f	f	f	f
5< Years<=10	0.060	0.019	0.048	0.067	0.043	0.063	5<Years<=10	0.057	0.100	0.009	0.069	0.106	0.016
	(1.58)	(0.34)	(0.97)	(2.31)*	(1.03)	(1.10)		(1.00)	(0.89)	(0.10)	(1.32)	(1.75)	(0.17)
10< Years<=20	0.059	0.008	0.043	0.052	0.087	0.156	10<Years<=20	0.121	0.212	0.082	0.113	0.138	0.147
	(1.80)	(0.14)	(1.00)	(1.27)	(1.88)	(2.46)*		(2.16)*	(2.12)*	(1.11)	(2.01)*	(2.18)*	(1.18)
20< Years<=30	0.039	-0.036	0.017	0.070	0.081	0.150	20< Years<=30	-0.032	0.028	-0.050	-0.036	-0.008	0.084
	(1.17)	(-0.47)	(0.40)	(1.80)	(2.86)**	(2.07)*		(-0.51)	(0.20)	(-0.56)	(-0.78)	(-0.07)	(0.59)
> 30 Years	0.092	0.109	0.088	0.118	0.111	0.127	> 30 Years	0.038	-0.109	-0.022	0.065	0.113	0.177
	(2.43)*	(1.22)	(2.04)*	(3.89)**	(1.96)	(1.61)		(0.35)	(-0.31)	(-0.20)	(0.53)	(0.64)	(1.21)
Education:							**Education:**						
No qualification	-0.072	-0.015	-0.095	-0.140	-0.142	0.129	No qualification	-0.015	0.178	-0.140	-0.100	-0.036	-0.108
	(-0.88)	(-0.06)	(-1.47)	(-1.77)	(-0.87)	(0.61)		(-0.08)	(0.64)	(-10.43)	(-0.38)	(-0.11)	(-0.36)
Primary	f	f	f	f	f	f	Primary	f	f	f	f	f	f
Secondary	0.177	0.264	0.154	0.165	0.184	0.197	Secondary	0.205	0.193	0.213	0.177	0.159	0.296
	(5.56)**	(5.40)**	(4.43)**	(5.48)**	(3.48)**	(3.85)**		(3.41)**	(1.90)	(2.97)**	(1.58)	(2.04)*	(2.90)**
College	0.356	0.460	0.338	0.313	0.367	0.402	College	0.317	0.429	0.353	0.280	0.224	0.427
	(8.57)**	(4.87)**	(8.09)**	(8.06)**	(7.27)**	(4.13)**		(3.81)**	(3.43)**	(3.53)**	(2.78)**	(2.84)**	(2.50)*
University	0.651	0.700	0.627	0.633	0.648	0.705	University	0.654	0.662	0.547	0.530	0.648	0.854
	(15.39)**	(8.91)**	(11.50)**	(15.57)**	(14.19)**	(7.46)**		(6.21)**	(4.88)**	(4.29)**	(2.93)**	(3.36)**	(5.01)**
Settlement type:							**Settlement type:**						
Rural	f	f	f	f	f	f	Rural	f	f	f	f	f	f
City	0.041	0.053	0.066	0.049	0.015	0.090	City	0.023	0.016	0.097	0.041	0.010	-0.044
	(1.81)	(0.99)	(2.14)*	(2.06)*	(0.66)	(2.97)**		(0.54)	(0.20)	(1.91)	(0.91)	(0.15)	(-0.60)
Marital Status:							**Marital status:**						
Single	-0.014	-0.095	-0.070	0.015	-0.029	-0.006	Single	-0.172	-0.193	-0.103	-0.092	0.005	-0.762
	(-0.27)	(-1.27)	(-0.67)	(0.31)	(-0.46)	(-0.07)		(-0.97)	(-0.63)	(-0.55)	(-0.62)	(0.01)	(-1.44)
Married	0.065	-0.030	0.001	0.047	0.077	0.134	Married	-0.070	-0.032	0.051	0.013	0.067	-0.776
	(1.43)	(-0.45)	(0.01)	(0.97)	(1.54)	(1.72)		(-0.41)	(-0.11)	(0.32)	(0.10)	(0.18)	(-1.54)
Divorced/Widow	f	f	f	f	f	f	Divorced/Widow	f	f	f	f	f	f
Region:							**Region:**						
Belgrade	f	f	f	f	f	f	Belgrade	f	f	f	f	f	f
Vojvodina	-0.059	-0.022	-0.022	-0.047	-0.061	-0.036	Vojvodina	-0.229	-0.302	-0.267	-0.243	-0.123	-0.160
	(-1.86)	(-0.57)	(-0.47)	(-1.15)	(-2.28)*	(-0.58)		(-4.42)**	(-2.80)**	(-4.03)**	(-3.43)**	(-2.04)*	(-1.44)
Central Serbia	-0.167	-0.080	-0.118	-0.164	-0.193	-0.158	Cserbia	-0.261	-0.361	-0.373	-0.316	-0.145	-0.097
	(-6.04)**	(-2.51)*	(-2.62)**	(-5.76)**	(-5.27)**	(-3.10)**		(-5.29)**	(-4.5)**	(-5.42)**	(-5.56)**	(-2.96)**	(-0.89)
Industry Branch:							**Industry Branch:**						
Agriculture	f	f	f	f	f	f	Agriculture	f	f	f	f	f	f
Industry&Mining	0.089	0.021	0.087	0.073	0.114	0.094	Industry&Mining	0.079	0.106	0.045	-0.008	0.019	0.163
	(2.62)**	(0.42)	(1.78)	(2.03)*	(3.04)**	(1.42)		(1.17)	(1.17)	(0.56)	(-0.12)	(0.20)	(0.96)

Construction	-0.060	-0.261	-0.087	0.005	-0.008	-0.077	Construction	0.085	0.023	-0.062	0.117	0.096	0.210
	(-1.04)	(-3.11)**	(-0.73)	(0.07)	(-0.15)	(-0.66)		(0.96)	(0.15)	(-0.53)	(0.79)	(0.83)	(1.16)
Trade	-0.239	-0.537	-0.321	-0.222	-0.138	-0.068	Trade	0.061	0.103	0.039	0.017	0.064	0.090
	(-3.50)**	(-3.59)**	(-2.91)**	(-3.05)**	(-1.87)	(-0.57)		(0.97)	(0.97)	(0.59)	(0.20)	(0.58)	(0.68)
Catering&Tourism	-0.087	-0.133	0.043	-0.078	-0.181	-0.181	Catering&Tourism	-0.026	-0.288	-0.170	-0.137	0.017	0.253
	(-1.02)	(-0.51)	(0.34)	(-1.17)	(-2.55)*	(-0.81)		(-0.25)	(-1.34)	(-1.36)	(-1.40)	(0.10)	(1.15)
Transport	0.102	0.152	0.164	0.093	0.094	-0.009	Transport	0.206	0.247	0.173	0.080	0.179	0.179
	(2.45)*	(2.34)*	(4.09)**	(1.87)	(1.87)	(-0.12)		(2.22)*	(1.55)	(1.32)	(1.09)	(1.58)	(0.69)
Financial Services	0.015	-0.046	0.018	0.112	0.007	0.018	Financial Services	0.153	0.191	0.114	0.159	0.089	0.156
	(0.24)	(-0.30)	(0.18)	(1.94)	(0.11)	(0.21)		(2.34)*	(1.08)	(1.28)	(1.95)	(1.03)	(1.18)
Govern't Admin	0.233	0.303	0.277	0.234	0.178	0.151	Govern't Admin	0.177	0.260	0.521	0.228	-0.120	-0.287
	(5.68)**	(4.86)**	(5.31)**	(6.30)**	(3.59)**	(1.79)		(1.26)	(0.70)	(1.54)	(2.63)**	(-0.74)	(-1.33)
Education&Health	0.108	0.263	0.148	0.047	0.006	-0.061	Education&Health	0.032	-0.271	0.131	0.200	0.148	0.169
	(2.66)**	(4.24)**	(2.75)**	(0.97)	(0.14)	(-0.66)		(0.18)	(-0.74)	(0.33)	(0.84)	(0.74)	(0.53)
Year:							**Year:**						
2003	0.122	0.118	0.082	0.107	0.126	0.142	2003	0.125	0.258	0.152	0.106	0.054	0.026
	(5.00)**	(2.54)*	(2.47)*	(3.67)**	(4.34)**	(4.04)**		(3.07)**	(2.94)**	(3.52)**	(3.40)**	(0.88)	(0.39)
Constant	4.003	3.477	3.789	4.026	4.269	4.376	**Constant**	4.283	3.617	3.944	4.279	4.433	5.403
	(57.54)**	(32.48)**	(33.86)**	(49.27)**	(41.36)**	(29.96)**		(21.28)**	(9.93)**	(16.71)**	(22.11)**	(12.22)**	(9.70)**
Rsq Pseudo Rsq:	0.23	0.15	0:14	0.15	0.15	0.13	**R-sq/Pseudo Rsq:**	0.15	0.12	0.11	0.09	0.08	0.1
Observations:	2135	2135	2135	2135	2135	2135	**Observations:**	778	778	778	778	778	778

Notes to Table 4.9:

a) Samples relate to full-time employees aged 15 to 64 who reported non-zero main job hours of work and non-zero main job earnings received for the month and the year of the survey. The public sector includes social and state sectors.

b) The dependent variable is the log of real hourly earnings. Earnings are net of taxes, pensions and welfare benefits. They include payments for meals, transport, union benefits, credits from the firm and payment in kind. They are expressed in October 2005 Serbian dinars.

c) All explanatory variables are categorical.

d) The estimation procedure for the mean robust regression is OLS and *t* test reported in parentheses is calculated based on White (1980) heteroskedasticity-robust estimated standard errors. Bootstrapped quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}). The *t* test reported in parentheses for the quantile regressions is calculated based on standard errors estimated by the bootstrapping procedure with 1000 replications in all cases. OLS and bootstrapped quantile regression analysis reported used STATA 8.0: ** and * denote significance at the 0.01 and 0.05 level respectively.

e) *f* denotes category omitted in estimation.

Data Source: Living Standard Measurement Survey 2002-2003

Table A4.10: Estimation of main job hourly earnings in Serbia for women, 2002-2003

Public	Mean	10th	25th	50th	75th	90th	Private	Mean	10th	25th	50th	75th	90th
Experience:							**Experience:**						
<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*	<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*
5< Years<=10	0.036	0.022	0.028	0.008	0.050	0.059	5< Years<=10	0.008	0.055	0.032	0.066	0.041	0.004
	(0.81)	(0.53)	(0.49)	(0.18)	(0.89)	(0.78)		(0.11)	(0.62)	(0.38)	(0.63)	(0.43)	(0.02)
10< Years<=20	-0.039	-0.038	0.012	0.021	0.021	0.017	10< Years<=20	0.030	0.006	0.096	0.129	0.083	-0.003
	(-0.93)	(-1.01)	(0.22)	(0.54)	(0.50)	(0.28)		(0.40)	(0.05)	(1.31)	(1.55)	(1.48)	(-0.03)
20< Years<=30	0.049	0.055	0.088	0.068	0.081	0.104	20< Years<=30	0.015	0.200	0.126	0.178	-0.020	-0.066
	(1.16)	(1.38)	(1.86)	(1.73)	(2.54)*	(1.43)		(0.21)	(2.58)*	(1.62)	(2.22)*	(-0.29)	(-0.48)
> 30 Years	0.102	-0.078	0.058	0.125	0.183	0.215	> 30 Years	-0.242	-0.315	-0.053	-0.146	-0.054	-0.089
	(1.27)	(-0.75)	(0.85)	(1.88)	(2.49)*	(1.15)		(-1.24)	(-0.73)	(-0.14)	(-0.61)	(-0.17)	(-0.19)
Education:							**Education:**						
No qualification	0.100	0.185	0:101	0.127	0.197	0.003	No qualification	-0.067	-0.111	0.168	-0.056	-0.164	0.440
	(1.15)	(1.49)	(1.48)	(1.02)	(2.50)*	(0.03)		(-0.23)	(-0.35)	(0.62)	(-0.28)	(-0.34)	(0.53)
Primary	*f*	*f*	*f*	*f*	*f*	*f*	Primary	*f*	*f*	*f*	*f*	*f*	*f*
Secondary	0.278	0.232	0.286	0.308	0.344	0.359	Secondary	-0.032	0.134	0.028	-0.003	-0.060	-0.329
	(6.78)**	(2.96)**	(7.01)**	(8.60)**	(8.78)**	(7.35)**		(-0.32)	(1.18)	(0.30)	(-0.02)	(-0.83)	(-1.01)
College	0.481	0.464	0.495	0.475	0.543	0.674	College	0.011	0.166	0.162	0.079	0.086	-0.265
	(9.56)**	(6.46)**	(9.74)**	(11.75)**	(19.79)**	(8.16)**		(0.10)	(0.82)	(1.30)	(0.50)	(0.80)	(-0.90)
University	0.774	0.695	0.709	0.730	0.847	0.972	University	0.441	0.436	0.418	0.566	0.604	0.224
	(16.02)**	(9.82)**	(18.86)**	(19.95)**	(17.64)**	(12.45)**		(3.31)**	(1.69)	(2.57)*	(3.07)**	(5.42)**	(0.48)
Settlement type:							**Settlement type:**						
Rural	*f*	*f*	*f*	*f*	*f*	*f*	Rural	*f*	*f*	*f*	*f*	*f*	*f*
City	0,045	0.100	0.057	0.044	0.043	-0.016	City	0.048	0.091	0.076	0.078	0.020	-0.010
	(1.39)	(1.64)	(1.52)	(2.40)*	(0.98)	(-0.26)		(0.83)	(1.43)	(1.39)	(1.17)	(0.55)	(-0.08)
Marital Status:							**Marital Status:**						
Single	-0.107	-0.054	-0.081	-0.089	-0.083	-0.054	Single	-0.349	-0.249	-0.174	-0.163	-0.293	-0.657
	(-1.93)	(-0.62)	(-1.37)	(-1.59)	(-1.35)	(-0.64)		(-3.13)**	(-2.05)*	(-1.74)	(-1.73)	(-1.90)	(-4.16)**
Married	-0.035	0.019	-0.037	-0.084	-0.074	-0.070	Married	-0.203	-0.140	-0.114	-0.135	-0.150	-0.362
	(-0.92)	(0.45)	(-0.99)	(-1.79)	(-1.96)*	(-0.86)		(-1.97)*	(-1.14)	(-1.01)	(-2.05)*	(-1.06)	(-2.70)**
Divorced/Widow	*f*	*f*	*f*	*f*	*f*	*f*	Divorced/Widow	*f*	*f*	*f*	*f*	*f*	*f*
Region:							**Region:**						
Belgrade	*f*	*f*	*f*	*f*	*f*	*f*	Belgrade	*f*	*f*	*f*	*f*	*f*	*f*
Vojvodina	-0.039	-0.026	-0.050	-0.041	-0.046	0.025	Vojvodina	-0.159	-0.118	-0.167	-0.194	-0.201	-0.155
	(-1.13)	(-0.49)	(-1.26)	(-1.16)	(-0.93)	(0.47)		(-2.30)*	(-0.97)	(-1.91)	(-3.43)**	(-3.19)**	(-1.28)
Central Serbia	-0.150	-0.136	-0.139	-0.126	-0.155	-0.064	Central Serbia	-0.319	-0.231	-0.300	-0.337	-0.290	-0.423
	(-4.65)**	(-3.08)**	(-4.28)**	(-4.74)**	(-3.36)**	(-1.14)		(-5.27)**	(-1.70)	(-3.13)**	(-5.28)**	(-5.82)**	(-3.74)**
Industry Branch:							**Industry Branch:**						
Agriculture	*f*	*f*	*f*	*f*	*f*	*f*	Agriculture	*f*	*f*	*f*	*f*	*f*	*f*
Industry&Mining	-0.144	-0.317	-0.185	-0.129	-0.039	0.041	Industry&Mining	-0.244	-0.094	-0.146	-0.162	-0.244	-0.297
	(-2.82)**	(-3.88)**	(-3.37)**	(-2.26)*	(-0.89)	(0.27)		(-1.98)*	(-0.50)	(-1.59)	(-1.45)	(-2.03)*	(-1.85)
Construction	-0.290	-0.380	-0.086	-0.290	-0.026	-0.079	Construction	0.048	0.193	-0.103	0.026	0.009	0.712

	(-1.74)	(-2.33)*	(-0.46)	(-1.91)	(-0.13)	(-0.38)		(0.27)	(0.96)	(-0.54)	(0.13)	(0.04)	(1.60)
Trade	-0.321	-0.500	-0.370	-0.274	-0.189	-0.086	Trade	-0.234	-0.164	-0.242	-0.173	-0.223	-0.186
	(-4.21)**	(-4.92)**	(-4.76)**	(-3.81)**	(-2.96)**	(-0.49)		(-2.01)*	(-1.08)	(-3.24)**	(-1.95)	(-2.48)*	(-1.56)
Catering&Tourism	-0.075	-0.131	0.023	-0.129	-0.050	-0.088	Catering&Tourism	-0.151	-0.346	-0.293	-0.228	-0.072	0.151
	(-0.93)	(-0.82)	(0.28)	(-1.99)*	(-0.56)	(-0.25)		(-0.93)	(-1.55)	(-2.07)*	(-1.39)	(-0.54)	(0.32)
Transport	0.110	0.100	0.101	0.058	0.141	0.242	Transport	-0.109	-0.016	-0.123	0.007	-0.127	-0.260
	(1.56)	(0.70)	(1.27)	(0.99)	(1.80)	(0.86)		(-0.67)	(-0.05)	(-0.57)	(0.04)	(-0.77)	(-1.83)
Financial Services	0.148	0.083	0.199	0.139	0.146	0.239	Financial Services	-0.106	-0.177	-0.080	-0.054	-0.162	0.175
	(2.10)*	(0.76)	(2.95)**	(2.13)*	(1.68)	(1.21)		(-0.84)	(-0.82)	(-0.87)	(-0.57)	(-1.46)	(0.94)
Govern't Admin	-0.026	-0.073	-0.009	0.026	-0.016	0.018	Govern't Admin	0.098	0.261	0.052	0.106	0.034	-0.270
	(-0.47)	(-0.70)	(-0.15)	(0.36)	(-0.37)	(0.10)		(0.64)	(0.72)	(0.18)	(0.40)	(0.16)	(-1.23)
Education&Health	0.035	0.140	0.101	0.004	-0.026	0.001	Education&Health	0.079	0.059	-0.004	-0.054	0.040	0.434
	(0.73)	(2.01)*	(2.40)*	(0.05)	(-0.66)	(0.01)		(0.47)	(0.27)	(-0.03)	(-0.35)	(0.18)	(1.22)
Year:							**Year:**						
2003	0.162	0.125	0.123	0.174	0.154	0.148	2003	0.083	0.161	0.072	0.096	0.056	0.047
	(5.42)**	(2.46)*	(4.17)**	(5.03)**	(6.33)**	(2.41)*		(1.68)	(2.41)*	(1.13)	(1.98)*	(0.86)	(0.39)
Constant:	4.020	3.512	3.734	4.013	4.167	4.310	**Constant:**	4.685	3.692	4.125	4.410	4.923	5.758
	(47.14)**	(32.28)**	(39.80)**	(40.93)**	(53.43)**	(18.41)**		(24.97)**	(16.62)**	(31.33)**	(30.27)**	(23.23)**	(17.73)**
R-sq/Pseudo Rsq:	0.29	0.23	0.22	0.2	0.18	0.17	**R-sq/Pseudo Rsq:**	0.16	0.11	0.11	0.12	0.14	0.16
Observations:	1554	1554	1554	1554	1554	1554	**Observations:**	661	661	661	661	661	661

Notes to Table A4.10: See Notes to Table A4.9.

Data Source: Living Standard Measurement Survey 2002-2003

Table A4.11: Estimation of main job hourly earnings in Serbia for men, 2004-2008

Public	Mean	10th	25th	50th	75th	90th	Private	Mean	10th	25th	50th	75th	90th
Experience:							**Experience:**						
<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*	<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*
5< Years<=10	0.027	0.055	0.050	0.032	0.021	0.051	5< Years<=10	0.038	0.047	0.060	0.032	-0.005	0.023
	(1.18)	(2.45)*	(1.40)	(1.43)	(0.75)	(1.14)		(2.02)*	(1.42)	(2.05)*	(1.23)	(-0.25)	(0.89)
10< Years<=20	0.055	0.090	0.079	0.055	0.042	0.050	10< Years<=20	0.074	0.068	0.084	0.065	0.065	0.104
	(2.77)**	(3.12)**	(2.20)*	(2.46)*	(1.55)	(1.33)		(3.91)**	(1.63)	(2.77)**	(3.26)**	(2.57)*	(2.91)**
20< Years<=30	0.063	0.089	0.082	0.085	0.059	0.075	20< Years<=30	0.078	0.055	0.114	0.074	0.077	0.076
	(3.06)**	(3.07)**	(2.33)*	(3.56)**	(2.59)**	(2.03)*		(3.79)**	(1.24)	(4.36)**	(2.64)**	(4.55)**	(2.11)*
> 30 Years	0.071	0.083	0.101	0.098	0.065	0.110	> 30 Years	0.091	0.104	0.149	0.097	0.068	0.099
	(3.12)**	(1.73)	(2.89)**	(3.41)**	(2.98)**	(2.60)**		(3.67)**	(2.08)*	(4.83)**	(3.44)**	(2.79)**	(3.82)**
Education:							**Education:**						
No qualification	-0.009	0.030	-0.061	-0.045	-0.013	-0.035	No qualification	-0.071	-0.157	-0.003	-0.017	-0.096	-0.072
	(-0.17)	(0.25)	(-0.81)	(-0.75)	(-0.28)	(-0.76)		(-1.62)	(-1.21)	(-0.05)	(-0.36)	(-2.45)*	(-0.99)
Primary	*f*	*f*	*f*	*f*	*f*	*f*	Primary	*f*	*f*	*f*	*f*	*f*	*f*
Secondary	0.162	0.223	0.173	0.153	0.135	0.146	Secondary	0.084	0.122	0.096	0.095	0.062	0.098
	(7.72)**	(4.28)**	(8.19)**	(6.07)**	(5.17)**	(7.22)**		(4.59)**	(5.21)**	(4.14)**	(4.01)**	(3.22)**	(3.09)**
College	0.330	0.386	0.355	0.309	0.312	0.294	College	0.228	0.220	0.244	0.265	0.240	0.168
	(11.80)**	(6.20)**	(14.79)**	(9.03)**	(9.56)**	(8.02)**		(6.96)**	(3.00)**	(7.67)**	(7.49)**	(7.46)**	(3.87)**
.University	0.610	0.618	0.588	0.583	0.578	0.663	University	0.487	0.404	0.495	0.528	0.510	0.506
	(22.17)**	(9.37)**	(22.70)**	(15.98)**	(16.20)**	(17.02)**		(13.65)**	(6.91)**	(11.17)**	(17.05)**	(14.78)**	(9.76)**
Settlement type:							**Settlement type:**						
Rural	*f*	*f*	*f*	*f*	*f*	*f*	Rural	*f*	*f*	*f*	*f*	*f*	*f*
City	0.052	0.047	0.055	0.042	0.042	0.056	City	0.030	0.039	0.041	0.044	0.031	0.024
	(4.41)**	(1.86)	(3.81)**	(3.64)**	(3.41)**	(3.53)**		(2.28)*	(1.58)	(2.24)*	(2.95)**	(2.06)*	(1.25)
Region:							**Region:**						
Belgrade	*f*	*f*	*f*	*f*	*f*	*f*	Belgrade	*f*	*f*	*f*	*f*	*f*	*f*
Central Serbia	-0.244	-0.287	-0.263	-0.249	-0.220	-0.162	Central Serbia	-0.324	-0.390	-0.363	-0.317	-0.307	-0.289
	(-18.2)**	(-10.3)**	(-19.8)**	(-24.0)**	(-16.3)**	(-8.62)**		(-19.5)**	(-10.2)**	-(24.0)**	(-14.3)**	(-20.6)**	(-10.2)**
Vojvodina	-0.095	-0.141	-0.167	-0.127	-0.069	-0.017	Vojvodina	-0.252	-0.319	-0.309	-0.270	-0.230	-0.211
	(-5.88)**	(-3.90)**	(-11.2)**	(-7.21)**	(-3.91)**	(-0.73)		(-13.5)**	(-9.69)**	(-18.4)**	(-14.3)**	(-9.69)**	(-6.24)**
Marital Status:							**Marital Status:**						
Married	0.058	0.013	0.069	0.084	0.065	0.022	Married	0.036	0.033	0.044	0.001	0.022	0.034
	(2.14)*	(0.47)	(2.73)**	(3.98)**	(2.29)*	(0.34)		(1.22)	(0.70)	(1.31)	(0.05)	(0.84)	(0.97)
Single	-0.023	-0.041	-0.007	0.013	-0.009	-0.017	Single	-0.015	-0.005	0.018	-0.042	-0.030	0.015
	(-0.76)	(-0.93)	(-0.29)	(0.47)	(-0.28)	(-0.25)		(-0.47)	(-0.09)	(0.51)	(-1.44)	(-0.89)	(0.36)
Divorced/Widow	*f*	*f*	*f*	*f*	*f*	*f*	Divorced/Widow	*f*	*f*	*f*	*f*	*f*	*f*
Nationality:							**Nationality:**						
Serbian	0.058	0.088	0.018	0.055	0.053	0.061	Serbian	0.013	-0.000	0.002	-0.003	0.017	0.039
	(2.95)**	(1.85)	(1.08)	(2.94)**	(1.94)	(2.55)*		(0.67)	(-0.00)	(0.07)	(-0.21)	(0.82)	(1.09)
Other	*f*	*f*	*f*	*f*	*f*	*f*	Other	*f*	*f*	*f*	*f*	*f*	*f*
Industry Branch:							**Industry Branch:**						

Agriculture	*f*	*f*	*f*	*f*	*f*	*f*	Agriculture	*f*	*f*	*f*	*f*	*f*	*f*
Industry&Mining	0.163	0.104	0.092	0.179	0.182	0.160	Industry&Mining	0.311	0.393	0.318	0.208	0.235	0.295
	(4.60)**	(1.75)	(2.54)*	(5.29)**	(5.15)**	(2.50)*		(8.39)**	(6.07)**	(3.95)**	(4.65)**	(7.16)**	(4.71)**
Construction	0.203	0.239	0.169	0.190	0.172	0.143	Construction	0.314	0.349	0.308	0.229	0.269	0.352
	(4.81)**	(3.11)**	(2.78)**	(5.54)**	(3.64)**	(2.41)*		(7.93)**	(5.79)**	(3.70)**	(4.95)**	(7.73)**	(4.83)**
Trade	0.068	0.077	0.011	0.048	0.091	0.079	Trade	0.246	0.354	0.281	0.165	0.186	0.218
	(1.32)	(1.04)	(0.22)	(0.87)	(1.64)	(1.14)		(6.32)**	(5.18)**	(3.98)**	(3.50)**	(5.87)**	(3.26)**
Catering&Tourism	-0.031	-0.101	-0.050	-0.048	-0.077	-0.068	Catering&Tourism	0.216	0.275	0.166	0.095	0.196	0.142
	(-0.53)	(-0.83)	(-0.76)	(-0.63)	(-1.20)	(-0.73)		(3.83)**	(2.74)**	(1.83)	(1.24)	(3.06)**	(1.81)
Transport	0.178	0.236	0.165	0.147	0.125	0.087	Transport	0.335	0.338	0.281	0.235	0.321	0.394
	(4.92)**	(3.65)**	(3.81)**	(3.71)**	(4.65)**	(1.27)		(7.63)**	(4.22)**	(3.29)**	(4.79)**	(9.28)**	(4.41)**
Financial Services	0.141	0.211	0.110	0.113	0.058	0.098	Financial Services	0.327	0.324	0.328	0.257	0.303	0.358
	(3.78)**	(3.28)**	(2.50)*	(2.83)**	(1.30)	(1.38)		(7.34)**	(3.53)**	(4.01)**	(4.69)**	(9.19)**	(4.49)**
Govern't Admin	0.271	0.375	0.274	0.225	0.162	0.153	Govern't Admin	0.580	0.979	0.687	0.433	0.340	0.258
	(7.46)**	(6.32)**	(7.19)**	(5.91)**	(4.83)**	(2.27)*		(6.96)**	(4.29)**	(5.02)**	(4.00)**	(3.73)**	(3.34)**
Education&Health	0.145	0.341	0.186	0.105	0.014	-0.061	Education&Health	0.140	0.149	0.109	0.097	0.096	0.210
	(4.05)**	(5.85)**	(4.68)**	(2.69)**	(0.42)	(-0.81)		(1.70)	(0.90)	(0.92)	(1.09)	(1.82)	(1.60)
Occupations:							**Occupations:**						
Farmer	-0.020	-0.020	-0.076	-0.086	0.037	0.017	Farmer	-0.034	-0.139	-0.105	-0.091	-0.023	-0.039
	(-0.31)	(-0.16)	(-0.73)	(-0.82)	(-0.30)	(0.19)		(-0.51)	(-0.88)	(-0.82)	(-1.40)	(-0.66)	(-0.44)
Industrial Worker	-0.070	-0.086	-0.102	-0.110	-0.050	0.005	Industrial Worker	0.164	0.181	0.159	0.171	0.171	0.068
	(-3.34)**	(-2.17)*	(-5.06)**	(-5.67)**	(-1.74)	(0.12)		(4.02)**	(2.26)*	(2.81)**	(3.38)**	(4.09)**	(1.57)
Trade Worker	-0.099	-0.210	-0.226	-0.121	-0.085	0.005	Trade Worker	0.022	0.034	0.009	0.006	0.029	-0.091
	(-1.60)	(-3.53)**	(-1.98)*	(-1.72)	(-1.34)	(0.05)		(0.50)	(0.42)	(0.16)	(0.11)	(0.59)	(-1.73)
Service Worker	*f*	*f*	*f*	*f*	*f*	*f*	Service Worker	*f*	*f*	*f*	*f*	*f*	*f*
Welfare Worker	0.027	0.085	0.010	0.004	0.042	0.053	Welfare Worker	0.256	0.634	0.277	-0.010	0.338	0.107
	(0.85)	(1.51)	(0.32)	(0.10)	(1.29)	(0.94)		(1.58)	(2.37)*	(1.50)	(-0.04)	(1.13)	(0.37)
Clerk	-0.095	-0.064	-0.104	-0.101	-0.089	-0.059	Clerk	0.198	0.241	0.191	0.158	0.182	0.150
	(-4.05)**	(-2.18)*	(-3.93)**	(-5.20)**	(-3.08)**	(-1.46)		(4.41)**	(3.16)**	(4.24)**	(3.61)**	(3.18)**	(2.44)*
Manager	0.189	0.257	0.208	0.159	0.164	0.200	Manager	0.567	0.583	0.548	0.491	0.546	0.667
	(4.90)**	(3.78)**	(4.88)**	(3.64)**	(3.45)**	(2.82)**		(9.73)**	(3.73)**	(6.61)**	(9.27)**	(6.61)**	(6.11)**
Professional	0.032	0.033	0.018	0.021	0.046	0.085	Professional	0.381	0.428	0.369	0.361	0.354	0.296
	(1.47)	(0.80)	(0.92)	(1.22)	(1.52)	(2.02)*		(9.10)**	(5.11)**	(7.92)**	(6.69)**	(8.28)**	(6.14)**
Other	-0.165	-0.142	-0.172	-0.177	-0.159	-0.107	Other	0.020	0.025	0.014	0.035	0.040	-0.055
	(-6.24)**	(-3.55)**	(-4.70)**	(-6.57)**	(-4.31)**	(-2.50)*		(0.44)	(0.32)	(0.20)	(0.75)	(0.87)	(-1.13)
Year:							**Year:**						
2004	*f*	*f*	*f*	*f*	*f*	*f*	2004	*f*	*f*	*f*	*f*	*f*	*f*
2005	0.056	0.033	0.063	0.034	0.037	0.016	2005	0.034	0.020	0.023	0.024	0.055	0.048
	(3.35)**	(1.08)	(3.64)**	(2.40)*	(1.98)*	(0.56)		(1.52)	(0.52)	(1.07)	(1.02)	(1.93)	(1.68)
2006	0.183	0.176	0.168	0.142	0.158	0.144	2006	0.165	0.218	0.179	0.141	0.133	0.107
	(10.94)**	(5.04)**	(7.90)**	(8.75)**	(6.22)**	(9.65)**		(7.88)**	(6.80)**	(5.40)**	(5.81)**	(5.16)**	(3.80)**
2007	0.297	0.302	0.290	0.276	0.275	0.252	2007	0.186	0.298	0.212	0.158	0.154	0.120
	(16.98)**	(7.17)**	(12.73)**	(16.38)**	(13.39)**	(9.48)**		(8.72)**	(8.86)**	(8.02)**	(7.29)**	(5.97)**	(3.50)**
2008	0.341	0.350	0.303	0.311	0.308	0.301	2008	0.243	0.344	0.275	0.197	0.182	0.165

	(19.96)**	(9.58)**	(15.06)**	(16.96)**	(19.04)**	(16.47)**		(12.10)**	(7.88)**	(12.21)**	(8.87)**	(9.20)**	(5.38)**
Constant:	4.064	3.531	3.924	4.144	4.390	4.527	**Constant:**	3.817	3.182	3.540	3.987	4.194	4.393
	(73.77)**	(39.87)**	(68.25)**	(65.94)**	(92.29)**	(47.63)**		(55.04)**	(26.58)**	(49.02)**	(64.35)**	(70.88)**	(42.64)**
R-sq/Pseudo Rsq:	0.37	0.21	0.23	0.24	0.25	0.26	**R-sq/Pseudo Rsq:**	0.33	0.18	0.17	0.19	0.27	0.23
Observations:	5990	5990	5990	5990	5990	5990	**Observations:**	5928	5928	5928	5928	5928	5928

Notes to Table 4.11:

a) Samples relate to full-time employees aged 15 to 64 who reported non-zero main job hours of work and non-zero main job earnings received for the month and the year of the survey. The public sector includes social and state sectors.
b) The dependent variable is the log of real hourly earnings. Earnings are net of taxes, pensions and welfare benefits and are expressed in October 2005 Serbian dinars.
c) All explanatory variables are categorical.
d) The estimation procedure for the mean robust regression is OLS and *t* test reported in parentheses is calculated based on White (1980) heteroskedasticity-robust estimated standard errors. Bootstrapped quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}). The *t* test reported in parentheses for the quantile regressions is calculated based on standard errors estimated by the bootstrapping procedure with 1000 replications in all cases. OLS and bootstrapped quantile regression analysis reported used STATA 8.0: ** and * denote significance at the 0.01 and 0.05 level respectively.
e) *f* denotes category omitted in estimation.

Data Source: Labour Force Survey of the Republic of Serbia 2004-2008

Table A4.12: Estimation of main job hourly earnings in Serbia for women, 2004-2008

Public	Mean	10th	25th	50th	75th	90th	Private	Mean	10th	25th	50th	75th	90th
Experience:							**Experience:**						
<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*	<= 5 Years	*f*	*f*	*f*	*f*	*f*	*f*
.5< Years<=10	0.032	0.085	0.010	0.020	0.030	-0.009	5<Years<=10	0.047	0.026	0.039	0.030	0.041	0.092
	(1.59)	(2.73)**	(0.46)	(1.74)	(2.04)*	(-0.33)		(2.34)*	(0.78)	(2.45)*	(1.70)	(1.94)	(3.32)**
10< Years<=20	0.086	0.118	0.064	0.073	0.085	0.060	10<Years<=20	0.113	0.096	0.090	0.102	0.112	0.171
	(4.88)**	(3.79)**	(2.28)*	(6.16)**	(6.53)**	(3.35)**		(6.09)**	(3.87)**	(4.14)**	(4.66)**	(5.59)**	(5.28)**
20< Years<=30	0.131	0.155	0.109	0.099	0.124	0.095	20<Years<=30	0.142	0.133	0.123	0.134	0.165	0.195
	(7.13)**	(4.89)**	(4.47)**	(7.45)**	(9.48)**	(3.77)**		(6.93)**	(3.13)**	(4.38)**	(7.15)**	(7.49)**	(8.54)**
> 30 Years	0.177	0.233	0.158	0.146	0.161	0.117	> 30 Years	0.097	0.038	0.078	0.046	0.096	0.188
	(8.26)**	(6.83)**	(6.35)**	(10.08)**	(7.76)**	(4.62)**		(2.97)**	(0.61)	(2.04)*	(1.12)	(3.03)**	(4.02)**
Education:							**Education:**						
No qualification	-0.027	-0.073	-0.052	0.051	-0.025	-0.082	No qualification	-0.117	-0.021	-0.104	-0.064	-0.097	-0.195
	(-0.32)	(-0.39)	(-0.53)	(0.84)	(-0.78)	(-0.49)		(-2.27)*	(-0.18)	(-1.64)	(-1.10)	(-1.79)	(-2.19)*
Primary	*f*	*f*	*f*	*f*	*f*	*f*	Primary	*f*	*f*	*f*	*f*	*f*	*f*
Secondary	0.197	0.137	0.157	0.163	0.201	0.212	Secondary	0.109	0.055	0.101	0.136	0.127	0.107
	(9.73)**	(7.25)**	(9.56)**	(10.00)**	(7.50)**	(6.91)**		(4.86)**	(1.73)	(2.82)**	(5.68)**	(4.34)**	(2.21)*
College	0.366	0.318	0.333	0.308	0.339	0.361	College	0.263	0.183	0.245	0.301	0.330	0.275
	(15.10)**	(10.82)**	(10.83)**	(16.09)**	(9.90)**	(10.79)**		(7.21)**	(3.18)**	(4.00)**	(8.74)**	(7.62)**	(3.82)**
University	0.642	0.575	0.575	0.566	0.642	0.748	University	0.525	0.410	0.527	0.554	0.543	0.586
	(26.43)**	(18.00)**	(19.09)**	(25.95)**	(18.25)**	(18.77)**		(13.93)**	(9.09)**	(12.55)**	(11.74)**	(9.34)**	(8.27)**
Settlement type:							**Settlement type:**						
Rural	*f*	*f*	*f*	*f*	*f*	*f*	Rural	*f*	*f*	*f*	*f*	*f*	*f*
City	0.038	0.028	0.025	0.027	0.042	0.068	City	0.061	0.065	0.056	0.053	0.054	0.071
	(3.48)**	(0.99)	(1.61)	(2.84)**	(3.26)**	(6.35)**		(4.27)**	(2.21)*	(3.61)**	(2.85)**	(2.86)**	(2.99)**
Region:							**Region:**						
Belgrade	*f*	*f*	*f*	*f*	*f*	*f*	Belgrade	*f*	*f*	*f*	*f*	*f*	*f*
Central Serbia	-0.163	-0.116	-0.122	-0.129	-0.142	-0.125	Central Serbia	-0.359	-0.390	-0.392	-0.385	-0.349	-0.315
	(-13.9)**	(-6.80)**	(-9.15)**	(-10.5)**	(-10.1)**	(-7.85)**		(-21.5)**	(-13.8)**	(-21.9)**	(-18.0)**	(-15.8)**	(-13.2)**
Vojvodina	-0.083	-0.079	-0.087	-0.066	-0.061	-0.042	Vojvodina	-0.256	-0.278	-0.303	-0.287	-0.249	-0.200
	(-5.82)**	(-4.00)**	(-4.79)**	(-4.19)**	(-3.73)**	(-2.20)*		(-12.90)**	(-8.01)**	(-13.60)**	(-11.40)**	(-7.54)**	(-5.74)**
Marital Status:							**Marital Status:**						
Married	0.015	0.034	0.000	-0.001	-0.006	-0.031	Married	0.005	0.048	0.011	0.011	-0.006	-0.013
	(0.83)	(2.02)*	(0.01)	(-0.07)	(-0.29)	(-1.08)		(0.22)	(1.41)	(0.50)	(0.58)	(-0.19)	(-0.38)
Single	0.004	0.010	-0.009	-0.015	0.009	-0.026	Single	0.009	0.080	0.020	-0.007	0.011	0.021
	(0.16)	(0.30)	(-0.29)	(-0.88)	(0.38)	(-0.70)		(0.32)	(2.08)*	(0.68)	(-0.24)	(0.39)	(0.72)
Divorced/Widow	*f*	*f*	*f*	*f*	*f*	*f*	Divorced/Widow	*f*	*f*	*f*	*f*	*f*	*f*
Nationality:							**Nationality:**						
Serbian	0.013	-0.005	0.011	0.010	0.026	0.026	Serbian	0.037	0.052	0.044	0.058	0.045	0.004
	(0.70)	(-0.15)	(0.47)	(0.61)	(1.20)	(0.99)		(1.59)	(1.46)	(1.55)	(2.56)*	(1.23)	(0.16)
Other	*f*	*f*	*f*	*f*	*f*	*f*	Other	*f*	*f*	*f*	*f*	*f*	*f*
Industry Branch:							**Industry Branch:**						

Agriculture	*f*	*f*	*f*	*f*	*f*	*f*	Agriculture	*f*	*f*	*f*	*f*	*f*	*f*
Industry&Mining	0.044	0.107	-0.101	0.082	0.124	0.092	Industry&Mining	0.303	0.690	0.371	0.197	0.173	0.199
	(0.80)	(0.72)	(-0.76)	(1.33)	(1.78)	(2.38)*		(5.44)**	(4.00)**	(4.32)**	(5.52)**	(2.55)*	(4.80)**
Construction	0.087	0.247	0.032	0.073	0.065	0.064	Construction	0.261	0.705	0.382	0.169	0.141	0.199
	(1.07)	(0.77)	(0.23)	(1.06)	(0.69)	(0.49)		(3.44)**	(3.29)**	(4.45)**	(2.67)**	(1.51)	(1.78)
Trade	0.127	0.357	0.065	0.143	0.087	0.055	Trade	0.268	0.631	0.371	0.179	0.129	0.160
	(2.04)*	(1.74)	(0.45)	(2.09)*	(1.21)	(1.27)		(4.68)**	(3.85)**	(4.26)**	(4.13)**	(1.72)	(3.20)**
Catering&Tourism	0.081	0.215	-0.050	0.115	0.098	0.051	Catering&Tourism	0.252	0.593	0.265	0.123	0.107	0.200
	(1.28)	(1.15)	(-0.39)	(1.85)	(1.03)	(0.84)		(3.78)**	(3.15)**	(3.13)**	(1.68)	(1.50)	(2.83)**
Transport	0.194	0.411	0.137	0.191	0.195	0.172	Transport	0.342	0.617	0.345	0.235	0.261	0.272
	(3.47)**	(2.35)*	(1.01)	(3.47)**	(2.68)**	(3.93)**		(4.73)**	(3.22)**	(2.91)**	(2.80)**	(2.74)**	(4.58)**
Financial Services	0.195	0.414	0.122	0.162	0.174	0.186	Financial Services	0.400	0.702	0.440	0.321	0.294	0.313
	(3.61)**	(2.42)*	(0.86)	(3.01)**	(2.28)*	(3.80)**		(6.72)**	(3.88)**	(5.08)**	(8.61)**	(3.65)**	(5.64)**
Govern't Admin	0.243	0.520	0.180	0.212	0.172	0.150	Govern't Admin	0.322	0.841	0.403	0.142	0.154	0.741
	(4.66)**	(3.06)**	(1.38)	(3.95)**	(2.42)*	(3.37)**		(2.11)*	(5.47)**	(3.61)**	(0.99)	(0.40)	(1.65)
Education&Health	0.157	0.517	0.148	0.133	0.034	-0.035	Education&Health	0.361	0.749	0.428	0.235	0.241	0.275
	(3.05)**	(3.12)**	(1.16)	(2.40)*	(0.50)	(-0.92)		(4.93)**	(4.62)**	(4.31)**	(3.32)**	(1.93)	(2.60)**
Occupations:							**Occupations:**						
Farmer	-0.010	0.156	-0.196	-0.044	0.014	-0.073	Farmer	0.153	0.176	0.113	0.063	0.217	0.247
	(-0.10)	(0.92)	(-1.27)	(-0.25)	(0.14)	(-0.42)		(2.04)*	(1.16)	(1.32)	(0.68)	(2.26)*	(2.40)*
Industrial Worker	-0.124	-0.119	-0.118	-0.076	-0.084	-0.117	Industrial Worker	0.058	0.046	0.035	0.045	0.037	0.043
	(-2.69)**	(-1.06)	(-1.88)	(-1.65)	(-1.45)	(-1.79)		(1.40)	(0.65)	(0.74)	(0.73)	(0.67)	(0.72)
Trade Worker	-0.219	-0.177	-0.251	-0.165	-0.218	-0.215	Trade Worker	-0.004	0.018	-0.060	-0.025	-0.024	-0.020
	(-3.81)**	(-1.53)	(-2.40)*	(-2.07)*	(-4.45)**	(-3.37)**		(-0.09)	(0.28)	(-1.26)	(-0.44)	(-0.49)	(-0.28)
Service Worker	*f*	*f*	*f*	*f*	*f*	*f*	Service Worker	*f*	*f*	*f*	*f*	*f*	*f*
Welfare Worker	0.132	0.181	0.180	0.176	0.099	0.001	Welfare Worker	0.264	0.184	0.201	0.289	0.265	0.276
	(4.93)**	(5.01)**	(4.09)**	(7.21)**	(2.83)**	(0.04)		(6.24)**	(2.30)*	(4.03)**	(4.98)**	(5.62)**	(4.81)**
Clerk	0.272	0.348	0.294	0.365	0.276	0.224	Clerk	0.521	0.326	0.380	0.532	0.670	0.704
	(4.99)**	(5.17)**	(4.29)**	(4.46)**	(4.33)**	(3.50)**		(7.40)**	(3.68)**	(4.04)**	(5.75)**	(7.85)**	(7.53)**
Manager	0.221	0.287	0.279	0.289	0.207	0.153	Manager	0.350	0.290	0.286	0.347	0.358	0.385
	(8.96)**	(8.37)**	(6.37)**	(13.62)**	(6.42)**	(4.69)**		(8.86)**	(3.90)**	(6.33)**	(6.20)**	(8.61)**	(6.13)**
Professional	-0.099	-0.076	-0.102	-0.098	-0.117	-0.114	Professional	0.103	-0.027	0.046	0.110	0.115	0.228
	(-3.75)**	(-2.51)*	(-2.11)*	(-3.35)**	(-2.40)*	(-2.30)*		(2.42)*	(-0.34)	(1.19)	(1.96)	(1.70)	(2.38)*
Other							Other						
Year:							**Year:**						
2004	*f*	*f*	*f*	*f*	*f*	*f*	2004	*f*	*f*	*f*	*f*	*f*	*f*
2005	0.047	0.056	0.045	0.036	0.029	0.051	2005	0.041	-0.009	0.003	0.022	0.054	0.086
	(3.02)**	(1.94)	(4.32)**	(2.79)**	(1.54)	(3.20)**		(1.66)	(-0.18)	(0.09)	(0.68)	(1.96)	(1.89)
2006	0.130	0.131	0.118	0.115	0.120	0.138	2006	0.130	0.158	0.143	0.105	0.104	0.104
	(8.72)**	(5.86)**	(8.35)**	(7.57)**	(6.14)**	(6.15)**		(5.81)**	(4.23)**	(4.95)**	(5.27)**	(3.65)**	(3.03)**
2007	0.262	0.246	0.242	0.278	0.265	0.279	2007	0.182	0.206	0.196	0.166	0.136	0.154
	(16.56)**	(8.38)**	(18.86)**	(18.88)**	(15.27)**	(14.30)**		(8.30)**	(5.21)**	(5.30)**	(6.39)**	(5.85)**	(5.37)**
2008	0.306	0.265	0.270	0.311	0.318	0.302	2008	0.199	0.253	0.235	0.204	0.150	0.101
	(19.81)**	(12.04)**	(12.47)**	(19.83)**	(17.11)**	(17.69)**		(9.48)**	(5.81)**	(6.99)**	(9.01)**	(6.34)**	(3.87)**

Constant:	3.818 (57.96)**	3.154 (17.90)**	3.736 (31.93)**	3.869 (59.59)**	4.086 (56.36)**	4.321 (52.01)**	**Constant:**	3.653 (47.47)**	2.875 (12.89)**	3.427 (53.94)**	3.764 (50.34)**	4.027 (47.01)**	4.186 (39.58)**
Rsq/Pseudo Rsq:	0.54	0.35	0.38	0.38	0.38	0.38	**R-sq/Pseudo Rsq:**	0.45	0.22	0.24	0.29	0.32	0.34
Observations:	4772	4772	4772	4772	4772	4772	**Observations:**	4099	4099	4099	4099	4099	4099

Notes to Table A4.12: See Notes to Table A4.11.

Data Source: Labour Force Survey of the Republic of Serbia 2004-2008

Table A4.13: Decomposition of public-private sector earnings differential at different quantiles for men and women in Serbia

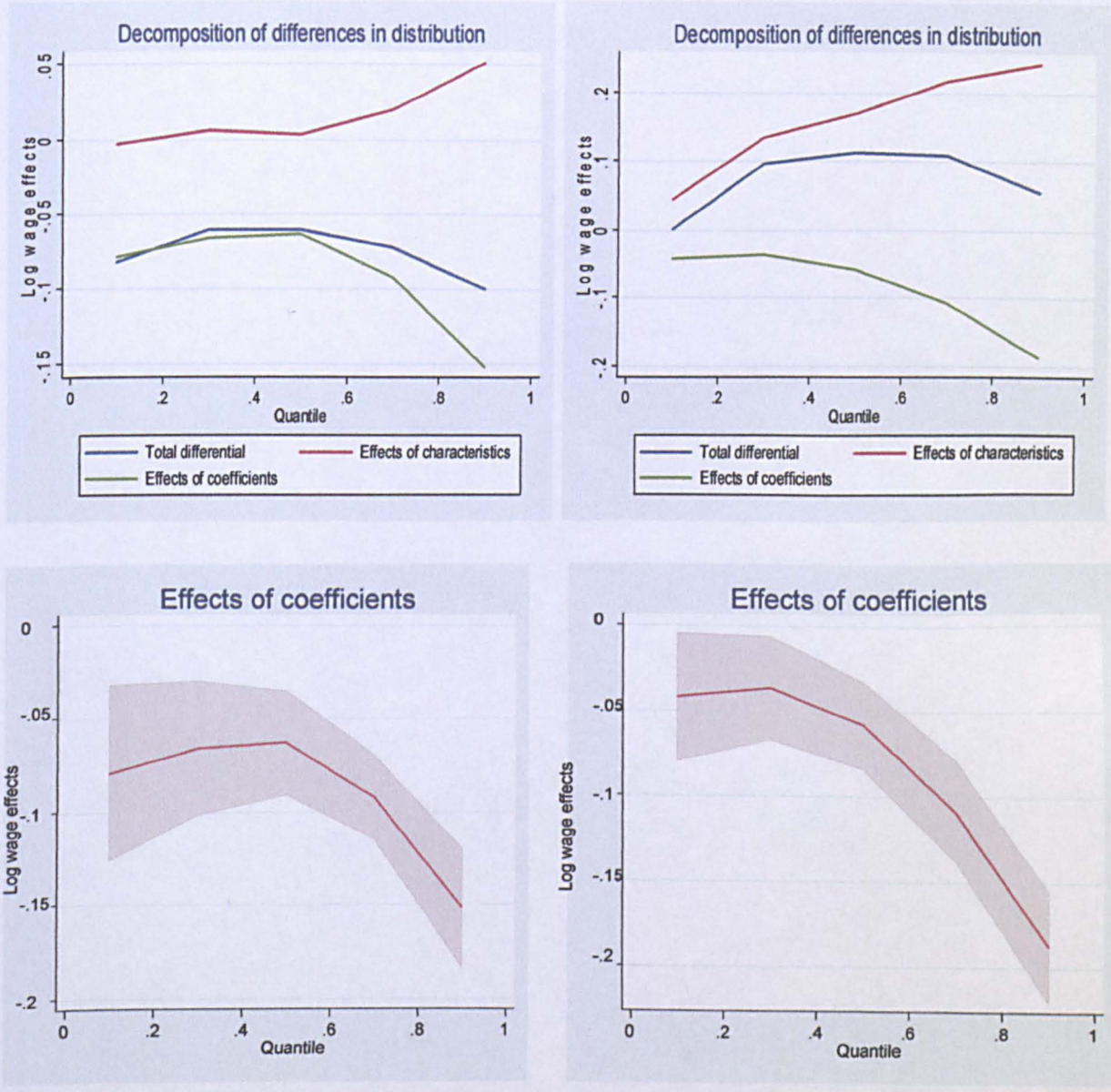
	LFS 1995-2003				LSMS 2002-2003				LFS 2004-2008			
	Men		Women		Men		Women		Men		Women	
Percentile:	Total differential	Effects of coefficients	Total differential	Effects of coefficients	Total differential	Effects of coefficients	Total differential	Effects of coefficients	Total differential	Effects of coefficients	Total differential	Effects of coefficients
10th	-0.084** (-9.67)	-0.078** (-4.21)	-0.000 (-0.03)	-0.043* (-2.23)	0.048* (2.24)	0.043 (1.09)	0.168** (7.69)	-0.072* (-2.37)	0.298** (24.19)	0.170** (11.57)	0.358** (29.74)	0.122** (18.98)
30th	-0.061** (-10.78)	-0.066** (-3.66)	0.095** (11.48)	-0.037* (-2.28)	0.011 (0.90)	-0.016 (-0.62)	0.209** (15.18)	-0.013 (-0.52)	0.282** (35.23)	0.131** (13.85)	0.429** (37.36)	0.158** (21.88)
50th	-0.062** (-14.2) **	-0.063** (-3.67)	0.109** (15.51)	-0.058** (-3.83)	-0.024* (-2.04)	-0.062** (-2.78)	0.178** (14.90)	0.014 (0.66)	0.271** (33.24)	0.103** (11.69)	0.417** (51.54)	0.118** (19.94)
70th	-0.074** (-15.33)	-0.092** (-4.97)	0.106** (14.14)	-0.109** (-8.53)	-0.054** (-3.84)	-0.079** (-3.64)	0.154** (11.26)	-0.044 (-1.93)	0.256** (27.32)	0.076** (7.83)	0.365** (42.43)	0.052** (7.51)
90th	-0.104** (-16.63)	-0.153** (-6.42)	0.051** (6.23)	-0.188** (-9.25)	-0.077** (-4.38)	-0.130** (-3.37)	0.001 (0.02)	-0.259** (-4.70)	0.197** (17.82)	-0.000 (-0.02)	0.232** (16.75)	-0.059** (-5.33)

Notes to Table A4.13: See Notes to Figures A4.1, A4.2 and A4.3.

Data Source: Labour Force Survey of the Republic of Serbia (LFS) 1995-2008 and Living Standard Measurement Survey (LSMS) 2002-2003

Figure A4.1: Decomposition of public-private sector earnings differential at different quantiles for men and women in Serbia, LFS 1995-2003

Men **Women**



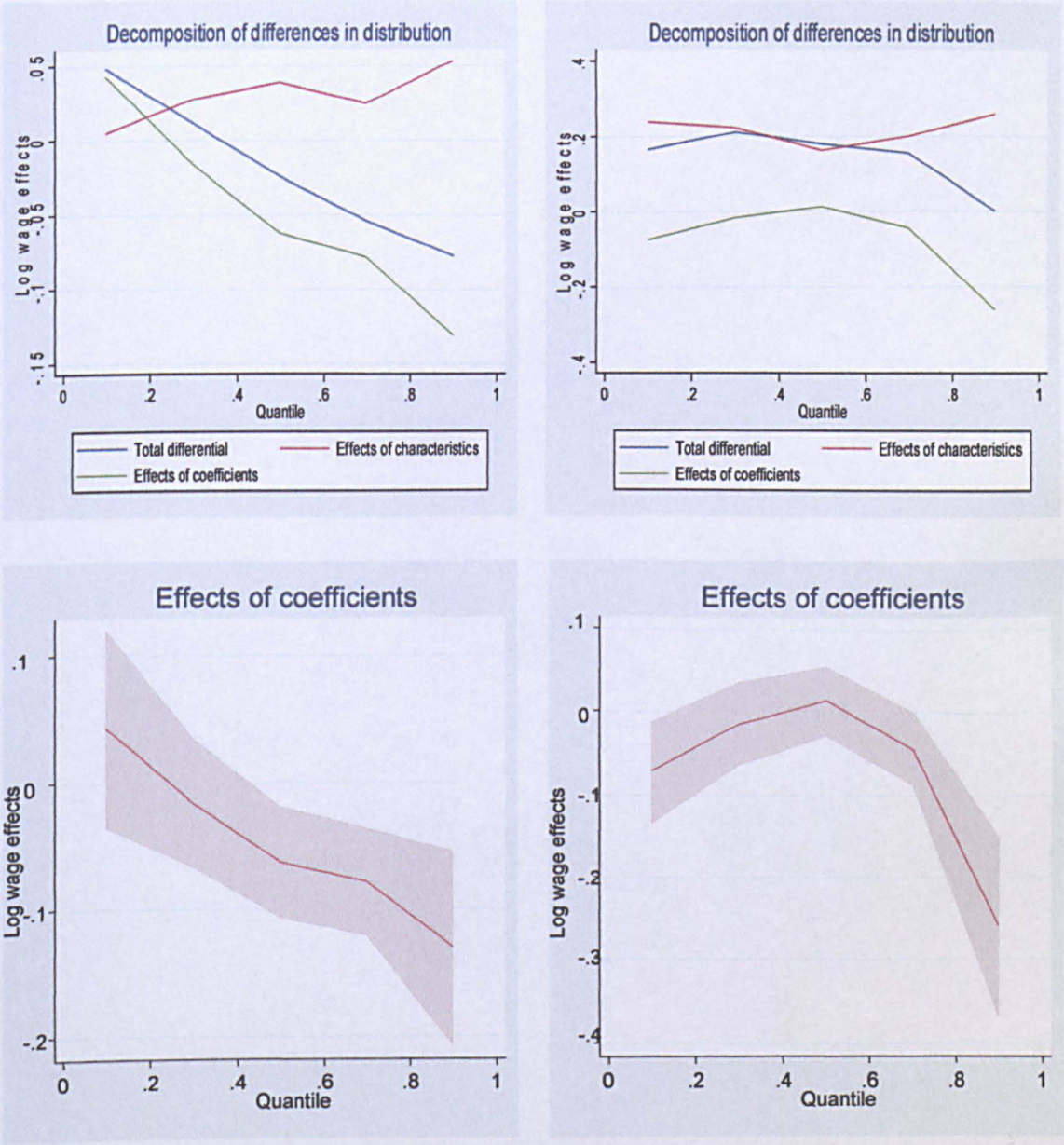
Notes to Figure A4.1:

Decomposition estimation procedure implemented by estimating 100 traditional quantile regressions in each sector. Each regression specification includes a set of dummies for: labour force experience, educational qualification, marital status, settlement type, region, nationality, industry branch, occupational affiliation and year. The variance has been estimated by bootstrapping the results 100 times. Effects of coefficients presented with 95% confidence interval.

Data Source: LFS 1995-2003

Figure A4.2: Decomposition of public-private sector earnings differential at different quantiles for men and women in Serbia, LSMS 2002-2003

Men **Women**



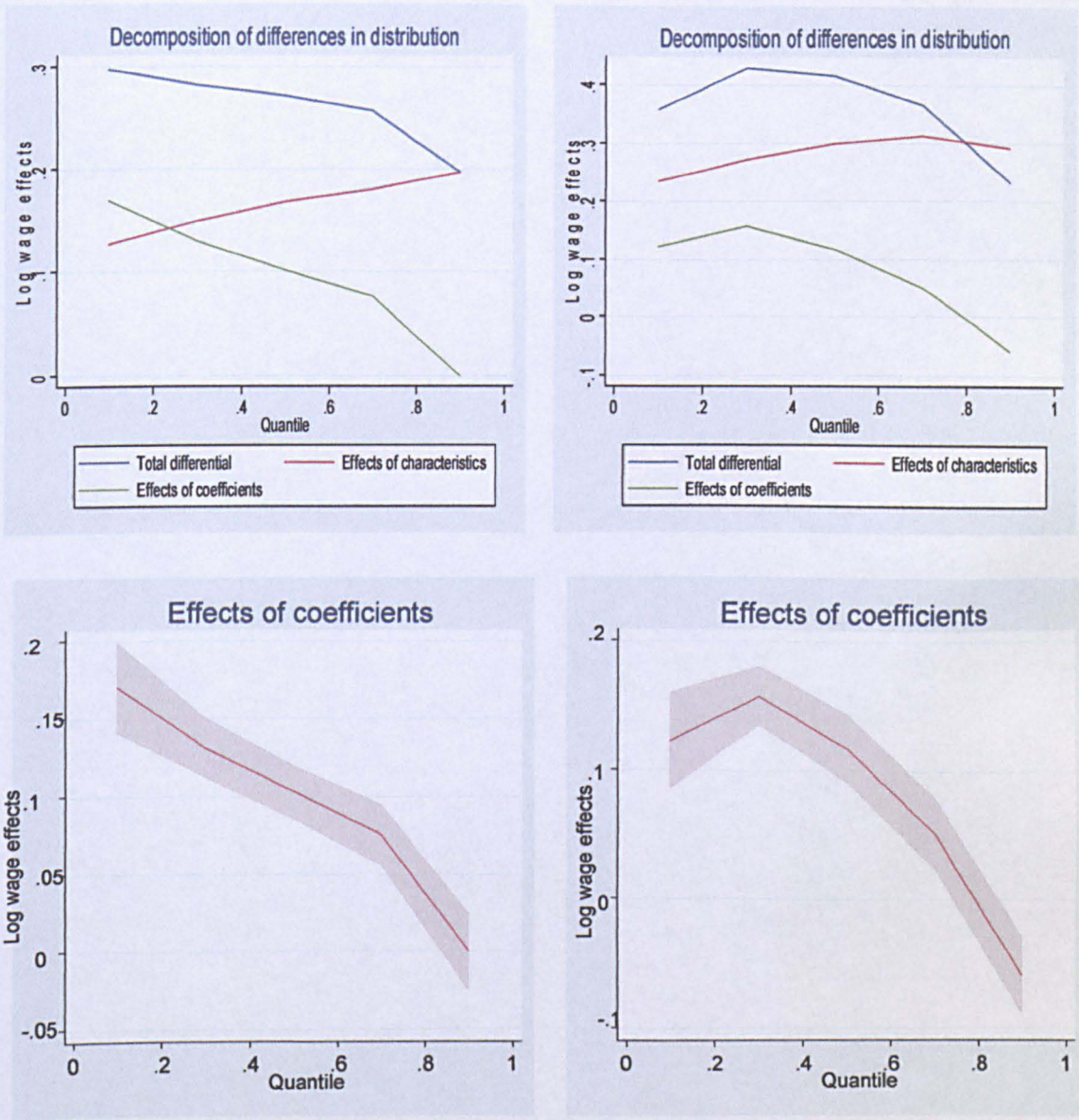
Notes to Figure A4.2:

Decomposition estimation procedure implemented by estimating 100 traditional quantile regressions in each sector. Each regression specification includes a set of dummies for: labour force experience, educational qualification, marital status, settlement type, region, industry branch and year. The variance has been estimated by bootstrapping the results 100 times. Effects of coefficients presented with 95% confidence interval.

Data Source: LSMS 2002-2003

Figure A4.3: Decomposition of public-private sector earnings differential at different quantiles for men and women in Serbia, LFS 2004-2008

Men **Women**



Notes to Figure A4.3:

Decomposition estimation procedure implemented by estimating 100 traditional quantile regressions in each sector. Each regression specification includes a set of dummies for: labour force experience, educational qualification, marital status, settlement type, region, nationality, industry branch, occupational affiliation and year. The variance has been estimated by bootstrapping the results 100 times. Effects of coefficients presented with 95% confidence interval.

Data Source: LFS 2004-2008

Chapter 5

5 Public-private earnings differentials in Hungary

5.1 Introduction

This chapter aims to explore wage differentials between the public and private sectors in Hungary from 1992 to 2003. The question of interests are again whether there is evidence of different wage distributions between the public and private sectors and to what extent the public sector wage distribution has changed as a result of the economic transition.

The analysis of the evolution of the wage structures between private and public sectors during the economic transition is particularly interesting for the case of Hungary. During the period observed (1992-2003), the public sector has been largely privatised and restructured through a number of wage reforms. The ownership transformation had a potential effect on the distributions of wages in the two sectors of employment.

The evolution of wages in the public and private sectors during the period of economic transition in Hungary is examined by estimating wage differentials for full-time male and female employees with similar characteristics on average and across the percentiles of the wage distribution. Furthermore, the chapter examines public sector pay penalties/premia for different skilled groups of workers. Ordinary least squares (OLS) and quantile regression estimation methods as well as decomposition of differences in distributions are again utilised. This chapter does not attempt to control for the measurement error in cross-sectional estimates of the public sector pay gap because the microdata used is an employer survey.

The chapter is organised into three parts. In the first part we examine the institutional setting and method of privatisation in Hungary, as well as macroeconomic context and wage reforms during the economic transition. The second part explains the data and variables used in the empirical analysis. This part also introduces the wage trends and inequality. The final part estimates public-private sector earnings differentials by gender on average and at different points of the distribution. In addition, the pay effects of public sector status across groups differentiated by educational qualifications attained are estimated.

5.2 Transition in Hungary

5.2.1 Institutional background and privatisation

Pre-transition Hungary had a similar wage-employment setting to other central planned economies. Köllő (1998) describes the system of pay reward in Hungary as having two main characteristics: first, firms in Hungary were constrained in their scope for discretionary wage-setting; and second, enterprises had an incentive to over-employ workers beyond the efficient level.

Public wage policy was intended to minimise wage differentials. Workers were not rewarded according to their skill or productivity. The returns to education were low (Hámori, 2007).

Although Hungary abolished central planning in 1968, the wage plan remained the single most rigid limit set for enterprises. Wage levels were controlled by means of a tax that was a function of the ratio of wage bill growth to value added growth (Köllő, 1998). The tax regime penalised "excessive" increases in the wage bill and encouraged enterprises to increase employment rather than wage rates.

Wages were not taxed at the individual level. Personal income tax was introduced for the first time in Hungary in 1988 (Abraham and Kézdi, 2000).

The first market-oriented reforms of the Hungarian labour market started in 1985. Managing rights in labour markets were delegated to firms and political barriers to dismissals

were eliminated (Köllő, 1998). As a result, employment in Hungary started to decline as over-employment was reduced.

Commander, Köllő and Ugaz (1994) document that at the start of the economic transition, Hungarian firms in the state sector (relative to other Eastern European comparators) cut employment often by involuntary means and by large magnitudes (for example over 33% between 1989 and 1993). These cuts in employments were seen as a response to very significant labour hoarding and intended to bring employment closer to competitive levels. For example, during the period 1990-1993, the ratio of state sector job losses to private sector job gains was 1.7 (Commander, Köllő and Ugaz, 1994). Consequently, open unemployment grew from virtually zero during the pre-transition period to double digits during the 1990s (Delteil, Pailhé and Redor, 2004).

The organised process of privatising state enterprises started in 1991. Privatisation in Hungary was mainly based on competitive tenders open to foreign participation. Brown, Earle and Telegdy (2008) point out that workers were not given rights to preferentially acquire shares in their companies nor were there mass distribution of shares aided by vouchers unlike in other transition economies (for example in Poland or Czech Republic). The outcome was very little worker ownership (in only about 250 firms), and instead significant managerial ownership and highly concentrated block holdings, many of them by foreign investors.

The method of case-by-case privatisation (mainly by foreign direct investment), although gradual, was completed earlier than in most other Eastern European countries. Brown, Earle and Telegdy (2008) report that by the end of 1992, 43.6% of Hungarian firms had already been privatised and that the share of firms privatised to foreigner ownership was the highest, relative to other Eastern European countries (nearly 17% of all enterprises by 2004). In terms of employment, this meant that more than 50% of employment of the firms that were privatised was sold to foreign investors (Delteil, Pailhé and Redor, 2004).

Overall, Hungary has been considered as one of the most successful countries in transforming its economy from state socialism to modern capitalism (Kézdi, 2002). The EBRD (2003) Transition Report records that, even during post-privatisation phase of foreign investment.(from 1998), Hungary continues to attract foreign capital owing to the wide availability of skilled and 'knowledge workers' and also because of the implementation of supportive economic policies.

The supportive economic policies to the business sector included: low corporate tax rate at 16% (which is one of the lowest among OECD countries) as well as the tax exemption of inbound dividends, tax deductions on interest income and a system of direct budgetary support in favour of certain types of companies in both private and state ownership (EBRD, 2004).

In 2003, the government adopted a plan to complete the process of privatisation within the next three years, after which only 37 companies would remain permanently in state ownership (EBRD, 2003). Nevertheless, even these companies are market oriented and in terms of wage-setting do not differ from privately owned companies. For this reason the public sector in Hungary now comprises only "budget sectors": government administration, education, health and social services.

Since privatisation, enterprise-level bargaining plays the decisive role in wage determination (Kertesi and Köllő, 2000). A tripartite Commission of Conciliation of Interests was set up in 1988 to help industrial dialogue and to facilitate negotiations between the state, employers' associations and trade unions (Delteil, Pailhé and Redor, 2004). However, even though unions, chambers of commerce and the government enter national-level negotiations, they only publish recommendations rather than effective guidelines (Kertesi and Köllő, 2000). In general, from 1993 in Hungary wages are set at the firm level regardless of the ownership type and the majority of the firms have no collective agreement at the industry branch or region level (Delteil, Pailhé and Redor, 2004).

Kertesi and Köllő (2000) reveal that the emerging institutional patterns of bargaining provide favourable conditions for competitive labour markets. A 'union effect' on wages is not found. In addition, during the 1990s minimum wages were set at low levels and only indirectly influenced the wage-setting through underpinning public sector pay and social benefits (Kertesi and Köllő, 2000). The next section describes macroeconomic circumstances during the economic transition in Hungary.

5.2.2 Macroeconomic Context and Wages

The economic transition in Hungary can be divided into three periods.[30] The first period, from 1990 to 1997, relates to so called 'transformational' phase and stabilisation package. The second time period, from 1998 to 2000, is known as 'the boom of the Hungarian economy'. The third time period from 2001 to 2003 is characterised by the set of wage reforms.

During the 'transformational recession' real gross wages declined (by 7.6% in 1995 relative to 1994) coupled with a decrease in the rate of real GDP growth (by 1.4% in 1995 relative to 1994) and an increase in the inflation rate (by 10% in 1995 relative to 1994) (Tables 5.1a and 5.1b).

In 1995, the *'Bokors Csomag'* stabilisation programme was adopted This programme constrained the growth of nominal public sector wages and the government budget. These measures increased the GDP growth rate (by 4-5% per year) and decreased the inflation rate from around 28% in 1995 to 10% by 2000 (Hámori (2007) and Table 5.1a). Moreover, in 1995, apart from fiscal restrictions and changes in monetary policy, the banks and public utilities were privatised to foreign strategic investors (Kézdi, 2002).

During the 'boom' of the Hungarian economy, from 1998 to 2000, real wages started to increase (by 4% on average per annum) as well as labour force participation (by 1% average per annum) and the unemployment rate declined to 6.4% in 2000 (Table 5.1b).

The third period of economic transition begun after 2000 and coincides with the period of wage reforms when the Socialist-led government came into the office in 2002. During this period the minimum wage increased from around 29% of average earnings in 2000 to 41% in 2002 (Hámori, 2007).[31] In addition, between September 2002 and 2003, public sector nominal wages increased by 50% on average affecting various groups of public service employees (approximately 800,000 employees which represents around 20% of the labour force) (Hámori, 2007).

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[30] Division based on Horváth and Hudomiet (2005) and Hámori (2007)

[31] The statutory minimum wage relates to gross monthly earnings net of overtime pay, shift pay and bonuses. The minimum wage is legally binding and covers all employment contracts (Hámori, 2007).

Table 5.1a: Main macroeconomic indicators in Hungary, 1990-2008

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Growth in real GDP (%)	-3.5	-11.9	-3.1	-0.6	2.9	1.5	1.3	4.6	4.9	4.2	6.0	4.3	3.8	3.4	5.2	4.1	3.5	1.2	0.6
Inflation (%)	28.9	35.0	23.0	22.5	18.8	28.2	23.6	18.3	14.3	10.0	9.8	9.2	5.3	4.7	6.8	3.6	4.0	6.7	11.7
Govn't Balances (% GDP)	0.0	-2.9	-6.1	-6.0	-7.5	-6.7	-5.0	-6.8	-8.0	-5.6	-3.0	-3.5	-8.4	-6.4	-5.4	-6.1	-8.6	-4.9	-3.4
Current Account (% GDP)	0.4	0.8	0.9	-9.0	-3.7	-4.0	-4.5	-7.2	-7.8	-8.5	-6.1	-7.1	-8.7	-8.6	-7.4	-7.8	-7.6	-6.4	-8.4
Foreign Direct Investment	311	1459	1471	2328	1097	4772	3335	3715	3070	3060	2151	3573	2722	479	3542	5353	3500	2197	4685

Notes to Table 5.1a: Foreign Direct Investn't net inflows recorded in the balance of payments in US$ million. *Data Source*: EBRD Transition Report various years

Table 5.1b: Economy and labour market indicators in Hungary, 1994-2008

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
GDP per capita (in US$)	4052	4359	4425	4495	4641	4757	4683	5140	6467	8219	9971	10829	11215	13785	15382
Nominal Gross Earnings (%) [1]	22.6	16.8	20.4	22.3	18.3	13.9	13.5	18.2	18.3	12.0	6.1	8.8	8.2	8.0	7.5
Real Gross Earnings (%) [1]	3.8	-11.4	-3.2	4.0	4.0	3.9	3.7	9.0	13.0	7.3	-0.7	5.2	4.2	0.0	1.4
Labour force (%) [1]	-3.3	-2.6	-1.2	-1.3	0.4	2.1	0.6	-0.4	0.2	1.4	0.1	1.3	1.0	-0.2	-0.7
Employment (%) [1]	-2.0	-1.9	-0.8	0.0	1.4	3.1	1.2	0.3	0.1	1.3	-0.3	0.0	0.7	-0.1	-1.2
Unemployment (%) [2]	12.4	12.1	11.8	11.6	10.1	9.9	6.4	5.7	5.8	5.9	6.3	7.3	7.5	7.4	7.8
Private Sector Share Emp't(%) [3]	na	71.0	76.8	83.3	81.4	82.1	80.4	79.6	79.3	79.1	79.1	79.4	77.3	78	78.1
Industry Share in Emp't (%) [4]	27.6	26.7	26.7	26.7	27.8	27.4	33.7	34.1	34.1	33.3	32.9	32.4	32.3	32.6	32.1
Privatisation Revenues [5]	123	20.8	23.4	27.5	28.6	29.8	30.2	30.3	30.7	31.1	33.5	34.2	33.3	33.5	33.6
Private Sector (% GDP) [3]	55	60	70	75	80	80	80	80	80	80	80	80	80	80	80
Share of industry (% GDP)	21.9	23.1	23.5	25.0	25.9	26.7	27.9	27.2	26.8	27.5	28.3	25.9	26.0	25.5	25.1
Share of agric. (% GDP)	5.9	5.9	6.1	5.8	5.4	5.3	4.6	5.5	4.7	4.4	4.6	3.6	3.5	3.4	3.7
Population, millions (end-year)	10.2	10.2	10.2	10.2	10.1	10.0	10.0	10.2	10.1	10.1	10.1	10.1	10.1	10.1	10.1

Notes to Table 5.1b: Earnings are monthly; na denotes that data is not available; [1] annual average; [2] % of labour force (end-year); [3] rough EBRD estimates, based on available statistics from both official (government) sources and unofficial sources. The underlying concept of private sector value added includes income generated by the activity of private registered companies, as well as by private entities engaged in informal activity in those cases where reliable information on informal activity is available; [4] includes electricity, power, manufacturing, mining and water; [5] cumulative (% GDP): government revenues from cash sales of enterprises, not including investment commitments.
Data Source: EBRD Transition Report various years

Hámori (2007) provides a detailed explanation of the Hungarian public sector wage scale (*Közalkalmazotti bértábla*) according to which wages increase mechanically both horizontally and vertically along ten educational categories (A – J). Within each qualification category wages increase with seniority along 14 brackets of different magnitudes. The wage scale is justified as assuring equal wages for public sector employees for a given job with the same qualification and seniority. There are however separate wage scale for tertiary education and research institutes and civil servants. According to Hámori (2007) the government revised the wage scale in 2002 such that the wages in the lowest qualification and seniority category (A1) are equal to the statuary minimum wage and those in the lowest seniority bracket of the highest qualification category (J1) earn 2.65 times more than the minimum wage. Moreover, the government introduced a minimum monthly wage for tertiary graduates, whereby the wages of the lowest education and seniority bracket of tertiary graduates (F1) were set to be twice the statutory minimum wage (Hámori, 2007).

According to Telegdy (2006), the motivation behind the significant wage increases for public service employees between September 2002 and 2003 was to combat losses of highly skilled labour in the public sector due to the private selection. Furthermore, the intention was to impede negative selection by labour quality into the public sector because the public sector wages were lagging behind private sector wages during the whole period of economic transition in the 1990s (a phenomenon documented by Nickell and Quintini (2002) for the UK).

Although, the general government deficit more than doubled in 2002 (Table 5.1a), it was argued that generous public sector wage increases were important for the government to retain the human capital needed to improve administrative capacity and absorb European Union (EU) funds during following years (EBRD, 2003). Hungary joined the EU on the 1st of January, 2004.

The next section presents the wage trends in public and private sectors and estimates the public sector pay 'gap' for different groups of workers during the economic transition in Hungary before EU accession.

5.3 Data and variables used in empirical analysis

The empirical analysis is carried out by using microdata for Hungary from the Harmonised Hungarian Wage Survey (WS). The WS is an employer-provided cross-sectional microdataset. The data host is the Hungarian National Employment Office and the harmonised database is created by the Institute of Economics of the Hungarian Academy of Sciences.

The target population of the WS includes all budget institutions and companies above a certain size. Waves are available for 1986, 1989, and annually since 1992. From 1992 the data is collected from both the private and public sectors.

The sampling frame for firms until 1994 includes every tax-paying legal entity using double-sided balance sheet with at least 20 employees. From 1995 firms employing at least 10 employees and from 2000 employing at least 5 employees are included in the survey. On the other hand all budgetary institutions, independent of size, provide information on their full-time employees. From 2002 the data also cover part-time employees. The selection procedure provides a random sample of workers by collecting the data from sampled employers on individual workers born on 5th, 15th and 25th of any month.[32] The sampling weights are defined in a way that the ratio of the business and public employees included in the unweighted sample reflects the same ratio as aggregate data for the Hungarian economy. The frequency weights are used in the empirical analysis in order to make harmonised sample representative.

In order to provide sample consistency over the years the analysis is restricted to employers with more than 20 employees. This selection procedure may potentially cause a bias (constant over time) due to the well-known employer size – wage effect. In particular, if small private firms pay lower wages this would affect the measured public-private sector pay gap. Therefore, the estimates must be interpreted with caution and as conditional on the selected samples. On the other hand, the possible problem of underreporting wages in the private sector which is characteristic of small employers is mitigated in this analysis. For example, Kertesi and Köllő (2003) find that, although generally high, the compliance rate to minimum wage regulations in Hungary is lower among smaller private employers and Hámori

[32] This includes on average 6.5% of production workers and 10% of non-production workers within firms and 10%-12% random samples in the case of budgetary institutions.

(2007) points out that especially small enterprises are more likely to report workers at the officially declared minimum wage but pay them above that level.

Particularly useful for the analysis of wage levels and wage dispersion is that the WS data sets are very large cross-sections, ranging from 130,000 to 220,000 observations, depending on the year. We employ data from the selected waves from May 1992 until May 2003. The sample includes full-time wage earners aged between 15 and 64 who are working in the public or private sector. The non-profit sector is excluded.

The public sector relates to the budgetary institutions. From 1994 it is possible to distinguish between civil servants, public servants, judges and prosecutors within the budgetary sector. Business employees in the companies represent the private sector. Since there is no information on employer ownership structure within the private sector, even companies with the majority share owned by the state are classified into the private sector. Hence, the public sector in this dataset consists of the budgetary institutions that are under direct government supervision only, whereas the companies comprise the 'business' i.e. private sector whether or not they are fully privately owned or of mixed ownership. It is argued by the data providers that this classification does not impede the analysis of public-private sector wage differentials because the market-related wage setting mechanism within the 'business' sector holds for all companies irrespectively of the precise ownership structure. However, we cannot test whether this is the case given these definitions.

Table 5.2: Annual sample sizes by ownership type and gender, 1992-2003

Sector:	Public Sector				Private Sector			
Gender:	Men		Women		Men		Women	
Year:	Number of obs.	as % of Men	Number of obs.	as % of Women	Number of obs.	as % of Men	Number of obs.	as % of Women
1992	9,751	15.20	25,879	39.27	54,402	84.80	40,014	60.73
1995	9,429	12.85	31,459	40.97	63,936	87.15	45,326	59.03
1996	11,881	18.35	40,233	51.41	52,859	81.65	38,026	48.59
1997	11,977	18.69	41,840	52.67	52,101	81.31	37,600	47.33
1998	11,650	18.16	40,176	52.12	52,500	81.84	36,903	47.88
1999	11,442	18.27	38,420	51.69	51,171	81.73	35,907	48.31
2001	10,394	17.19	36,374	49.37	50,072	82.81	37,299	50.63
2002	10,239	15.40	36,922	48.96	56,262	84.60	38,485	51.04
2003	9,704	14.82	32,788	44.95	55,782	85.18	40,155	55.05

Data Source: The Harmonised Hungarian Wage Survey (WS), 1992-2003

The number of observations in the working sample by sector and gender is summarised in the Table 5.2. Since the public sector includes the budgetary institutions only, there are approximately five times more male workers in the private than in the public sector sample. Female workers are more equally distributed across sectors in the working sample.

Table A5.1 in the Appendix describes the variables used in the empirical analysis. The first variable, earnings, is the natural logarithm of the monthly gross earnings. This is defined as the monthly gross wage in May plus regular premia and bonuses in May plus one twelfth of the sum of all other payments and irregular incomes connected to the full-time job paid over the previous year denoted in Hungarian currency (forint) and converted to 2003 earnings by the annual consumer price index.[33] The irregular incomes and all other payments include the 13th month's salary, year-end bonuses and other pecuniary payments but do not include in-kind benefits (such as car and cellular phone usage, representation expenses, meals and transportation subsidies etc.). There are, however, differences in the amount of unobserved benefits across sectors. For example, teachers have long holidays and nearly all public sector employees receive meal vouchers. Hence, these public sector advantages may bias the level of sector pay gap but not its changes over time given that these differences are constant. In addition, the data on earnings are considered to be more precise in WS than those gained by the household survey because the earnings information is provided by the employers (Horváth, Hudomiet and Kézdi, 2004)[34].

The WS contains weekly hours as specified by the employment contract but only for 1992, 2002 and 2003 and monthly paid hours are recorded from 1999. Due to this limitation we base our analysis on monthly gross earnings for the whole period observed from 1992 until 2003. The hourly gross earnings equations are estimated only for three last years of the observed period.

The WS contains a rich set of employee and employer information. We use variables on individual employee's gender, educational qualification and occupation and employer's industry branch, size and ownership as well as geographical location by urban type and region as dummies as in previous chapter.

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[33] The harmonised WS also include information on net wages. The net wage is calculated from the gross amount using the tax brackets of the given year and is not used in our analysis.

[34] Horváth, Hudomiet and Kézdi (2006) compare the household Tarki Monitor survey with the WS and find that the average after tax earnings are about 15% lower in the self-reported data (i.e. household survey data)

Due to significant changes in the Hungarian occupational code the harmonised dataset provides the longitudinal analysis only from 1995 until 2003 and hence, the occupational affiliation is not used as an explanatory variable in the 1992 year data set. Potential labour market experience is created as age minus years spent in education minus six and is used as a continuous variable together with its squared term. Years spent in education are estimated as follows: 6 if the employee has not finished primary education, 8 in case he/she finished primary education, 11 in the case of completed vocational training, 12 in the case where the employee has completed secondary education, 16.5 if the employee obtained a university degree before 1996 and 16.3 if he/she obtained a university degree after 1996. The educational information in the dataset allows for the differentiation of four education groups: primary school or less (unskilled), vocational degree (low-skilled), high school degree (middle-skilled) and tertiary degree (high-skilled).

Proportions and means of the variables used in analysis are presented in Tables A5.2 and A5.3 in the Appendix. The t-squared tests shows that there is a significant difference between the vectors of the means of the variables in the public and private sector for both genders. This confirms that the characteristics of the public sector workers differ from those of the private sector in a number of dimensions.

Public sector employees are on average older than private sector employees for both genders. Moreover, public sector employees have more years of experience and are better educated than private sector employees for both genders. The majority of public sector workers are employed in establishments employing between 50 and 300 employees. There are more private than public sector employees, for both genders on average, that work in companies larger than 300 employees. The distribution of workers across urban and rural type is similar across sectors.

Since the public sector includes budgetary institutions only, the public sector employees are concentrated in public administration and education, health and social work (50% of public sector male workers and 60% of public sector female workers are hired in education, health and social work and the rest in public administration). In the private sector, the dominant industry branch is manufacturing (around 40% for both genders), followed by transport, telecommunications and trade. Agriculture is a more important industry branch for

male private sector workers compared to female private sector workers, whereas financial services are more important employers for female than for male private sector workers. The industry branch affiliation will not be used in the empirical analysis as an explanatory variable because of the collinearity with the public-private sample distinction in this data.

Professionals represented a dominant occupation for both genders on average in the public sector (around 35%). Conversely, in the private sector professionals represent around 5% of work-force for both genders. The proportions of male and female managers is almost equal across sectors. Blue collar men (such as industrial workers and operators) and white collar women (such as technicians and clerks) workers represent the majorities in the private sector occupational structure.

In general, observed differences in the public-private sample composition should explain a good deal of the differences in earnings between two sectors.

5.4 Public-private sector earnings differentials

This section illustrates the unconditional earnings distribution by sector and gender and provides measures of earnings inequality as well as a brief summary of previous studies of Hungarian public-private sector earnings differentials. It is followed by a section containing econometric analysis.

5.4.1 Trends in public and private sector pay during economic transition

The unconditional public and private gross monthly real earnings distribution from 1992 until 2003 for male and female workers are plotted in Figures 5.1 and 5.2. For men, the raw average gross monthly earnings are higher on average and across most of the percentiles in the public than in the private sector from 1992 until 2003, with the exception of the year 1996. The same holds for women, apart from the 90^{th} percentile at which the private sector earnings are higher than public sector earnings during most of the years reviewed. Public sector earnings for both men and women showed more variation over the period than private sector earnings. In particular, all percentiles presented saw a decline in public sector earnings until 1996, a modest increase until 2001 and a sharp increase during the last two years observed.

Figure 5.1: Gross Monthly Real Earnings Percentiles for Male Employees in public and private sectors in Hungary, 1992-2003

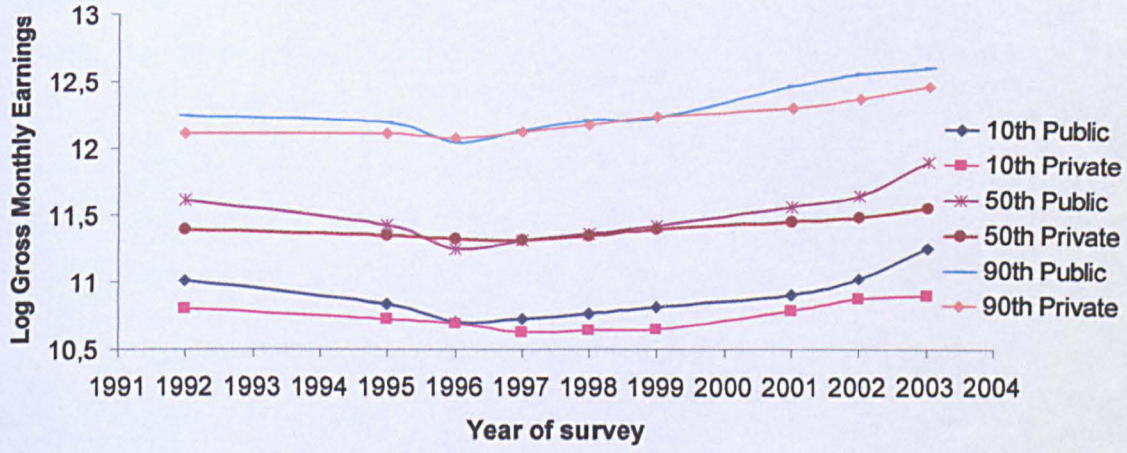
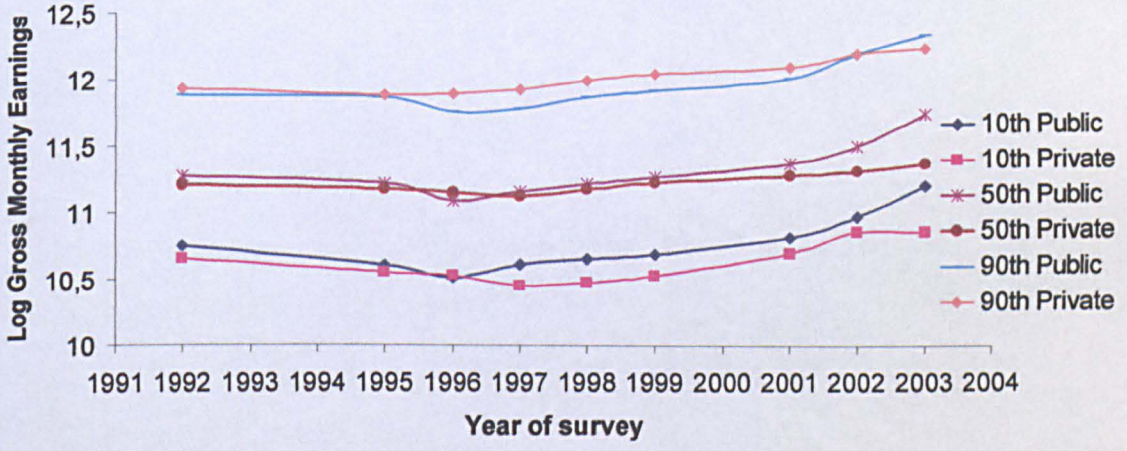


Figure 5.2: Gross Monthly Real Earnings Percentiles for Female Employees in public and private sectors in Hungary, 1992-2003



Notes to Figures 5.1 and 5.2: Earnings at 10th 50th and 90th percentiles are given in natural logarithm values. The gross monthly real earnings relate to before tax and include regular wage in May plus regular premia and bonuses in May plus one twelfth of the sum of all additional payments and irregular incomes connected to the full-time job paid over the previous year denoted in Hungarian currency (forint) and converted to 2003 earnings by the annual consumer price index.

Data Source: The Harmonised Hungarian Wage Survey (WS) from 1992 until 2003

On the other hand, in the private sector, earnings for both male and female workers at the 90th percentile have been increasing over the whole period. The earnings of the workers at the median remained rather stable whereas those at the 10th percentile saw a decline during the 1990's and sharp increase in 2001 and 2002.

The magnitude of pay inequality is summarised by using three measures of inequality: the standard deviation of the log gross earnings, the 90/10th decile ratio and the Gini coefficient. All measures of inequality presented in Table 5.3 show greater dispersion of earnings in the private than in the public sector for both male and female workers during most of the years considered. In addition, there is almost no difference in monthly and hourly earnings dispersion, as estimated for the last three years for which the data on monthly hours are available.

Table 5.3: Earnings inequality by gender and ownership type in Hungary, 1992-2003

	90/10th Ratio				Standard Deviation				Gini Coefficient			
	Men		Women		Men		Women		Men		Women	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
1992	1.24	1.30	1.13	1.27	0.48	0.52	0.44	0.50	0.27	0.31	0.26	0.30
1995	1.36	1.38	1.26	1.32	0.55	0.56	0.49	0.53	0.32	0.33	0.28	0.31
1996	1.34	1.38	1.24	1.38	0.53	0.58	0.48	0.56	0.31	0.35	0.28	0.33
1997	1.41	1.50	1.17	1.47	0.56	0.62	0.46	0.59	0.33	0.37	0.27	0.36
1998	1.44	1.54	1.21	1.52	0.57	0.62	0.48	0.60	0.33	0.37	0.29	0.36
1999	1.42	1.60	1.22	1.52	0.56	0.64	0.49	0.61	0.33	0.39	0.29	0.37
2001	1.58	1.54	1.18	1.40	0.62	0.61	0.48	0.57	0.38	0.38	0.29	0.35
2001*h*	1.58	1.52	1.16	1.38	0.62	0.61	0.47	0.57	0.38	0.38	0.29	0.35
2002	1.56	1.51	1.23	1.35	0.59	0.61	0.49	0.55	0.35	0.39	0.29	0.35
2002*h*	1.57	1.50	1.22	1.34	0.59	0.61	0.48	0.55	0.35	0.39	0.29	0.35
2003	1.38	1.59	1.15	1.38	0.55	0.63	0.44	0.56	0.31	0.40	0.26	0.35
2003*h*	1.36	1.57	1.12	1.37	0.54	0.63	0.44	0.56	0.31	0.40	0.25	0.35

Notes to Table 5.3: The gross monthly earnings relate to before tax and include regular wage in May plus regular premia and bonuses in May plus one twelfth of the sum of all additional payments and irregular incomes connected to the full-time job paid over the previous year denoted in Hungarian currency (forint) and converted to 2003 earnings by the annual consumer price index. The gross hourly earnings are obtained by dividing the gross monthly earnings with monthly hours. The gross hourly earnings inequality measures are reported for 2001, 2002 and 2003 years and denoted by the letter *h*. Decile ratios 90/10th are calculated as the difference between the log earnings at the 90th percentile and at the 10th percentile. The Gini coefficient estimates use earnings in unlogged form.

Data Source: The Harmonised Hungarian Wage Survey (WS) from 1992 until 2003.

Standard deviations, Gini coefficients and 90/10th ratios show that the male public sector earnings inequality has an inverted U shape, first increasing until 2001 and declining afterwards. This period relates to minimum wage increases (by 57% in 2001 and 25% in 2002) and public sector wage increases between 2002 and 2003. For female workers the public sector inequality measures show more volatility during the period. On the other hand,

the private sector earnings distribution narrowed only in 2001 and 2002 for both men and women. This is not surprising given the minimum wage increases in these years.

5.4.2 Empirical studies on Hungarian public-private sector pay differentials

To our knowledge, there are only two empirical studies on the Hungarian public sector earnings gap. A detailed analysis of public-private sector earnings differentials for full-time male wage earners was conducted by Hámori (2007) using WS data from 1994 until 2003. This study applied OLS and quantile regression methods to estimate the annual public sector gap at the mean and at five percentiles of the gross monthly real log earnings distribution conditional on education, potential labour force experience and Hungarian capital Budapest.

Hámori (2007) found substantial public sector earnings penalties between 1994 and 2002, at all estimated quantiles (other than at the 10^{th} quantile in some cross-sections) which increased across the distribution. For example, the negative public sector earnings gap was estimated to be 13% at the bottom quantile and 40% at the top quantile in 1994 and 25% at the bottom quantile and 62% at the top quantile in 1997. In the later period, from 1998 until 2000 the public sector pay penalty amounted to around 3% and 55% at the 10^{th} and 90^{th} quantiles respectively. In the final year of the observed period (i.e. 2003 which was the year of public sector pay reforms) the public sector pay gap became positive for male employees at the 10^{th} and 25^{th} percentiles of the earnings distribution but remained negative at other percentiles.

Separating samples by educational qualification, Hámori (2007) found that changes in the size of the public-private sector earnings gap over time were uniform across the distribution for the unskilled (primary school and less educational level) and low-skilled (vocational school level) groups. For middle (high school level) and especially for high skilled (university degree and above) groups of workers, increases in the public sector pay penalty until 2000 were more pronounced at the top of the distribution whereas a decreasing trend in the public sector penalty in the years after 2000 was more pronounced at the bottom of the distribution.

Telegdy (2006) used the WS databases during the post-transition period, between 2000 and 2004, to examine the effects of 2003 public pay reforms in education, health care and public administration in Hungary. This study did not disaggregate male and female

employees. Telegdy (2006) estimated by OLS that the 27% public sector average pay penalty in 2000, obtained after controlling for worker's gender, experience, education and occupation, became a premium of 8.4% in 2004.

5.5 Regression Analysis

5.5.1 Overview of Goals

The empirical anaysis has four goals. First, we want to test whether there was a public-private sector earnings differential and how it changed during the period of economic transition. For this purpose, the public and private sector data sets are pooled together in a single equation model estimated by ordinary least squares (OLS). The coefficient estimates on a public sector dummy variable are used to show the average unconditional and conditional mean for each year of the observed period from 1992 until 2003. In this context we also want to test whether personal and job characteristics of the workers affect the sectoral pay gap. So, in regression analysis we use a large set of personal and job characteristics of the workers as conditioning variables and test for their potential impact.

Our second goal is to test whether the public sector pay effect for workers with similar characteristics varies across the earnings distribution. Hence, the quantile regressions are estimated at the selected percentiles of the earnings distribution conditional on the same set of covariates as in the mean regressions.

Our third goal is to test whether the returns to characteristics differ across sectors. Hence, we estimate public and private sector earnings at the conditional mean and at the conditional selected percentiles for each sector separately. Finally, the estimated public sector pay effects across the conditional earnings distribution are re-estimated by a decomposition method.

Our fourth goal is to test whether the public-private sector earnings differential varies with worker's skill level. So, the public sector pay effects are estimated for groups of workers according to their educational qualification at the conditional mean and at the conditional selected percentiles of the earnings distribution.

Since each of the goals are accomplished for male and female employees separately we are able to investigate wheather the public sector sector pay differential behaved differently between these two groups of workers during the period of economic transition.

Finally, it should be acknowledged that we do not explicitly deal with endogeneity and measurement error problems in this chapter. On the one hand, there are no suitable instruments in the employer-provided survey to control for differences in workers' unobserved heterogeneity between sectors. Moreover, the public sector includes only budgetary institutions and hence, unlike in the chapter 4, we are not able to use changes in the proportions of industry branches or occupations within the public sector caused by large-scale privatisations as an instrument for endogeneity. On the other hand, there is less measurement error in this data because it is an employer survey.

5.5.2 Annual Mean and Quantile Regression Estimates

Cross sectional differences in earnings between public and private sector employees for each year of the observed period are first estimated by OLS. Hence, both sectors' data sets are pooled together in an earnings regression with a dummy variable P_i taking the value one if the i th employee works in the public sector and zero otherwise. This 'dummy variable' model is given by:

$$\ln w_i = \alpha + \beta' x_i + \gamma P_i + \varepsilon_i \qquad \text{for } i = 1,...,N \qquad (5.1)$$

where $\ln w_i$ is the log gross real earnings for the i th individual. The set of observed worker and job characteristics x_i with the parameter vector β includes worker's labour force experience and its quadratic form, educational qualification and occupational affiliation and employer's urban type, region and size and ε_i is an error term which is assumed to be uncorrelated with x_i. A public sector dummy variable $P_i = 1$ if the i^{th} individual works in the public sector and zero otherwise. Hence, $\hat{\gamma}$ is the 'average' estimate of the public sector pay gap equivalent to an intercept shift.

The estimation results from monthly and hourly gross earnings annual equations over the period of economic transition in Hungary from 1992 until 2003 are presented in Tables 5.4 and 5.5 for men and women separately. Gross hourly earnings are calculated by dividing the gross monthly earnings with monthly hours. Monthly hours are available for the last three years.

The unconditional time trends of $\hat{\gamma}$ presented in Tables 5.4 and 5.5 are the raw differences in mean real gross earnings between public and private sector workers. The conditional time trends of $\hat{\gamma}$ presented in Tables 5.4 and 5.5 are differences in mean real gross earnings between public and private sector workers conditional on worker's labour force experience and its quadratic term, education, occupation (except in 1992) and employer's urban type, region and size. Tables 5.4 and 5.5 present only the returns to labour force experience and education. The full specification results from conditional regressions are presented in Tables A5.4 and A5.5 in the Appendix.

The fit of the monthly gross earnings equations augmented by additional 'control' variables using the R-squared is relatively high. The explanatory power of the variance of mean log monthly gross pay in the augmented regression increases from 0.45 (0.52) in 1995 to 0.54 (0.60) in 2003 for men (women). The regression standard error increases from 0.45 (0.35) for men (women) in 1995 to 0.46 (0.39) in 1999 and declines to 0.42 (0.34) in 2003 for men (women). The Breusch-Pagan test for heteroskedasticity is performed by regressing the residuals from an OLS regression on the same set of covariates. Although estimated coefficients and R squared statistics are not affected, in all cases the test showed heteroskedastic errors which implies that the variance of log monthly pay varies across variables. For this reason, the estimated heteroskedasticity robust or "White" standard errors of the coefficients reported in parentheses are used to calculate 95% confidence intervals.

The overall F statistic evaluates the null hypothesis that coefficients on all explanatory variables in the model equal zero and leads easily to rejection of this null hypothesis in all equations. Most of the control variables are statistically significant at 1% level of significance for both genders. The overall explanatory power of the variance of mean log hourly gross pay is equal to the monthly and the estimates are not materially different.

Table 5.4: Estimation of real monthly and hourly gross earnings in Hungary for men, 1992-2003

	1992	1995	1996	1997	1998	1999	2001	2002	2003	*2001h*	*2002h*	*2003h*
Unconditional Model												
Public Sector:	0.183***	0.090***	-0.051***	0.016***	0.049***	0.043***	0.106***	0.158***	0.283***	*0.126****	*0.159****	*0.290****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	*(0.002)*	*(0.001)*	*(0.002)*
Conditional Model												
Experience:	0.034***	0.024***	0.024***	0.021***	0.021***	0.019***	0.017***	0.017***	0.017***	*0.018****	*0.017****	*0.016****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
Experience Sq:	-0.051***	-0.034***	-0.035***	-0.020***	-0.031***	-0.028***	-0.028***	-0.027***	-0.025***	*-0.028****	*-0.027****	*-0.024****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
Education:												
Unskilled	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Lowskilled	0.155***	0.080***	0.099***	0.116***	0.120***	0.112***	0.010***	0.072***	0.098***	*0.103****	*0.073****	*0.099****
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Middleskilled	0.381***	0.201***	0.222***	0.265***	0.270***	0.266***	0.235***	0.202***	0.210***	*0.241****	*0.208****	*0.214****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Highskilled	0.836***	0.561***	0.609***	0.676***	0.702***	0.737***	0.706***	0.676***	0.691***	*0.711****	*0.685****	*0.700****
	(0.001)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*
Public Sector :	-0.065***	-0.075***	-0.252***	-0.228***	-0.204***	-0.215***	-0.223***	-0.196***	-0.071***	*-0.202****	*-0.199****	*-0.069****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Constant:	10.55***	10.42***	10.22***	10.27***	10.24***	10.32***	10.49***	10.65***	10.77***	*5.509****	*5.607****	*5.686****
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*
R-squared	0.405	0.455	0.468	0.460	0.476	0.473	0.483	0.513	0.538	*0.490*	*0.523*	*0.548*
Root MSE	0.40	0.41	0.42	0.45	0.45	0.46	0.44	0.42	0.42	*0.44*	*0.42*	*0.42*
Observations	64153	73365	64740	64078	64150	62613	60466	66501	65486	*60466*	*66501*	*65486*

Notes to Table 5.4: The samples used relate to full time employees, aged between 15 and 64. The depended variable is the log of real monthly and hourly gross earnings. Monthly gross earnings are defined as monthly gross wage in May plus regular premia and bonuses in May plus one twelfth of the sum of all other payments and irregular incomes connected to the full-time job paid over the previous year, denoted in HUF and converted to 2003 earnings by the annual consumer price index. The gross hourly earnings calculated by dividing the gross monthly earnings with monthly hours and estimates in italics are obtained for 2001, 2002 and 2003 years denoted by the letter *h*. All specifications include worker's occupational affiliation (except 1992) and employer's urban type, region and size. Full results given in Table A5.4 in the Appendix. The estimation procedure for the mean robust regressions is OLS and estimated robust standard errors calculated based on White (1980) are reported in parentheses. OLS regression analysis reported used STATA 10.0: *** denotes the 0.01 significance level. *f* denotes category omitted in estimation.

Data Source: The Harmonised Hungarian Wage Survey (WS) from 1992 until 2003

Table 5.5: Estimation of real monthly and hourly gross earnings in Hungary for women, 1992-2003

	1992	1995	1996	1997	1998	1999	2001	2002	2003	*2001h*	*2002h*	*2003h*
						Unconditional Model						
Public Sector	0.037***	0.032***	-0.068***	0.009***	0.028***	0.020***	0.047***	0.114***	0.289***	*0.078****	*0.112****	*0.298****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
						Conditional Model						
Experience	0.028***	0.024***	0.022***	0.019***	0.018***	0.020***	0.017***	0.015***	0.015***	*0.018****	*0.015****	*0.015****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
Experience Sq	-0.038***	-0.030***	-0.024***	-0.018***	-0.017***	-0.024***	-0.022***	-0.018***	-0.017***	*-0.023****	*-0.018****	*-0.016****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
Education:												
Unskilled	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Lowskilled	0.181***	0.063***	0.067***	0.058***	0.062***	0.073***	0.059***	0.044***	0.036***	*0.055****	*0.043****	*0.033****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Middleskilled	0.406***	0.223***	0.231***	0.242***	0.247***	0.249***	0.190***	0.199***	0.179***	*0.189****	*0.201****	*0.180****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Highskilled	0.791***	0.509***	0.529***	0.575***	0.600***	0.686***	0.627***	0.649***	0.653***	*0.624****	*0.649****	*0.654****
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
Public Sector	-0.077***	-0.052***	-0.184***	-0.156***	-0.150***	-0.183***	-0.191***	-0.130***	0.005***	*-0.163****	*-0.133****	*0.015****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Constant	10.43***	10.29***	10.19***	10.25***	10.27***	10.27***	10.46***	10.68***	10.83***	*5.463****	*5.588****	*5.682****
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
R-squared	0.440	0.522	0.527	0.504	0.503	0.514	0.508	0.529	0.598	*0.510*	*0.532*	*0.602*
Root MSE	0.35	0.35	0.36	0.37	0.38	0.38	0.36	0.35	0.33	*0.36*	*0.35*	*0.32*
Observations	65893	76785	78259	79440	77079	74327	73673	75407	72943	*73673*	*75407*	*72943*

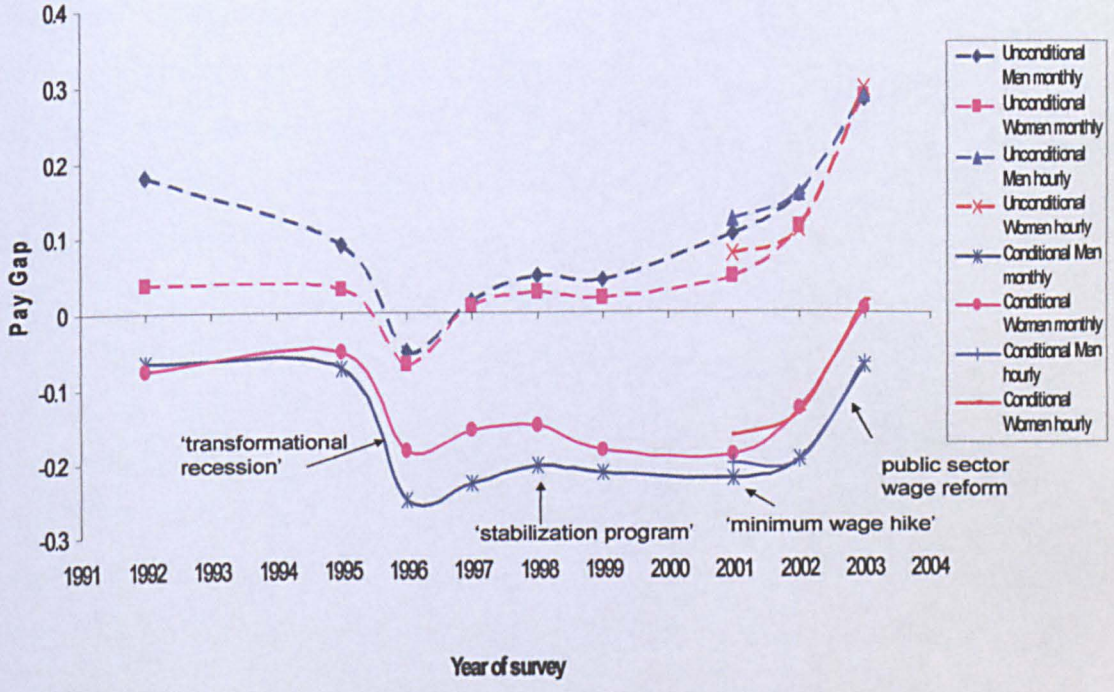
Notes to Table 5.5: See Notes to Table 5.4. Full results given in Table A5.5 in the Appendix.

Data Source: The Harmonised Hungarian Wage Survey (WS) from 1992 to 2003

Comparison between unconditional and conditional estimates in Tables 5.4 and 5.5 shows that the sectoral pay gap is largely determined by different nature of jobs and skills in public and private sectors. In particular, the statistically significant unconditional public sector premium for the most of the years, turns into statistically significant public sector penalty after controlling for differences in characteristics.

A further insight into time trends of estimated unconditional and conditional public sector pay gap $\hat{\gamma}$ [35] is given by Figure 5.3.[36]

Figure 5.3: Public sector pay relative to private sector pay: unconditional and conditional differences in real gross earnings by gender in period 1992-2003



Data Source: The Harmonised Hungarian Wage Survey (WS) from 1992 until 2003

Figure 5.3 shows that the conditional results lower the measured public sector pay effect. Moreover, male workers across sectors are more different in observable characteristics than female workers. In general, estimated conditional differentials for a decade of economic

[35] expressed in log percentage points throughout the chapter

[36] The 95% confidence intervals spread is about 0.005 or less (i.e. difference between lower and upper bound). Since the 95% confidence intervals are attached closely to the estimates they are not presented on Figure 5.3.

transition in Hungary reveal widening of the sector pay gap from 1992 until 2001 and its closure by 2003. Hence, the public sector pay gap was negative during most of the period of economic transition, but grew to zero by the end of the period reviewed in this chapter.

The cyclicality in the public sector pay gap may be related to economic policies. The increasing negative trend in the estimated public sector pay gap during the initial years of economic transition correlates with the period of 'transformational recession' during which the public sector employment increased from 21% of total employment in 1992 to 24.1% in 1995 (Kézdi, 1998). As suggested by theoretical model in chapter 3 an increase in public sector employment leads to pay reduction given by the budget constraint. Indeed, the increase in the public sector pay penalty in 1996 resulted from the government income measure to 'freeze' public sector wages (Hámori, 2007). In addition, in 1995 the banks and public utilities were privatised to foreign strategic investors (Kézdi, 2002).

The 'boom' of the Hungarian economy as a result of the implementation *'Bokors Csomag'* macroeconomic stabilisation program relates to the 1997-2000 period. Figure 5.3 shows a modest decline in the public sector pay penalty in 1997 and 1998, but a further increase until 2001. Hence the economic boom led to a generally more rapid increase in private sector pay. Furthermore, the minimum wage increases in 2001 and 2002 mainly affected private sector pay since the majority of minimum wage earners is located in that sector.[37] However, the public sector pay penalty declined from 2002 and closed down in 2003. Increases in the average public sector wage between 2002 and 2003 are associated with wage reforms which aimed to increase the public sector nominal wages by 50% on average.

In addition to the monthly estimates, hourly public sector pay differentials from 2001 until 2003 are also plotted in Figure 5.3. The difference between the hourly and monthly gross pay gap estimates is rather modest. In particular, the difference is observable in 2001 only, albeit quite small (around 2% for male and 3% for female workers).

The estimated annual conditional public sector pay effects at the mean can be compared to the results reported by Hámori (2007) and Telegdy (2006) that used the same data. Hámori (2007) obtained public sector pay gap estimates from OLS monthly earnings

[37] Hámori (2007) emphasises that the compliance of minimum wage regulations is very high in Hungary. For example in 2001, less than 2% of the full-time employees were paid less than the minimum wage.

equations for male workers from 1994 until 2003 after controlling for labour force experience, its squared term, education and Hungarian capital Budapest. That study estimated that the gap was -21%, -31% and -38% in 1995, 1996 and 1997 and -36%, -32% and -14% in 2001, 2002 and 2003 respectively. These estimates are a bit larger than those reported in Table 5.4 mainly due to the fact that they are not conditional on workers' occupation. In particular, the public sector workers are on average more educated and more experienced than the private sector workers but most of the better paying occupations are in the private sector. This tends to decrease the estimated gap. Indeed, our estimates are in line with the results reported by Telegdy (2006). That study obtained the OLS estimates in monthly earnings equations for the 2000-2004 period on the pooled sample of male and female workers after controlling for worker's gender, experience, education and occupation. Similarly to conditional estimates in Tables 5.4 and 5.5 Telegdy (2006) reported that the mean public sector pay gap was -25.7%, -20.5% and 7% in 2001, 2002 and 2003 respectively.

Furthermore, Tables 5.4 and 5.5 present the returns to labour force experience and education over the period of economic transition in Hungary. The labour force experience effects are statistically significant and increase at a decreasing rate. This is in contrast to the usual finding that labour force experience gained during the pre-transition is not valued by the market in transition (Adamchik and Bedi (2000) for Poland, Jovanović and Lokshin (2004) for Moscow and earlier chapter 4 for Serbia). However, these estimates are consistent with the results reported by Orazem and Vodopivec (1997) for Slovenia and may be explained by early retirement schemes which made experienced labour relatively scarce at the start of economic transition.

The level of educational attainment strongly correlates to pay differentials. As expected, university level education (high-skilled educational qualification) is valued the most in the labour market. The returns to high-skilled educational level are increasing during the whole period i.e. from 56% in 1995 to 69% in 2003 for men and from 51% in 1995 to 65% in 2003 for women.[38]

[38] The estimates on returns to education are greater in 1992 than in the following years, but this is because the occupational affiliation is not controlled for 1992 due to significant changes in the Hungarian occupational code.

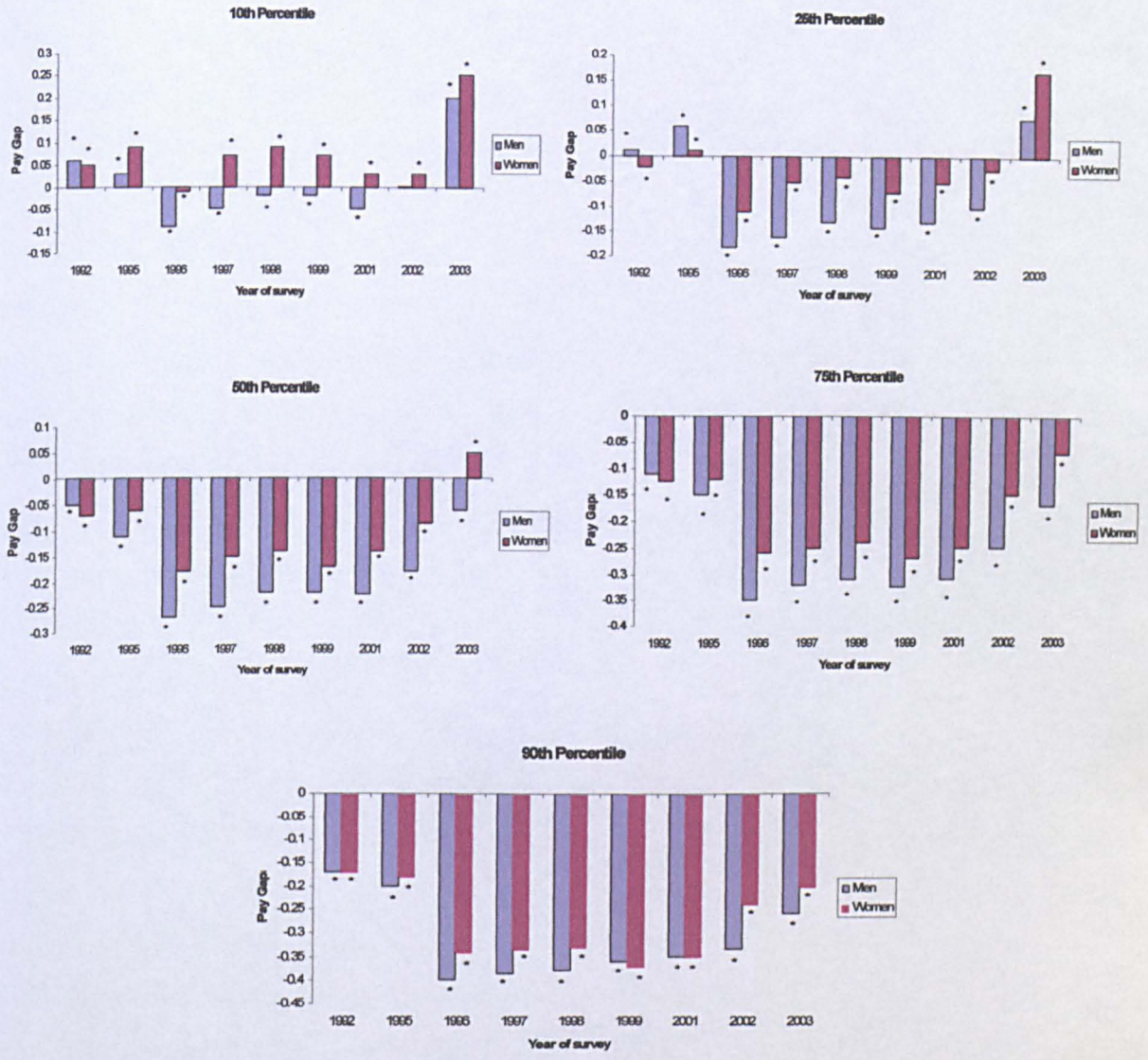
The estimated returns to educational qualification obtained for Hungary are comparable with the findings reported by related empirical studies for other transitional economies. For the Czech Republic, Munich, Svenjar and Terrell (2002) reported an increase in returns to university educated male workers relative to junior high school from 28% in 1989 to 72% in 1996. For Slovenia, Orazem and Vodopivec (1997) found the returns to university education relative to less than primary school increased from 72% in 1987 to 94% in 1991. For Poland, Keane and Prasad (2001) estimated that returns to college education relative to primary school increased from 37% in 1986 to 53% in 1992 and then further increased to 68% in 1996. Finally, for Hungary, Hámori (2007) finds that relative to primary school or less (unskilled) the average premium to high school (middle-skilled) and university degree (high-skilled) rose dramatically while the average return to vocational education (low-skilled) remained constant during the transition period from 1994 until 2003. Hámori (2007) suggests that this is on the one hand partially due to the inefficient training in vocational institutions and on the other hand due to the increasing demand for high-skilled labour.

Returns to other characteristics from the full regression specifications presented in Tables A5.4 and A5.5 in the Appendix are summarised as follows. The top paying occupations are professionals and managers. Nevertheless, the managers are rewarded almost two times more on average than professionals. Male managers are better paid than female managers whereas the difference in pay between genders is not particularly pronounced for professionals. Female technicians and clerk employees are more rewarded than male employees with the same occupations, on average, during most of the years considered. The least paid occupations are farmers and labourers, for both genders.

The earnings are highly positively correlated with the firm size. The increase in pay with the firm size is greater for male than for female workers. Working in the Hungarian capital Budapest or county centers provides significant premiums relative to working in the rural areas but more for female than for male workers. All regions relative to Central Hungary are less rewarding.

The same conditional annual equations are now estimated at the selected quantiles of the earnings distribution.

Figure 5.4: Evolution of conditional public sector pay gap for each of the percentiles of the monthly gross pay distribution by gender in Hungary, 1992-2003



Notes to Figure 5.4: Quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles. The public sector monthly gross earnings pay gap is estimated abstracting from all variations attributable to worker's labour force experience, its quadratic form, educational qualification and occupational affiliation (except in 1992) and employer's urban type, region and size. Presented estimates are reported in Table A5.6 in Appendix. Standard errors obtained by the bootstrapping procedure based on 200 replications in all cases. * denotes that estimates are significantly different from zero at the 0.01 significance level.

Data Source: The Harmonised Hungarian Wage Survey (WS), 1992-2003

Each bar on Figure 5.4 presents the annual conditional public sector pay penalties/premia for each of the selected percentiles of the log real monthly gross earnings distribution, for men and women separately. The estimated standard errors are obtained by the bootstrapping procedure with 200 replications in all cases.[39] The coefficient estimates presented on Figure 5.4 are summarised in Table A5.6 in the Appendix.

The quantile regression estimates provide a richer insight into the public sector pay gap. In particular, apart from females at the 10th percentile that gained from the public sector status over the whole period considered, Figure 5.4 shows an increasing public sector pay penalty until 1996, modest fluctuations until 1999 and declining trend at all percentiles of the pay distribution for both gender during 2000s. In 2003 the public sector male workers below the median and female workers at and below the median started to collect statistically significant 'mark-up' relative to their private sector counterparts. Although other groups of public sector workers also saw the improvements in their financial position the increses in pay as a result of wage reforms in 2003 appear to had the greatest effects on the lower part of the earnings distribution.

In general, Figure 5.4 provides evidence of significant public sector pay compression relative to the private sector earnings distribution. Particularly, whereas for workers below the median the public-private sector pay gap is rather small, for workers at and above the median the gap is substantial over the whole period considered. The pattern of the increasing conditional public sector pay penalty as one moves up the earnings distribution is best illustrated by comparing the estimates across the percentiles. For example, the public sector pay penalty for male workers is greater by almost one tenth at the 25th percentile, by one fifth at the 50th percentile, by one quarter at the 75th percentile and by more than a third at the 90th percentile relative to the public pay penalty at the 10th percentile over a decade considered.

[39] The number of replications is lower than in the chapter 4 given the large dataset. As pointed by Melly (2006) the number of replications must be kept reasonable because of the computation time. The same number of replications is used by Hámori (2007).

5.5.3 Pooled Estimates

(i) Mean and Quantile Regressions

In the further analysis previous results are pooled across the years. The changes in the public sector pay distribution relative to the private sector pay distribution are investigated comparing the period of economic transition during 1990s with the period during 2000s. The reasons for this time division are the wage reforms that took place after 2000 which might affected the earnings distribution. These reforms related to minimum wage increases in 2001 and 2002 and to public sector wage increases between 2002 and 2003.

Initially a 'dummy variable' approach was used to obtain the pooled estimates across the earnings distribution from 1995 until 1999 and from 2001 until 2003. The covariates included in the pooled regressions are the same as in annual regressions but expanded by year dummies to account for aggregate time effects. The public sector pay differentials at the mean and at the selected percentiles of the earnings distribution for the two time periods by gender are presented in Table 5.6. The improvements in the financial position of public sector workers between the two periods are given by the last two columns of Table 5.6. A negative sign of the point change shows decline in the public sector pay penalty.

In general, Table 5.6 shows that the public sector pay gap is smaller at lower-half and larger in upper-half of the earnings distribution than that obtained using OLS for all workers. In particular, the public sector pay penalty increases monotonically over the earnings distribution for men during 1995-1999. The same public sector inequality reducing pattern is present during 2001-2003 but the male workers at the 10^{th} percentile collect the public sector premium. In addition, the public sector penalties for the rest of the percentiles during 2001-2003 are lower than during 1995-1999. For female workers the 10^{th} percentile during 1995-1999 and the 10^{th} and 25^{th} percentiles of the public sector earnings distribution during 2001-2003 are higher than their counterpart percentile on the private sector earnings distribution. The reverse holds for the other percentiles, but as for men, public sector penalty is lower during 2001-2003 than during 1995-1999. The upward shift in the public sector earnings distribution relative to the private sector earnings distribution between the two periods was the most pronounced for workers at and below the middle of the distribution.

Table 5.6: Public sector pay penalty and premium across monthly gross earnings distribution for men and women in Hungary in 1995-1999 and 2001-2003

	1995-1999		2001-2003		Change	
	Men	Women	Men	Women	Men	Women
Mean	-0.195***	-0.144***	-0.164***	-0.106***	*-0.031*	*-0.038*
	(0.001)	(0.000)	(0.001)	(0.001)		
R-sq; Adj R-sq.	0.46	0.51	0.51	0.55		
Root MSE	0.44	0.38	0.43	0.36		
10th Percentile	-0.037***	0.059***	0.020***	0.091***	*-0.057*	*-0.031*
	(0.001)	(0.000)	(0.001)	(0.000)		
Pseudo Rsq	0.22	0.27	0.20	0.26		
25th Percentile	-0.137***	-0.048***	-0.062***	0.030***	*-0.075*	*-0.078*
	(0.001)	(0.000)	(0.001)	(0.000)		
Pseudo Rsq	0.25	0.30	0.26	0.31		
50th Percentile	-0.214***	-0.139***	-0.152***	-0.060***	*-0.062*	*-0.079*
	(0.000)	(0.000)	(0.001)	(0.000)		
Pseudo Rsq	0.27	0.32	0.30	0.35		
75th Percentile	-0.289***	-0.226***	-0.231***	-0.158***	*-0.058*	*-0.068*
	(0.000)	(0.000)	(0.000)	(0.000)		
Pseudo Rsq	0.30	0.38	0.35	0.37		
90th Percentile	-0.340***	-0.305***	-0.305***	-0.252***	*-0.035*	*-0.053*
	(0.001)	(0.001)	(0.001)	(0.001)		
Pseudo Rsq	0.34	0.40	0.39	0.39		
Observations	328946	385890	192453	222023		

Notes to Table 5.6: The public sector monthly gross earnings pay gap is estimated conditional on the following set of regressors: labour force experience, its quadratic form, educational qualification, occupational affiliation, employer urban type, employer region, employer size and year dummies. The estimation procedure for the mean robust regressions is OLS and estimated standard errors calculated based on White (1980) are reported in parentheses. Quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles. Standard errors obtained by the bootstrapping procedure with 200 replications in all cases and reported in parentheses. *** denotes the 0.01 significance level.

Data Source: Pooled Harmonised Hungarian Wage Survey (WS), 1995-1999 and 2001-2003

Three main conclusion can be drawn from these results: firstly, the public-private sector pay differential is greater for workers at higher percentiles for both men and women during both periods of economic transition; secondly, the gap is higher for men than for women during both periods of economic transition; thirdly, the gap declined from earlier to later period of economic transition. These conclusions are based on the assumption that the returns to characteristics are the same across sectors.

In order to test whether the returns to characteristics differ between sectors earnings equations are now estimated using the same set of covariates but in the following 'double equation' model:

Private sector: $$\ln w_i^{NP} = \alpha^{NP} + \beta'^{NP} x_i + \varepsilon_i^{NP} \quad (5.2)$$

Public sector: $$\ln w^P{}_i = \alpha^P + \beta'^{P} x_i + \varepsilon_i^P \quad (5.3)$$

where NP and P denote non-public (i.e. private) and public sectors respectively. The estimates are obtained by gender for two sub-periods, 1995-1999 and 2001-2003 at the conditional mean and at conditional selected percentiles using monthly gross earnings whereas hourly gross earnings equations have been estimated for the later period only. The results are presented in Tables A5.7-A5.10 in the Appendix. Most of the control variables included in both earnings equations are statistically significant at 0.01 level of significance. However, the sizes of the estimated coefficients differ between sectors implying different structure of the returns to characteristics.

In particular, returns to all skill levels for both male and female workers are greater in the private than in the public sector, except for low skilled women. The inter-sectoral differences in returns to education increase with the level of education. For example, during 1995-1999 the average returns to vocational (low skilled), high school (middle skilled) and university (high skilled) education for full-time male employees are estimated to be 11%, 25% and 69% higher than the reference primary (unskilled) level of education in the private sector and 8%, 18% and 39% in the public sector, respectively. The results obtained for the private sector are comparable with the estimates reported by other studies for Hungary. For example, Kertesi and Köllő (2002) estimated that between 1986 and 1999 the average relative returns to vocational education remained approximately constant (around 12%) but average relative returns to high school and college education increased, from 14% to 21% and from 36% to 63% respectively, relative to the primary education base.

Furthermore, the quantile regressions reveal the effects of the rigid pay scales in the public sector. As explained at the beginning of the chapter the public sector wage scale in Hungary assured equal wages for employees for a given job with the same qualification and seniority. Indeed, the quantile regressions show that the inter-sectoral differences in returns to

education increase with higher percentiles of the earnings distribution for each level of education.

A divergent earnings determination pattern between sectors is the most pronounced for university graduates. For example, the inter-sectoral difference in returns to education was 10 percentage points at the 10^{th} percentile and 50 percentage points at the 90^{th} percentile for male graduates during 1995-1999. This was caused by an equal 'mark-up' to university level of education relative to the primary education base at each percentile of the earnings distribution paid by the public sector as given by coefficient estimates presented in Table A5.7 in the Appendix. As opposed to the rigid pay scales in the public sector the earnings determination in the private sector was more flexible allowing workers at a higher percentiles an accumulation of returns.

Focusing attention on returns to education in each sector during the 2001-2003 period Tables A5.8 and A5.9 in the Appendix provide evidence of the convergence in public and private sectors earnings determination processes. In particular, a decline in inter-sectoral differences in returns to education between two sub-periods was the most pronounced for workers below the median who had university level of education. Hence, the results indicated that the inter-sectoral differences and their changes over time varied between workers with different levels of educational qualifications as well as across the earnings distribution within each educational level. This will be further investigated in the next section.

Additional inspection of Tables A5.7-A5.10 in the Appendix suggests that the earnings structure between the two sectors was different with respect to returns to other characteristics as well. For example, relative to the base group the majority of occupations were paid less in the public than in the private sector for both genders and contrary to returns to education these sectoral differences increased over the period. In addition, public sector pay was more equally distributed across employers in different regions and of different sizes than private sector pay. Finally, Tables A5.7-A5.10 in the Appendix show that the annual average public sector pay in years during 1996-1998 was lower than the reference pay in year 1995, whereas the average private sector pay increased during the same period. A decline in the public sector pay was proportional across the earnings distribution whereas the increase in private sector earnings was greater at the top-end of the earnings distribution.

On the other hand, average public sector earnings increased twice as fast as average private sector wages in 2002 and about three times faster in 2003 relative to the reference 2001 wage level. The pay increases during the 2001-2003 period may reflect both minimum wage increases and public sector wage reforms. The effects of minimum wage increases are likely to be captured by the 2002 year dummies as showed by greater increases in pay at the lower end of the earnings distribution in both sectors. If the 2003 year dummy estimates in public sector earnings equation reflect the increases in pay as a result of public sector wage reform then it can be observed that these effects declined as one moves up the earnings distribution. The differences in returns to characteristics between sectors are not explained by the number of working hours since the estimates obtained using the log of real hourly gross earnings during 2001-2003 are analogous to monthly estimates.

(ii) Decomposition of Differences in Distribution

We now re-estimate the pooled quantile regression models by using a decomposition method. This method is based on aggregating the differences in the distribution into a part explained by differences in returns to characteristics and into a part explained by differences in characteristics.

A decomposition is obtained by following a version of the approach developed by Melly (2006) in the same way as described in chapter 4. The model can be written as:

$$\vartheta(x^{P},\hat{\beta}^{P})-\vartheta(x^{NP},\hat{\beta}^{NP})=\left[\vartheta(x^{P},\hat{\beta}^{P})-\vartheta(x^{P},\hat{\beta}^{NP})\right]+\left[\vartheta(x^{P},\hat{\beta}^{NP})-\vartheta(x^{NP},\hat{\beta}^{NP})\right] \quad (5.4)$$

where the first bracket in (5.4) represents the effect of differences in coefficients (could be interpreted as public sector earnings premium or penalty) and the second bracket represents the effect of differences in the distribution of characteristics; ϑ is the estimated percentile of the earnings distribution and the x includes the same set of covariates as in the previous models.

The full decomposition estimation results are ploted in Figures A5.1 and A5.2 and summarised in Table A5.11 in the Appendix. The part of the total (i.e. unconditional)

differential explained by differences in returns to (observed) characteristics (interpreted as the sector pay gap) for the periods 1995-1999 and 2001-2003 by gender are presented in Table 5.7.

Table 5.7: Decomposition of public-private sector earnings differential at different percentiles: differences in returns to characteristics

	1995-1999		2001-2003		Change	
Percentile:	Men	Women	Men	Women	Men	Women
10th	-0.001	0.034***	-0.002**	0.046***	*0.001*	*-0.012*
	(0.001)	(0.001)	(0.001)	(0.000)		
30th	-0.136***	-0.069***	-0.054***	-0.012***	*-0.082*	*-0.057*
	(0.000)	(0.001)	(0.001)	(0.002)		
50th	-0.204***	-0.143***	-0.160***	-0.122***	*-0.044*	*-0.021*
	(0.000)	(0.001)	(0.000)	(0.004)		
70th	-0.289***	-0.261***	-0.273***	-0.256***	*-0.016*	*-0.005*
	(0.000)	(0.002)	(0.001)	(0.003)		
90th	-0.472***	-0.443***	-0.406***	-0.439***	*-0.065*	*-0.004*
	(0.001)	(0.002)	(0.003)	(0.003)		

Notes to Table 5.7: Decomposition of differences in distribution estimation procedure implemented by estimating 100 quantile regressions in each sector accounting for worker's labour force experience, its quadratic form, educational qualification, occupational affiliation and employer's urban type, region and size and year. The variance has been estimated by bootstrapping the results 100 times. Coefficients component contribution to the log difference in real monthly gross earnings between the public and private sectors are presented. The standard errors reported in parentheses. *** denotes the 0.01 significance level. Full decomposition results presented in Figures A5.1 and A5.2 and in Table A5.11 in the Appendix.

Data Source: Pooled Harmonised Hungarian Wage Survey (WS), 1995-1999 and 2001-2003

For each period Table 5.7 shows that the estimates are the same in sign and similar in size to the results obtained using the 'dummy variable' approach in Table 5.6. In particular, during the 1995-1999 period apart from the 10th percentile the public sector pay penalty was statistically significant and increased from the bottom-end to the high-end for both men and women. The same holds for the 2001-2003 period but workers at the 10th percentile collected statistically significant public sector premia whereas the public sector pay penalty at the other percentiles was lower than during the 1995-1999 period. Therefore, removing differences in characteristics, decomposition results reinforce the previous finding that the earnings

distribution is more compressed in the public than in the private sector and that the gap declined over period reviewed.

(iii) Mean and Quantile Regressions by Educational Qualification

The previous analysis suggested a compressed structure of the public sector earnings distribution. If a worker's earnings are interpreted as a measure of skill the compression of public sector pay indicates that the public sector pay penalty increases with skill. Furthermore, public sector pay compression may differ within each skill group. For example, the sectoral differences in earnings for unskilled workers are expected to be more uniform across the earnings distribution than for university graduates. As argued by Disney and Gosling (1998), if public sector workers with university degrees are more equal in terms of ability and 'drive' than their private sector counterparts, or if private sector workplaces are more likely to pay a premium for these attributes, then there will be a difference between the estimated effects of the public sector at for example the median or upper percentiles of the earnings distribution.

In order to test both between and within group public-private sector pay differentials as well as their changes over a decade of economic transition the sector pay gap in this sub-section is estimated across the pay distribution for each skill level separately.

The public sector pay effects across groups of workers differentiated by educational qualifications attained are estimated using a 'dummy variable' method given by equation (5.1) at the conditional mean and at the conditional selected percentiles of the earnings distribution. The public-private sector pay gap estimates are obtained by pooling the data during 1990s and 2000s separately for each educational group by gender.

The unskilled group includes workers with primary educational qualification or less. The skilled group includes workers with both vocational (low skilled) and high school degree (middle skilled). The high-skilled group includes workers with a university degree.

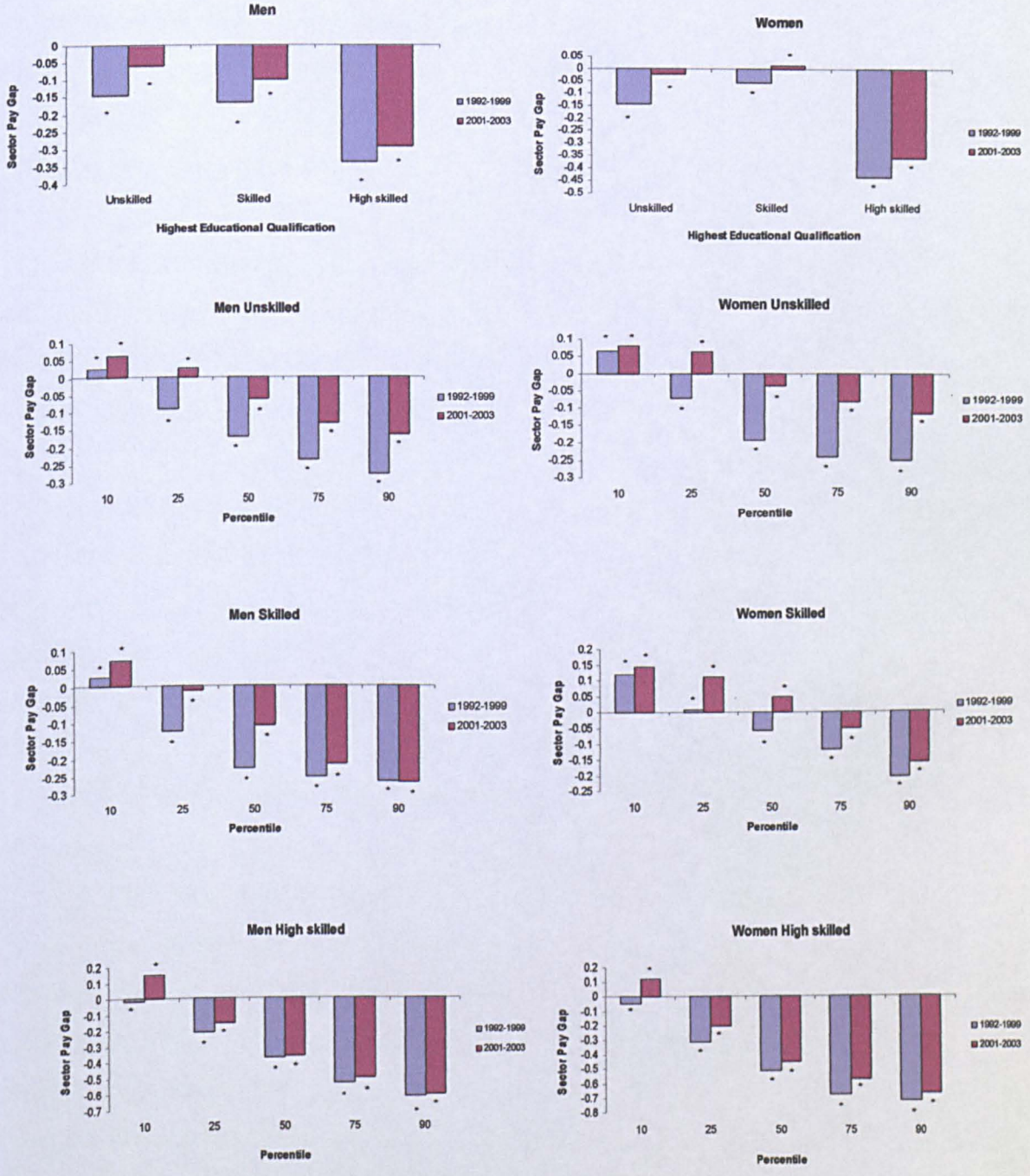
Since some of the occupations are not present for some educational groups we do not control for occupations and hence are able to pool data from 1992 until 1999 for the 1990s period. Each pooled regression is therefore estimated conditional on labour force experience, its quadratic form, employer urban type, employer region and a set of year dummies. We can compare our results to Hámori (2007) who estimated the annual sectoral pay gap from 1994

until 2003 WS data for different educational groups of full-time male employees conditional on the similar set of covariates.

The public sector pay differentials estimated for three groups of workers according to educational qualification by gender are plotted in the Figure 5.6. The first two charts present the results from mean regressions estimated by OLS. The rest of the charts illustrate quantile regression estimates. All estimated conditional public sector pay premia/penalties are statistically significant at the 0.01 level of significance and summarised in Table A5.12 in the Appendix. In addition to the monthly estimates Table A5.12 reports the hourly estimates for the 2001-2003 period. The difference between the monthly and hourly public-private sector differentials is insignificant.

The impact of the public sector pay status across groups differentiated by skill qualifications attained is evident from Figure 5.5. The between-group reduction in inequality for male workers arising from public sector earnings determination is observable in both periods by the increase in the negative average returns to public sector with higher skill level. For female workers the between-group reduction in inequality is observable in the higher negative average returns to public sector graduates relative to their private sector counterparts in both periods. In addition, the between-group reduction in inequality is also observable by a greater average public sector pay gap for men than for women. Finally, the between-group public sector pay compression is illustrated by a higher penalty to public sector status at the upper end of the earnings distribution which is almost double for high skilled workers than for other skill groups and by the higher premia for unskilled and skilled women at the lower end of the earnings distribution relative to men.

Figure 5.5: Public sector monthly gross pay premium/penalty by highest educational qualification on average and across the pay distribution by gender in Hungary during 1992-1999 and 2001-2003



Notes to Figure 5.5: The public sector monthly gross earnings gap is estimated conditional on labour force experience, its quadratic form, employer urban type, employer region and year. * denotes that all coefficients are significant at 0.01 level. Estimates are summarised in Table A5.12 in the Appendix.

Data Source: Pooled Harmonised Hungarian Wage Survey, 1992-1999 and 2001-2003

In addition to between-group pay compression Figure 5.5 suggests that there is an equalising effect within skill groups attached to public sector status. In particular, working in the public sector clearly reduces the pay inequality among graduates relative to the private sector for both men and women. For example, the public sector pay penalty increased from 1.5% (4.6%) at the 10th percentile to 61.5% (71.5%) for men (women) at the 90th percentile during 1992-1999.

The same inequality-reducing effect is apparent for public sector graduates from 2001 until 2003, but the public sector penalty is lower than during the 1992-1999 period. During 2001-2003 both public sector male and female graduates at the 10th percentile obtained premia relative to their private sector counterparts but the penalty for having a public sector job remained at the rest of the percentiles. For example, the 15% public sector premium for male workers at the 10th percentile converts into 60% public sector penalty at the 90th percentile.

Our estimates are consistent with Hámori (2007). In particular, controlling for labour force experience, its quadratic form and Hungarian capital Budapest in a log monthly gross earnings equation, Hámori (2007) estimated that in 1994, the public sector pay penalty for male graduates increased from around 21% at the 10th percentile to 69% at the 90th percentile. Similar to our results, Hámori (2007) found for 2003 a 27% public sector premium for graduates at the 10th percentile, but around 62% public sector penalty at the 90th percentile.

A substantial public sector within-group earnings equalising effect for graduates in Hungary may be best depicted if the results are compared to some of the developed OECD countries. For example, Disney and Gosling (1998) estimated for UK public sector male graduates in 1983 a 25% premium over their private sector counterparts at the 10th percentile which drops to zero as one moves up the income distribution. During 1991-1995 although the whole distribution has shifted downwards (with workers at 25th percentile and above obtaining public sector pay penalties) Disney and Gosling (1998) find the same inequality reducing effect. Hence, relative to the UK the estimated public sector pay compression for male graduates in Hungary was three times greater.

Differences between the estimated coefficients during the 1990s and 2000s plotted on the Figure 5.5 are presented in columns titled as 'change' in Table A5.12 in the Appendix by

gender and summarised in Table 5.8. A negative sign presents the improvements in the financial position of public sector workers between the 1992-1999 and 2001-2003 periods.

Table 5.8: Change in the public sector pay gap between 1992-1999 and 2001-2003 periods by highest educational qualification and gender

	1990s-2000s Change					
	Unskilled		*Skilled*		*High skilled*	
	Men	Women	Men	Women	Men	Women
Mean	*-0.087*	*-0.123*	*-0.067*	*-0.070*	*-0.045*	*-0.077*
10th	*-0.039*	*-0.015*	*-0.048*	*-0.025*	*-0.166*	*-0.165*
25th	*-0.061*	*-0.134*	*-0.111*	*-0.104*	*-0.060*	*-0.107*
50th	*-0.108*	*-0.160*	*-0.121*	*-0.104*	*-0.010*	*-0.063*
75th	*-0.103*	*-0.160*	*-0.039*	*-0.068*	*-0.033*	*-0.103*
90th	*-0.112*	*-0.134*	*0.004*	*-0.046*	*-0.009*	*-0.060*

Notes to Table 5.8: 1990s-2000s change is the difference between the estimated public sector pay gap during the 1992-1999 period and the estimated public sector pay gap during the 2001-2003 period. The public sector pay gap for each period by gender and highest educational qualification at the mean and selected percentiles are plotted on the Figure 5.5 and presented in Table A5.12 in the Appendix.

Data Source: Pooled Harmonised Hungarian Wage Survey, 1992-1999 and 2001-2003

Table 5.8 suggests the following conclusions. First, during 2001-2003 relative to 1992-1999 all public sector educational groups improved their financial position. On average the improvements were the highest for the unskilled group of male and female workers. However, quantile regressions reveal that high-skilled workers at the 10th percentile saw the greatest improvement relative to their private sector counterparts between the two sub-periods. Second, on average and at most of the conditional percentiles, improvements in the financial position of public sector workers were greater for women than for men for every educational group. Third, within the unskilled group except at the 10th percentile the improvements in financial position of public sector workers were uniform across the earnings distribution. Within the skilled group the public sector pay penalty declined the most for workers at the middle of the earnings distribution. Within the high-skilled group workers at the top-end saw the smallest change in their financial position between the two sub-periods relative to their private sector counterparts.

Again, these conclusions are consistent with Hámori (2007) who found uniform changes in the public sector pay gap across the earnings distribution during economic transition for male workers with lower skills but not with higher skills. As has been shown in this section, Hámori (2007) also suggested that high skilled male workers were more affected

at the top end until 2000 (increasing trend in public sector penalty) and at the bottom end of pay distribution after 2000 (decreasing trend in public sector penalty) due to public sector wage reforms.

5.5.4 Summary of the Regression Results

The empirical anaysis in this chapter had four goals. First, we tested whether there was a public-private sector earnings differential and how it changed during the period of economic transition. The OLS annual estimates showed that the conditional mean public sector pay differentials were negative during most of the period of economic transition in Hungary, but grew to zero by the end of the period reviewed in this chapter. In particular, there was a widening of the mean sector pay gap from 1992 until 2001 and its closure by 2003. The change in the sign of the public sector pay gap is argued to be due to public sector wage reforms that took place in the early 2000s and aimed to increase public sector nominal wages by 50% on average.

In addition, we tested personal and job characteristics of workers. In contrast to the usual finding that labour force experience gained during the pre-transition is not valued by the market in transition (Adamchik and Bedi (2000) for Poland, Jovanović and Lokshin (2004) for Moscow and our results in chapter 4 for Serbia) we found statistically significant returns to experience in Hungary. These results are similar to returns to experience reported by Orazem and Vodopivec (1997) for Slovenia and explained as an outcome of early retirement schemes which made experienced labour relatively scarce at the start of the economic transition.

Furthermore, we found that returns to university level education were increasing during the whole period observed. The estimated returns to educational qualification obtained for Hungary are comparable with the findings reported by related empirical studies for other transitional economies (such as Keane and Prasad (2001) for Poland; Munich, Svenjar and Terrell (2002) for Czech Republic; Orazem and Vodopivec (1997) for Slovenia).

Our second goal was to test whether the public sector pay effect for workers with similar characteristics varied across the earnings distribution. Indeed, quantile regressions indicated significant public sector pay compression. In particular we found: firstly, that the public-private sector pay differential was greater for workers at higher percentiles, i.e. the gap

was smaller at lower-half and larger in upper-half of the earnings distribution than that obtained using OLS; secondly, that the gap was higher for men than for women; and thirdly, that the gap declined from earlier to later period of economic transition (i.e. before and after 2000).

Our third goal was to test the robustness of the quantile regression estimates obtained from a 'dummy variable' approach. So, the public sector pay effects across the conditional earnings distribution are re-estimated by a decomposition method. Removing the differences in characteristics the results from the decompositions reinforced the previous finding that the earnings distribution was more compressed in the public than in the private sector and that the difference in distributions declined over a period reviewed.

Our fourth goal was to test whether the public sector compressed pay both within and between groups of workers with different educational qualifications. Between groups the public sector pay equalising effect is confirmed by a higher penalty to public sector status at the upper end of the earnings distribution which is almost double for high skilled workers than for other skill groups, and by the higher premia for unskilled and skilled women at the lower end of the earnings distribution relative to men. The public sector compressed the pay the most amongs graduates for both men and women. For example, the public sector within-group earnings equalising effect for male graduates in Hungary is found to be three times greater than the similar estimate reported by Disney and Gosling (1998) for the UK during 1990s.

Moreover, the chapter showed that all public sector educational groups improved their financial position during 2000s relative to the 1990s, although women more than men. This is not surprising given the public sector wage reforms in early 2000s and the fact that the public sector is more female dominated. Finally, the improvements were highest for the unskilled groups of male and female workers on average. However, quantile regressions revealed that actually high-skilled workers at the 10^{th} percentile saw the greatest improvement, whereas those at the top-end saw the smallest change in their financial position relative to their private sector counterparts. Within the skilled group the public sector pay penalty declined the most for workers at the middle of the earnings distribution. Within the unskilled group the improvements in financial position of public sector workers were uniform across the earnings distribution.

Finally, the chapter did not explicitly deal with endogeneity and measurement error problems. Employer survey has less measurement error than self-reported data but has no suitable instruments to control for differences in workers' unobserved heterogeneity between sectors. In addition, the public sector includes only budgetary institutions and hence, unlike in the chapter 4, we are not able to use changes in the proportions of industry branches within public sector caused by large-scale privatisations as an instrument for endogeneity. However, some conclusions from IV methods applied in the chapter 4 can be relevant for the results obtained here. In particular, chapter 4 indicated that the public sector workers are more likely to have lower unobserved earning potentials than private sector workers in which case the methods applied in this chapter tend to over-estimate the public sector pay penalty.

5.6 Conclusion

This chapter has aimed to provide a comprehensive picture of the evolution of the earnings distribution in public and private sectors by gender during the economic transition in Hungary. The analysis was performed during the twelve-year long period, from 1992 until 2003, using an employer-provided microdata.

Over the time period covered by the analysis the public sector had witnessed large-scale privatisations and restructuring through a number of wage reforms. In particular, during the 1990s the public sector earnings lagged behind the private sector earnings. In order to combat losses of highly skilled labour in the public sector due to the private sector selection the government increased nominally public sector wages by 50% on average between September 2002 and 2003. In addition, the level of minimum wage increased in 2001 by 57% and in 2002 by 25%.

The chapter illuminated changes in the public sector earnings inequality relative to the private sector by estimating public-private sector earnings differentials for each year and by the two sub-periods i.e. before and after 2000. The public sector pay gap was estimated by OLS, quantile regressions and decomposition of differences in distributions methods.

The empirical results obtained in this chapter are consistent with the predictions of the public sector monopsony model laid out in chapter 3 which suggested the negative public sector pay gap and greater pay compression relative to the competitive private sector. In

particular, the data confirmed that both men and women in the public sector fared significantly worse than their private sector counterparts during 1990s, but this penalty declined to almost zero until 2003. The results from quantile regressions verified that the public sector pay distribution was more compressed than in the private sector and hence workers at and above the median fared significantly worse off having a public sector status even by the end of the period considered.

A decline in the public sector monopsony power due to private sector competition for workers, as suggested in chapter 3, may have been reflected in the public sector wage reforms in Hungary which attempted to improve the financial position for skilled workers. However, although the quantile regressions revealed that the high-skilled workers indeed saw the greatest improvements as a result of public sector wage reforms, this was rather the case only for those at the 10^{th} percentile. In contrast to unskilled workers who experienced uniform changes across the earnings distribution, the skilled and high-skilled workers at the top-end of the earnings distribution saw the smallest changes in their financial position when compared to their private sector counterparts. Finally, the fact that the gap was the lowest for the unskilled workers and that the changes in the financial position for this group were uniform across the earnings distribution confirmed that these workers were more similarly rewarded across the two sectors. Therefore, the empirical results in this chapter verified two main characteristics of the public sector set by the theoretical model presented in the chapter 3: greater wage equality than in the private sector and differential monopsony power over skilled and unskilled workers.

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5.7 Appendix

Table A5.1: Description of Variables Used in the Analysis

Variable name	Variable description
	Wages and Hours Variables
Monthly Gross Earnings and natural log of Monthly Gross Earnings	Monthly gross earnings are defined as monthly gross wage in May plus regular premia and bonuses in May plus one twel of the sum of all additional payments and irregular incomes connected to the full-time job paid over the previous y denoted in Hungarian currency (forint) and converted to 2003 earnings by the annual consumer price index
Hourly Gross Earnings and natural log of Hourly Gross Earnings	Hourly gross earnings are obtained by dividing monthly gross earnings with monthly hours
Monthly Hours	The monthly hours are reported paid hours in May
	Employer Location and Region Variables
Budapest	=1 if the individual works in capital Budapest; otherwise 0.
County center	=1 if the individual works in county center; otherwise 0.
City	=1 if the individual works in city; otherwise 0.
Village[1]	=1 if the individual works in the village; otherwise 0.
Central Hungary[1]	=1 if the individual works in the Central Hungary; otherwise 0.
Central Transdanubia	=1 if the individual works in the Central Transdanubia; otherwise 0.
Western Transdanubia	=1 if the individual works in the Western Transdanubia; otherwise 0.
Southern Transdanubia	=1 if the individual works in the Southern Transdanubia; otherwise 0.
Northern Hungary	=1 if the individual works in the Northern Hungary; otherwise 0.
Northern Great Plain	=1 if the individual works in the Northern Great Plain; otherwise 0.
Southern Great Plain	=1 if the individual works in the Southern Great Plain; otherwise 0.
	Worker Education Level and Labour Force Experience Variables
Unskilled[1]	=1 if the individual has primary education and less; otherwise 0.
Low skilled	=1 if the individual has vocational education; otherwise 0.
Middle skilled	=1 if the individual has high school education; otherwise 0.
High skilled	=1 if the individual has tertiary education; otherwise 0.
Labour Force Experience <=5 years[1]	=1 if the individual has less or five years of working experience; otherwise 0.
5<Labour Force Experience<=10 years	=1 if the individual has more than five and less or ten years of working experience; otherwise 0.
10<Labour Force Experience<=20 years	=1 if the individual has more than ten and less or twenty years of working experience; otherwise 0.
20<Labour Force Experience<=30 years	=1 if the individual has more than twenty and less or thirty years of working experience; otherwise 0.
Labour Force Experience>30 years	=1 if the individual has more than thirty years of working experience; otherwise 0.
Labour Force Experience^2 (Years/100)	Labour Force Experience squared of individual in years (divided by 100)
	Worker Occupation Variables
Manager	=1 if the individual is a manager; otherwise 0.
Professional	=1 if the individual is a professional; otherwise 0.
Technician	=1 if the individual is a technician; otherwise 0.
Clerk	=1 if the individual is a clerk; otherwise 0.
Worker in Services[1]	=1 if the individual is a worker in the services; otherwise 0.
Farmer	=1 if the individual is a farmer; otherwise 0.
Miner Industrial	=1 if the individual is a miner or industrial; otherwise 0.
Operator	=1 if the individual is an operator; otherwise 0.
Labourer	=1 if the individual is a labourer; otherwise 0.
	Employer Industry Branch Variables
Agriculture[1]	=1 if the individual works in agriculture and forestry; otherwise 0.
Mining & Manufacturing	=1 if the individual works in industry sector; otherwise 0.
Electricity Gas Water	=1 if the individual works in electricity, gas and water; otherwise 0.
Construction	=1 if the individual works in construction; otherwise 0.
Trade	=1 if the individual works in trade; otherwise 0.
Tourism and Catering	=1 if the individual works in catering and tourism; otherwise 0.
Transport Post Telecommunications	=1 if the individual works in transport and communication; otherwise 0.

Financial Intermediation & Real Estate & Renting Machinery	=1 if the individual works in financial and other services such as real estate and renting machinery; otherwise 0.
IT & Research & Development	=1 if the individual works in computer sciences and research and development; otherwise 0.
Other Business Activities	=1 if the individual works in other business activities; otherwise 0.
Public Administration & Defense & Compulsory Social Security	=1 if the individual works in public administration and compulsory social security; otherwise 0.
Education & Health & Social Work	=1 if the individual works in education, health and social work; otherwise 0.
Sewage & Refuse Disposal & Sanitation	=1 if the individual works in sewage and refuse disposal, sanitation and similar; otherwise 0.
Sports & Cultural & Recreative	=1 if the individual works in sports and culture and similar; otherwise 0
Other & Private households with employed	=1 if the individual works either in non listed industry or for the private households; otherwise 0.
Extra territorial organisations and bodies	=1 if the individual works for extra territorial organisations and bodies; otherwise 0.
	Employer Size
21<=Employer Size<=50[1]	=1 if individual works for employer with over 20 employees but less than 51 employees
51<=Employer Size<=300	=1 if individual works for employer with over 50 employees but less than 301 employees
301<=Employer Size<=1000	=1 if individual works for employer with over 300 employees but less than 1001 employees
1001<=Employer Size<=3000	=1 if individual works for employer with over 1000 employees but less than 3001 employees
Employer Size>=3001	=1 if individual works for employer with over 3000 employees
	Ownership Sector Variable
Public[1]	=1 if the individual works in the 'budgetary sector' (1992) or the individual is civil servant, judge, prosecutor or public servant (1995-2003); otherwise 0.
Private	=1 if the individual works in the enterprise in the competitive sector; otherwise 0.

Notes to TableA 5.1: [1] - denotes variable omitted in estimation.

Data Source: The Harmonised Hungarian Wage Survey (WS), 1992-2003

Table A5.2: Proportions and Means of Variables used in Analysis from Harmonised Hungarian Wage Survey - Men

Period	1992				1995-1999				2001-2003			
Sector	Public		Private		Public		Private		Public		Private	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Log Monthly Gross Earnings (HUF)	11.63	0.48	11.45	0.52	11.43	0.56	11.40	0.61	11.79	0.60	11.60	0.62
Monthly Hours									180.83	14.9	182.57	13.1
Log Hourly Gross Earnings (HUF)									6.59	0.60	6.40	0.62
Age (years)	40.98	10.4	38.79	10.5	42.01	10.7	38.68	10.7	43.94	11.1	39.58	11.0
Labour Force Experience <=5	0.06	0.24	0.07	0.25	0.06	0.24	0.08	0.27	0.06	0.23	0.07	0.25
5<Lfe<=10 years	0.12	0.33	0.12	0.32	0.11	0.31	0.13	0.34	0.10	0.30	0.14	0.35
10<Lfe<=20 years	0.27	0.45	0.27	0.44	0.24	0.43	0.25	0.43	0.22	0.41	0.26	0.44
20<Lfe<=30 years	0.32	0.47	0.31	0.46	0.32	0.46	0.31	0.46	0.28	0.45	0.27	0.44
Labour Force Experience>30	0.20	0.40	0.20	0.40	0.24	0.43	0.20	0.40	0.29	0.45	0.22	0.42
Unskilled (Primary School or less)	0.18	0.38	0.28	0.45	0.17	0.37	0.21	0.41	0.12	0.33	0.17	0.38
Low skilled (Vocational Degree)	0.14	0.34	0.41	0.49	0.18	0.39	0.43	0.50	0.18	0.38	0.45	0.50
Middle skilled (High School Degree)	0.18	0.39	0.21	0.41	0.21	0.41	0.24	0.43	0.20	0.40	0.25	0.44
High skilled (Tertiary Degree)	0.51	0.50	0.10	0.29	0.43	0.50	0.11	0.31	0.50	0.50	0.12	0.33
Budapest	0.23	0.42	0.22	0.42	0.34	0.47	0.23	0.42	0.34	0.47	0.23	0.42
County center	0.31	0.46	0.25	0.43	0.29	0.45	0.27	0.44	0.30	0.46	0.27	0.44
City	0.31	0.46	0.34	0.48	0.26	0.44	0.35	0.48	0.26	0.44	0.37	0.48
Village	0.15	0.36	0.18	0.38	0.11	0.32	0.14	0.35	0.11	0.31	0.13	0.34
Central Hungary	0.29	0.45	0.28	0.45	0.39	0.49	0.29	0.45	0.38	0.49	0.30	0.46

Central Transdanubia	0.07	0.26	0.12	0.33	0.07	0.26	0.12	0.33	0.07	0.26	0.13	0.34
Western Transdanubia	0.10	0.30	0.13	0.34	0.08	0.28	0.13	0.34	0.08	0.27	0.13	0.34
Southern Transdanubia	0.12	0.32	0.09	0.29	0.09	0.28	0.09	0.29	0.09	0.28	0.09	0.28
Northern Hungary	0.13	0.34	0.11	0.31	0.11	0.31	0.11	0.31	0.11	0.31	0.11	0.31
Northern Great Plain	0.16	0.37	0.14	0.34	0.14	0.35	0.13	0.34	0.14	0.35	0.13	0.33
Southern Great Plain	0.12	0.33	0.13	0.34	0.12	0.33	0.12	0.33	0.12	0.33	0.12	0.32
21<=Employer Size<=50	0.08	0.26	0.07	0.25	0.12	0.32	0.14	0.34	0.12	0.33	0.19	0.39
51<=Employer Size<=300	0.46	0.50	0.29	0.45	0.44	0.50	0.33	0.47	0.46	0.50	0.36	0.48
301<=Employer Size<=1000	0.22	0.42	0.24	0.42	0.20	0.40	0.21	0.41	0.21	0.41	0.23	0.42
1001<=Employer Size<=3000	0.16	0.36	0.19	0.39	0.13	0.34	0.15	0.36	0.11	0.31	0.12	0.32
Employer Size>=3000	0.08	0.28	0.22	0.41	0.11	0.31	0.17	0.38	0.09	0.29	0.11	0.31
Agriculture					0.00	0.06	0.11	0.32	0.00	0.05	0.08	0.28
Mining & Manufacturing					0.00	0.00	0.40	0.49	0.00	0.00	0.43	0.49
Electricity Gas Water					0.00	0.02	0.07	0.25	0.00	0.02	0.05	0.23
Construction					0.00	0.02	0.07	0.26	0.00	0.01	0.07	0.26
Trade					0.00	0.00	0.08	0.27	0.00	0.00	0.11	0.31
Tourism & Catering					0.01	0.08	0.02	0.13	0.00	0.03	0.02	0.14
Transport Post Telecommunications					0.02	0.14	0.15	0.36	0.00	0.07	0.11	0.32
Financial Intermediation & Real Estate & Renting												
Machinery					0.00	0.05	0.03	0.17	0.01	0.08	0.04	0.18
Computer Activities & Research & Development					0.01	0.12	0.01	0.09	0.01	0.11	0.01	0.11
Other Business Activities					0.00	0.05	0.04	0.19	0.00	0.07	0.05	0.21
Public Administration & Defence & Compulsory Social Security					0.37	0.48	0.00	0.00	0.43	0.50	0.00	0.00
Education & Health & Social Work					0.53	0.50	0.00	0.06	0.50	0.50	0.00	0.06
Sewege & Refuse Disposal & Sanitation					0.00	0.04	0.01	0.10	0.00	0.03	0.01	0.11
Sport & Culture					0.05	0.22	0.00	0.06	0.04	0.19	0.01	0.08
Other & Private households with employed					0.00	0.02	0.00	0.06	0.00	0.02	0.00	0.05
Extra territorial organisations					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manager					0.11	0.31	0.10	0.31	0.13	0.33	0.09	0.29
Professional					0.32	0.47	0.04	0.19	0.35	0.48	0.05	0.22
Technician					0.17	0.37	0.08	0.28	0.17	0.38	0.09	0.29
Clerk					0.01	0.09	0.01	0.08	0.01	0.09	0.01	0.08
Service					0.08	0.27	0.09	0.29	0.07	0.26	0.09	0.28
Farmer					0.01	0.09	0.03	0.17	0.01	0.08	0.03	0.16
Miner Industrial					0.11	0.31	0.36	0.48	0.09	0.29	0.35	0.48
Operator					0.09	0.29	0.20	0.40	0.08	0.27	0.21	0.41
Labourer					0.10	0.30	0.08	0.27	0.09	0.29	0.08	0.27
1992	1.00	0.00	1.00	0.00								
1995					0.21	0.41	0.20	0.40				
1996					0.21	0.40	0.20	0.40				
1997					0.19	0.40	0.20	0.40				
1998					0.20	0.40	0.20	0.40				
1999					0.18	0.39	0.20	0.40				

2001									0.34	0.47	0.37	0.48
2002									0.34	0.47	0.32	0.47
2003									0.33	0.47	0.31	0.46
Observations	9751		54402		56379		272567		30337		162116	

Notes to Table A5.2: The samples used relate to full time male employees, aged between 15 and 64. Means, Proportions and Standard Deviations obtained for 1992 sample, pooled 1995-1999 samples and pooled 2001-2003 samples.

Data Source: The Harmonised Hungarian Wage Survey (WS), 1992-2003

Table A5.3: Proportions and Means of Variables used in Analysis from Harmonised Hungarian Wage Survey - Women

Period	1992				1995-1999				2001-2003			
Sector	Public		Private		Public		Private		Public		Private	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Log Monthly Gross Earnings (HUF)	11.31	0.44	11.27	0.50	11.23	0.48	11.23	0.58	11.59	0.49	11.43	0.56
Monthly Hours									178.65	11.4	181.04	10.1
Log Hourly Gross Earnings (HUF)									6.40	0.49	6.24	0.56
Age (years)	38.89	9.51	38.47	9.72	40.28	9.44	38.31	10.0	42.59	9.94	39.64	10.5
Labour Force Experience <=5	0.10	0.29	0.09	0.29	0.08	0.27	0.10	0.30	0.06	0.24	0.08	0.27
5<Lfe<=10 years	0.10	0.30	0.08	0.27	0.09	0.29	0.11	0.31	0.09	0.28	0.13	0.33
10<Lfe<=20 years	0.29	0.45	0.24	0.43	0.26	0.44	0.22	0.41	0.23	0.42	0.22	0.42
20<Lfe<=30 years	0.33	0.47	0.37	0.48	0.35	0.48	0.36	0.48	0.32	0.47	0.29	0.45
Labour Force Experience>30	0.17	0.38	0.21	0.41	0.21	0.41	0.21	0.40	0.27	0.44	0.26	0.44
Unskilled (Primary School or less)	0.25	0.43	0.36	0.48	0.22	0.42	0.29	0.45	0.16	0.37	0.25	0.44
Low skilled (Vocational Degree)	0.08	0.27	0.20	0.40	0.08	0.27	0.23	0.42	0.09	0.28	0.25	0.43
Middle skilled (High School Degree)	0.33	0.47	0.38	0.49	0.36	0.48	0.41	0.49	0.36	0.48	0.40	0.49
High skilled (Tertiary Degree)	0.35	0.48	0.06	0.24	0.34	0.47	0.08	0.27	0.39	0.49	0.10	0.30
Budapest	0.18	0.38	0.27	0.45	0.25	0.43	0.27	0.45	0.27	0.44	0.26	0.44
County center	0.28	0.45	0.25	0.43	0.28	0.45	0.26	0.44	0.28	0.45	0.26	0.44
City	0.34	0.47	0.35	0.48	0.30	0.46	0.36	0.48	0.30	0.46	0.36	0.48
Village	0.20	0.40	0.12	0.33	0.17	0.37	0.11	0.31	0.15	0.36	0.11	0.31
Central Hungary	0.25	0.43	0.33	0.47	0.32	0.47	0.33	0.47	0.34	0.47	0.34	0.47
Central Transdanubia	0.08	0.28	0.11	0.32	0.10	0.29	0.11	0.32	0.09	0.28	0.12	0.33
Western Transdanubia	0.09	0.29	0.11	0.32	0.09	0.29	0.13	0.34	0.08	0.27	0.13	0.34
Southern Transdanubia	0.12	0.33	0.09	0.28	0.10	0.30	0.09	0.28	0.09	0.29	0.08	0.28
Northern Hungary	0.15	0.36	0.11	0.31	0.12	0.33	0.10	0.30	0.12	0.33	0.09	0.29
Northern Great Plain	0.18	0.38	0.13	0.33	0.15	0.35	0.12	0.32	0.15	0.36	0.12	0.32
Southern Great Plain	0.12	0.32	0.12	0.33	0.13	0.33	0.12	0.33	0.12	0.33	0.11	0.31
21<=Employer Size<=50	0.08	0.27	0.06	0.25	0.16	0.37	0.12	0.32	0.19	0.39	0.15	0.36
51<=Employer Size<=300	0.46	0.50	0.28	0.45	0.46	0.50	0.32	0.47	0.46	0.50	0.35	0.48
301<=Employer Size<=1000	0.21	0.40	0.27	0.44	0.19	0.39	0.24	0.43	0.18	0.39	0.24	0.43
1001<=Employer Size<=3000	0.18	0.38	0.18	0.38	0.15	0.35	0.15	0.35	0.12	0.32	0.12	0.33
Employer Size>=3000	0.08	0.27	0.20	0.40	0.04	0.21	0.17	0.38	0.05	0.22	0.13	0.34
Agriculture					0.00	0.03	0.05	0.23	0.00	0.02	0.03	0.18

Mining & Manufacturing					0.00	0.00	0.44	0.50	0.00	0.01	0.44	0.50
Electricity Gas Water					0.00	0.01	0.03	0.18	0.00	0.01	0.03	0.16
Construction					0.00	0.02	0.02	0.12	0.00	0.01	0.01	0.12
Trade					0.00	0.00	0.16	0.37	0.00	0.00	0.18	0.38
Tourism & Catering					0.01	0.09	0.03	0.17	0.00	0.04	0.04	0.20
Transport Post Telecommunications					0.00	0.05	0.11	0.31	0.00	0.03	0.08	0.27
Financial Intermediation & Real Estate & Renting												
Machinery					0.00	0.05	0.09	0.28	0.01	0.07	0.07	0.26
Computer Activities & Research & Development					0.00	0.06	0.01	0.09	0.00	0.06	0.01	0.11
Other Business Activities					0.00	0.04	0.04	0.19	0.00	0.06	0.06	0.24
Public Administration & Defence & Compulsory Social Security					0.34	0.47	0.00	0.00	0.36	0.48	0.00	0.00
Education & Health & Social Work					0.62	0.48	0.01	0.08	0.61	0.49	0.01	0.12
Sewege & Refuse Disposal & Sanitation					0.00	0.01	0.01	0.07	0.00	0.02	0.01	0.08
Sport & Culture					0.02	0.14	0.01	0.07	0.02	0.13	0.01	0.09
Other & Private households with employed					0.00	0.01	0.01	0.09	0.00	0.02	0.01	0.07
Extra territorial organisations					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manager					0.06	0.24	0.07	0.26	0.07	0.25	0.07	0.25
Professional					0.29	0.45	0.03	0.17	0.31	0.46	0.04	0.19
Technician					0.33	0.47	0.21	0.41	0.33	0.47	0.20	0.40
Clerk					0.08	0.27	0.16	0.37	0.09	0.28	0.14	0.34
Service					0.06	0.24	0.11	0.31	0.05	0.22	0.12	0.33
Farmer					0.00	0.04	0.02	0.13	0.00	0.04	0.01	0.12
Miner Industrial					0.01	0.08	0.19	0.39	0.00	0.07	0.18	0.39
Operator					0.00	0.03	0.11	0.32	0.00	0.03	0.14	0.34
Labourer					0.16	0.37	0.09	0.28	0.14	0.34	0.10	0.30
1992	1.00	0.00	1.00	0.00								
1995					0.21	0.40	0.21	0.41				
1996					0.21	0.40	0.20	0.40				
1997					0.20	0.40	0.20	0.40				
1998					0.20	0.40	0.20	0.40				
1999					0.19	0.39	0.20	0.40				
2001									0.33	0.47	0.36	0.48
2002									0.33	0.47	0.32	0.47
2003									0.33	0.47	0.32	0.47
Observations	25879		40014		192128		193762		106084		115939	

Notes to Table A5.3: The samples used relate to full time female employees, aged between 15 and 64. Means, Proportions and Standard Deviations obtained for 1992 sample, pooled 1995-1999 samples and pooled 2001-2003 samples.

Data Source: The Harmonised Hungarian Wage Survey (WS), 1992-2003

Table A5.4: Estimation of real monthly and hourly gross earnings in Hungary for men, 1992-2003

	1992	1995	1996	1997	1998	1999	2001	2002	2003	*2001h*	*2002h*	*2003h*
						Unconditional Model						
Public Sector:	0.183***	0.090***	-0.051***	0.016***	0.049***	0.043***	0.106***	0.158***	0.283***	*0.126****	*0.159****	*0.290****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	*(0.002)*	*(0.001)*	*(0.002)*
						Conditional Model						
Experience:	0.034***	0.024***	0.024***	0.021***	0.021***	0.019***	0.017***	0.017***	0.017***	*0.018****	*0.017****	*0.016****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
Experience Sq:	-0.051***	-0.034***	-0.035***	-0.020***	-0.031***	-0.028***	-0.028***	-0.027***	-0.025***	*-0.028****	*-0.027****	*-0.024****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
Education:												
Unskilled	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Lowskilled	0.155***	0.080***	0.099***	0.116***	0.120***	0.112***	0.010***	0.072***	0.098***	*0.103****	*0.073****	*0.099****
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Middleskilled	0.381***	0.201***	0.222***	0.265***	0.270***	0.266***	0.235***	0.202***	0.210***	*0.241****	*0.208****	*0.214****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Highskilled	0.836***	0.561***	0.609***	0.676***	0.702***	0.737***	0.706***	0.676***	0.691***	*0.711****	*0.685****	*0.700****
	(0.001)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*
Occupation:												
Manager		0.575***	0.690***	0.668***	0.735***	0.690***	0.717***	0.727***	0.778***	*0.722****	*0.748****	*0.788****
		(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*
Professional		0.253***	0.294***	0.311***	0.332***	0.326***	0.361***	0.384***	0.441***	*0.355****	*0.398****	*0.439****
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*
Technician		0.197***	0.267***	0.232***	0.295***	0.306***	0.333***	0.334***	0.358***	*0.337****	*0.356****	*0.370****
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
Clerk		0.055***	0.112***	0.140***	0.153***	0.129***	0.152***	0.187***	0.167***	*0.152****	*0.207****	*0.179****
		(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	*(0.005)*	*(0.005)*	*(0.006)*
Service Worker		*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Farmer		0.065***	0.0517***	0.0642***	0.0769***	0.0880***	0.0739***	-0.01***	0.103***	*0.0714****	*0.010****	*0.106****
		(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*
Minerindustrial		0.142***	0.159***	0.147***	0.189***	0.195***	0.178***	0.155***	0.186***	*0.167****	*0.168****	*0.188****
		(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
Operator		0.204***	0.211***	0.220***	0.230***	0.234***	0.213***	0.169***	0.214***	*0.201****	*0.175****	*0.207****
		(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
Labourer		-0.077***	-0.066***	-0.084***	-0.043***	-0.052***	-0.056***	-0.04***	-0.014***	*-0.06****	*-0.021****	*-0.010****
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
Urban type:												
Budapest	0.178***	0.143***	0.121***	0.051***	0.100***	0.056***	0.093***	0.059***	0.083***	*0.086****	*0.056****	*0.078****
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
County center	0.139***	0.097***	0.093***	0.096***	0.060***	0.052***	0.044***	0.039***	0.022***	*0.041****	*0.034****	*0.020****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
City	0.087***	0.061***	0.071***	0.064***	0.038***	0.020***	0.025***	0.022***	0.004***	*0.025****	*0.020****	*0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*

Rural	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Firm size:												
Size 20-50	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	f	*f*	*f*	*f*
Size 51-300	0.024***	0.072***	0.158***	0.191***	0.211***	0.211***	0.196***	0.200***	0.198***	*0.188****	*0.193****	*0.196****
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Size 301-1000	0.0970***	0.239***	0.284***	0.319***	0.351***	0.388***	0.359***	0.349***	0.324***	*0.339****	*0.339****	*0.320****
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Size 1001-3000	0.163***	0.281***	0.334***	0.381***	0.440***	0.474***	0.416***	0.379***	0.420***	*0.390****	*0.353****	*0.411****
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
Size> 3000	0.287***	0.382***	0.424***	0.470***	0.449***	0.488***	0.359***	0.371***	0.423***	*0.378****	*0.358****	*0.409****
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
Public Sector:	-0.065***	-0.075***	-0.252***	-0.228***	-0.204***	-0.215***	-0.223***	-0.196***	-0.071***	*-0.202****	*-0.199****	*-0.069****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Constant:	10.55***	10.42***	-10.22***	10.27***	10.24***	10.32***	10.49***	10.65***	10.77***	*5.509****	*5.607****	*5.686****
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*
R-squared	0.405	0.455	0.468	0.460	0.476	0.473	0.483	0.513	0.538	*0.490*	*0.523*	*0.548*
Root MSE	0.40	0.41	0.42	0.45	0.45	0.46	0.44	0.42	0.42	*0.44*	*0.42*	*0.42*
Observations	64153	73365	64740	64078	64150	62613	60466	66501	65486	*60466*	*66501*	*65486*

Notes to Table A5.4: The samples used relate to full time employees, aged between 15 and 64. The depended variable is the log of real monthly and hourly gross earnings. Monthly gross earnings are defined as monthly gross wage in May plus regular premia and bonuses in May plus one twelfth of the sum of all other payments and irregular incomes connected to the full-time job paid over the previous year, denoted in HUF and converted to 2003 earnings by the annual consumer price index. The gross hourly earnings calculated by dividing the gross monthly earnings with monthly hours and estimates in italics are obtained for 2001, 2002 and 2003 years denoted by the letter *h*. All specifications include a set of regional dummies. The estimation procedure for the mean robust regressions is OLS and estimated robust standard errors calculated based on White (1980) are reported in parentheses. *, ** and *** denote the 0.1, 0.05 and 0.01 significance level. *f* denotes category omitted in estimation.

Data Source: Harmonised Hungarian Wage Survey (WS) from 1992 until 2003

Table A5.5: Estimation of real monthly and hourly gross earnings in Hungary for women, 1992-2003

	1992	1995	1996	1997	1998	1999	2001	2002	2003	*2001h*	*2002h*	*2003h*
						Unconditional Model						
Public Sector:	0.037***	0.032***	-0.068***	0.009***	0.028***	0.020***	0.047***	0.114***	0.289***	*0.078****	*0.112****	*0.298****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
						Conditional Model						
Experience:	0.028***	0.024***	0.022***	0.019***	0.018***	0.020***	0.017***	0.015***	0.015***	*0.018****	*0.015****	*0.015****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
Experience Sq:	-0.038***	-0.030***	-0.024***	-0.018***	-0.017***	-0.024***	-0.022***	-0.018***	-0.017***	*-0.023****	*-0.018****	*-0.016****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
Education:												
Unskilled	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Lowskilled	0.181***	0.063***	0.067***	0.058***	0.062***	0.073***	0.059***	0.044***	0.036***	*0.055****	*0.043****	*0.033****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Middleskilled	0.406***	0.223***	0.231***	0.242***	0.247***	0.249***	0.190***	0.199***	0.179***	*0.189****	*0.201****	*0.180****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Highskilled	0.791***	0.509***	0.529***	0.575***	0.600***	0.686***	0.627***	0.649***	0.653***	*0.624****	*0.649****	*0.654****
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
Occupation:												
Manager		0.667***	0.723***	0.715***	0.738***	0.696***	0.707***	0.659***	0.658***	*0.705****	*0.660****	*0.663****
		(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*
Professional		0.335***	0.310***	0.302***	0.306***	0.277***	0.254***	0.269***	0.353***	*0.246****	*0.259****	*0.343****
		(0.0020)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	*(0.003)*	*(0.003)*	*(0.002)*
Technician		0.252***	0.296***	0.291***	0.316***	0.316***	0.340***	0.329***	0.325***	*0.337****	*0.332****	*0.334****
		(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Clerk		0.152***	0.194***	0.208***	0.214***	0.222***	0.196***	0.174***	0.171***	*0.195****	*0.177****	*0.182****
		(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.001)*
Service Worker	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Farmer		0.086***	0.035***	0.017***	0.070***	0.042***	0.061***	0.030***	0.088***	*0.045****	*0.025****	*0.082****
		(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*
Minerindustrial		0.114***	0.077***	0.068***	0.06***	0.081***	0.057***	0.052***	0.048***	*0.044****	*0.046****	*0.0489****
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	*(0.002)*	*(0.001)*	*(0.001)*
Operator		0.199***	0.191***	0.163***	0.189***	0.189***	0.139***	0.124***	0.095***	*0.124****	*0.112****	*0.092****
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
Labourer		-0.127***	-0.107***	-0.096***	-0.081***	-0.070***	-0.058***	-0.037***	-0.054***	*-0.060****	*-0.035****	*-0.046****
		(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Urban type:												
Budapest	0.296***	0.232***	0.196***	0.175***	0.189***	0.178***	0.162***	0.127***	0.123***	*0.150****	*0.131****	*0.120****
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
County center	0.142***	0.137***	0.101***	0.090***	0.077***	0.074***	0.040***	0.025***	0.040***	*0.034****	*0.026****	*0.038****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
City	0.058***	0.062***	0.039***	0.029***	0.016***	0.001	0.016***	-0.012***	0.004***	*0.014****	*-0.009****	*0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*

Rural	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Firm size:												
Size 20-50	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Size 51-300	-0.009***	0.040***	0.085***	0.078***	0.110***	0.109***	0.122***	0.127***	0.098***	*0.114****	*0.126****	*0.099****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Size 301-1000	0.018***	0.112***	0.147***	0.160***	0.204***	0.217***	0.245***	0.205***	0.168***	*0.227****	*0.201****	*0.168****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Size 1001-3000	0.035***	0.110***	0.173***	0.177***	0.221***	0.227***	0.216***	0.175***	0.175***	*0.197****	*0.168****	*0.175****
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Size> 3000	0.139***	0.232***	0.224***	0.225***	0.213***	0.261***	0.202***	0.182***	0.177***	*0.197****	*0.178****	*0.169****
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	*(0.001)*	*(0.001)*	*(0.002)*
Public Sector:	-0.077***	-0.052***	-0.184***	-0.156***	-0.150***	-0.183***	-0.191***	-0.130***	0.005***	*-0.163****	*-0.133****	*0.015****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Constant:	10.43***	10.29***	10.19***	10.25***	10.27***	10.27***	10.46***	10.68***	10.83***	*5.463****	*5.588****	*5.682****
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	*(0.002)*	*(0.002)*	*(0.002)*
R-squared	0.440	0.522	0.527	0.504	0.503	0.514	0.508	0.529	0.598	*0.510*	*0.532*	*0.602*
Root MSE	0.35	0.35	0.36	0.37	0.38	0.38	0.36	0.35	0.33	*0.36*	*0.35*	*0.32*
Observations	65893	76785	78259	79440	77079	74327	73673	75407	72943	*73673*	*75407*	*72943*

Notes to Table A5.5: See Notes to Table A5.4

Data Source: Harmonised Hungarian Wage Survey (WS) from 1992 until 2003

Table A5.6: Annual Conditional Public Sector Pay premiums'/penalties in Hungary, 1992-2003

	Mean		*10th Percentile*		*25th Percentile*		*50th Percentile*		*75th Percentile*		*90th Percentile*	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
1992	-0.07***	-0.08***	0.06***	0.05***	0.01**	-0.02***	-0.05***	-0.07***	-0.11***	-0.12***	-0.17***	-0.17***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
1995	-0.08***	-0.05***	0.03***	0.09***	0.06***	0.01***	-0.11***	-0.06***	-0.15***	-0.12***	-0.20***	-0.18***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
1996	-0.25***	-0.18***	-0.09***	-0.01***	-0.18***	-0.11***	-0.27***	-0.18***	-0.35***	-0.26***	-0.40***	-0.34***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
1997	-0.23***	-0.16***	-0.05***	0.07***	-0.16***	-0.05***	-0.25***	-0.15***	-0.32***	-0.25***	-0.38***	-0.33***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
1998	-0.20***	-0.15***	-0.02***	0.09***	-0.13***	-0.04***	-0.22***	-0.14***	-0.31***	-0.24***	-0.38***	-0.33***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
1999	-0.22***	-0.18***	-0.02***	0.07***	-0.14***	-0.07***	-0.22***	-0.17***	-0.32***	-0.27***	-0.36***	-0.37***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
2001	-0.22***	-0.19***	-0.05***	0.03***	-0.13***	-0.05***	-0.22***	-0.14***	-0.31***	-0.25***	-0.35***	-0.35***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
2001*h*	-0.20***	-0.16***	-0.05***	0.06***	-0.115***	-0.02***	-0.20***	-0.11***	-0.28***	-0.23***	-0.33***	-0.33***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
2002	-0.20***	-0.13***	0.00	0.03***	-0.10***	-0.02***	-0.18***	-0.08***	-0.25***	-0.15***	-0.33***	-0.24***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
2002*h*	-0.20***	-0.13***	-0.00***	0.03***	-0.10***	-0.02***	-0.19***	-0.09***	-0.25***	-0.15***	-0.32***	-0.23***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
2003	-0.07***	0.01***	0.20***	0.25***	0.08***	0.17***	-0.06***	0.05***	-0.17***	-0.07***	-0.26***	-0.20***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
2003*h*	-0.07***	0.015***	0.20***	0.26***	0.08***	0.18***	-0.06***	0.07***	-0.17***	-0.05***	-0.25***	-0.19***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

Notes to Table A5.6: The samples used relate to full time employees, aged between 15 and 64. The dependent variable is the log of real monthly and hourly gross earnings. *h* indicates that the dependant variable is log of hourly gross earnings and is used for 2001, 2002 and 2003 years when the information on monthly paid hours is available. Monthly gross earnings are defined as monthly gross wage in May plus regular payments and bonuses in May one twelfth of the sum of all other payments and irregular incomes connected to the full-time job paid over the previous year, denoted in HUF and converted to 2003 earnings by the annual consumer price index. The hourly gross earnings are obtained by dividing the monthly gross earnings with monthly hours. The public sector dummy estimates are obtained conditional on worker's labour force experience and its squared term, educational qualification and occupational affiliation (except in 1992) dummies and employer's urban type, region and size dummies. The estimation procedure for the mean regression is OLS. Heteroskedasticity robust standard errors are computed on the basis of White (1980) and reported in the parentheses. Quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles. The estimated standard errors reported in parentheses for the quantile regressions are based on the bootstrapping procedure with 200 replications in all cases. OLS and quantile regression analysis reported used STATA 10.0. ***, **, * denote significance at the 0.01, 0.05 and 0.1 level.

Data Source: The Harmonised Hungarian Wage Survey (WS), 1992-2003

Table A5.7: Estimation of real monthly gross earnings in Hungary for men, 1995-1999

	Mean		10th		25th		50th		75th		90th	
Sector	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Experience	0.031***	0.021***	0.030***	0.017***	0.031***	0.021***	0.032***	0.022***	0.031***	0.021***	0.027***	0.025***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ExperienSq	-0.040***	-0.031***	-0.037***	-0.022***	-0.040***	-0.030***	-0.040***	-0.035***	-0.039***	-0.037***	-0.032***	-0.042***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education												
Unskilled	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Lowskilled	0.079***	0.109***	0.104***	0.108***	0.082***	0.106***	0.075***	0.105***	0.063***	0.114***	0.066***	0.122***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Middleskill	0.180***	0.252***	0.154***	0.200***	0.167***	0.227***	0.180***	0.249***	0.178***	0.277***	0.192***	0.308***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Highskilled	0.391***	0.689***	0.371***	0.464***	0.389***	0.572***	0.385***	0.688***	0.383***	0.808***	0.400***	0.925***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)
Urban type												
Budapest	0.229***	0.099***	0.122***	0.059***	0.160***	0.105***	0.221***	0.114***	0.270***	0.088***	0.341***	0.059***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)
Countycent	0.172***	0.076***	0.065***	0.053***	0.099***	0.082***	0.167***	0.086***	0.234***	0.072***	0.286***	0.053***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.007)	(0.000)	(0.001)
City	0.036***	0.058***	0.014***	0.047***	0.008***	0.062***	0.032***	0.059***	0.042***	0.050***	0.079***	0.038***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Rural	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Firm size												
21-50	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
51-300	0.058***	0.186***	0.030***	0.232***	0.033***	0.233***	0.043***	0.175***	0.064***	0.152***	0.079***	0.127***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
301-1000	0.152***	0.346***	0.110***	0.480***	0.131***	0.424***	0.130***	0.328***	0.159***	0.269***	0.162***	0.217***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
1001-3000	0.045***	0.438***	0.026***	0.587***	0.016***	0.512***	0.026***	0.418***	0.050***	0.366***	0.084***	0.310***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Size> 3000	0.0130***	0.506***	0.084***	0.713***	0.048***	0.608***	-0.005***	0.486***	-0.016***	0.407***	-0.050***	0.334***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Occupation												
Manager	0.827***	0.647***	0.733***	0.544***	0.752***	0.565***	0.788***	0.601***	0.901***	0.682***	0.993***	0.765***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)
Profession	0.354***	0.358***	0.328***	0.394***	0.323***	0.353***	0.333***	0.339***	0.372***	0.338***	0.416***	0.349***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.000)	(0.003)
Technician	0.190***	0.283***	0.141***	0.196***	0.147***	0.267***	0.182***	0.288***	0.215***	0.312***	0.249***	0.347***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)
Clerk	0.004	0.138***	-0.033***	0.108***	-0.013***	0.108***	0.002***	0.107***	0.067***	0.150***	0.038***	0.178***
	(0.003)	(0.003)	(0.001)	(0.004)	(0.002)	(0.002)	(0.000)	(0.002)	(0.002)	(0.003)	(0.000)	(0.004)
Service	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*

Farmer	-0.136***	0.119***	-0.084***	0.061***	-0.117***	0.114***	-0.175***	0.143***	-0.152***	0.115***	-0.089***	0.087***
	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)
Industrial	-0.039***	0.200***	-0.001**	0.178***	-0.029***	0.189***	-0.070***	0.191***	-0.058***	0.193***	-0.020***	0.217***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Operator	0.049***	0.254***	0.062***	0.235***	0.050***	0.255***	0.025***	0.261***	0.026***	0.251***	0.084***	0.250***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Labourer	-0.174***	-0.039***	-0.181***	-0.043***	-0.184***	-0.038***	-0.188***	-0.044***	-0.168***	-0.046***	-0.142***	-0.048***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)
Year												
1995	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
1996	-0.111***	0.034***	-0.103***	0.007***	-0.106***	0.009***	-0.106***	0.020***	-0.114***	0.039***	-0.125***	0.041***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
1997	-0.082***	0.031***	-0.072***	-0.026***	-0.077***	-0.013***	-0.074***	0.015***	-0.077***	0.047***	-0.098***	0.062***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
1998	-0.020***	0.062***	-0.018***	0.004***	-0.028***	0.016***	-0.014***	0.044***	-0.025***	0.080***	-0.027***	0.100***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
1999	0.013***	0.110***	0.012***	0.042***	0.008***	0.065***	0.022***	0.094***	0.010***	0.136***	-0.007***	0.149***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Constant	10.40***	10.42***	10.14***	9.850***	10.27***	10.08***	10.40***	10.42***	10.55***	10.74***	10.73***	11.03***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(00.000)	(0.003)
Observation	56379	272567	56379	272567	56379	272567	56379	272567	56379	272567	56379	272567
Rsq; Pseudo Rsq	0.669	0.445	0.42	0.21	0.44	0.23	0.46	0.26	0.45	0.29	0.42	0.33
Root MSE	0.32	0.45										

Notes to Table A5.7: a) The samples used relate to full time employees, aged between 15 and 64.

b) The dependent variable is the log of real monthly gross earnings. This is defined as monthly gross wage in May plus regular payments and bonuses in May one twelfth of the sum of all other payments and irregular incomes connected to the full-time job paid over the previous year, denoted in HUF and converted to 2003 earnings by the annual consumer price index.

c) The public sector includes budgetary sector and civil servants, judge, prosecutor and public servants. The private sector includes all non-public workers. Each earnings equation includes a full set of regional dummies.

d) The estimation procedure for the mean regression is OLS. The estimated standard errors reported in parentheses are heteroskedasticity robust computed on the basis of White (1980).

e) Quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}). The estimated standard errors reported in parentheses for the quantile regressions are based on the bootstrapping procedure with 200 replications in all cases.

f) OLS and quantile regression analysis reported used STATA 10.0. ***, **, * denote significance at the 0.01, 0.05 and 0.1 level. *f* denotes category omitted in estimation

Data Source: The Harmonised Hungarian Wage Survey (WS), 1995-1999

Table A5.8: Estimation of real monthly gross earnings in Hungary for men, 2001-2003

	Mean		10th		25th		50th		75th		90th	
Sector	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Experience	0.028***	0.016***	0.028***	0.008***	0.027***	0.012***	0.026***	0.016***	0.026***	0.020***	0.025***	0.023***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ExperiencS	-0.037***	-0.027***	-0.036***	-0.010***	-0.034***	-0.017***	-0.033***	-0.027***	-0.033***	-0.035***	-0.032***	-0.043***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education												
Unskilled	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Lowskilled	0.081***	0.096***	0.066***	0.073***	0.066***	0.076***	0.089***	0.087***	0.088***	0.104***	0.081***	0.123***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Middleskill	0.135***	0.228***	0.088***	0.135***	0.092***	0.176***	0.126***	0.218***	0.158***	0.271***	0.185***	0.320***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Highskilled	0.503***	0.704***	0.432***	0.420***	0.495***	0.566***	0.542***	0.707***	0.521***	0.829***	0.530***	0.937***
	(0.003)	(0.002)	(0.001)	(0.002)	(0.000)	(0.002)	(0.001)	(0.001)	(0.000)	(0.002)	(0.000)	(0.002)
Urban type												
Budapest	0.220***	0.074***	0.100***	0.018***	0.135***	0.049***	0.206***	0.070***	0.237***	0.072***	0.269***	0.056***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Countycent	0.120***	0.036***	0.065***	0.030***	0.078***	0.044***	0.121***	0.043***	0.157***	0.028***	0.186***	0.015***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	0.000	(0.001)	(0.000)	(0.001)
City	0.012***	0.023***	0.018***	0.033***	0.001***	0.033***	0.019***	0.025***	0.015***	0.006***	0.035***	-0.013***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Rural	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Firm size												
Size 21-50	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Size 51-300	0.086***	0.210***	0.027***	0.124***	0.058***	0.197***	0.075***	0.224***	0.097***	0.213***	0.117***	0.190***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
S301-1000	0.247***	0.351***	0.113***	0.299***	0.166***	0.370***	0.219***	0.367***	0.270***	0.330***	0.337***	0.272***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
S1001-3000	0.091***	0.447***	0.025***	0.433***	0.058***	0.481***	0.084***	0.454***	0.110***	0.407***	0.137***	0.348***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Size> 3000	0.102***	0.418***	0.119***	0.401***	0.151***	0.446***	0.109***	0.430***	0.067***	0.382***	0.126***	0.305***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.002)
Occupation												
Manager	0.731***	0.749***	0.635***	0.449***	0.655***	0.604***	0.691***	0.740***	0.783***	0.869***	0.850***	0.973***
	(0.004)	(0.002)	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.002)
Profession	0.275***	0.519***	0.303***	0.446***	0.258***	0.511***	0.224***	0.555***	0.273***	0.553***	0.300***	0.537***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.000)	(0.002)	(0.001)	(0.002)	(0.000)	(0.002)	(0.000)	(0.003)
Technician	0.150***	0.390***	0.123***	0.206***	0.175***	0.345***	0.159***	0.418***	0.139***	0.452***	0.131***	0.483***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.002)
Clerk	-0.042***	0.209***	0.018***	0.080***	0.018***	0.139***	-0.038***	0.209***	-0.050***	0.255***	-0.065***	0.311***
	(0.005)	(0.004)	(0.003)	(0.003)	(0.001)	(0.003)	(0.002)	(0.003)	(0.000)	(0.003)	(0.000)	(0.005)
Farmer	-0.167***	0.112***	-0.120***	0.064***	-0.127***	0.101***	-0.160***	0.126***	-0.200***	0.107***	-0.193***	0.090***

	(0.005)	(0.002)	(0.003)	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)	(0.000)	(0.002)	(0.000)	(0.003)
Industrial	-0.125***	0.221***	-0.055***	0.124***	-0.062***	0.178***	-0.115***	0.224***	-0.184***	0.247***	-0.170***	0.264***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.002)
Operator	-0.025***	0.242***	0.005***	0.146***	0.024***	0.206***	-0.022***	0.254***	-0.056***	0.261***	-0.070***	0.280***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.002)
Labourer	-0.209***	-0.007***	-0.144***	0.003**	-0.152***	0.006***	-0.203***	-0.002*	-0.247***	-0.022***	-0.241***	-0.029***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.0001)	(0.002)
Year												
2002	0.123***	0.067***	0.144***	0.106***	0.135***	0.076***	0.134***	0.061***	0.141***	0.048***	0.100***	0.038***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
2003	0.312***	0.122***	0.427***	0.126***	0.382***	0.125***	0.342***	0.125***	0.274***	0.107***	0.198***	0.089***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.00)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Constant	10.54***	10.71***	10.28***	10.40***	10.40***	10.48***	10.53***	10.67***	10.74***	10.95***	10.93***	11.23***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.000)	(0.002)	(0.000)	(0.003)
Observation	30337	162116	30337	162116	30337	162116	30337	162116	30337	162116	30337	162116
Rsq;												
Pseudo Rsq	0.689	0.49	0.43	0.17	0.47	0.23	0.48	0.28	0.48	0.33	0.45	0.39
Root MSE	0.33	0.44										

Notes to Table A5.8 See Notes to Table A5.7

Data Source: The Harmonised Hungarian Wage Survey (WS), 2001-2003

Table A5.9: Estimation of real monthly gross earnings in Hungary for women, 1995-1999

	Mean		10th		25th		50th		75th		90th	
Sector	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Experience	0.030*	0.015***	0.028***	0.015**	0.030*	0.015***	0.031***	0.016***	0.031***	0.016***	0.030*	0.017**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ExperiencS	-0.034**	-0.018**	-0.039**	-0.016***	-0.034**	-0.017***	-0.037***	-0.020*	-0.037**	-0.020*	-0.033**	-0.022**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education												
Unskilled	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Lowskilled	0.115***	0.055***	0.121***	0.067***	0.116***	0.053***	0.111***	0.046***	0.102***	0.053***	0.104***	0.064***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Middleskill	0.215***	0.252***	0.173***	0.195***	0.183***	0.215***	0.202***	0.234***	0.232***	0.261***	0.238***	0.290***
	(0.001)	(0.001)	(0.01)	(0.00)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Highskilled	0.451***	0.720***	0.372***	0.504***	0.389***	0.619***	0.422***	0.739***	0.476***	0.817***	0.513***	0.858***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Urban type												
Budapest	0.220***	0.207***	0.106***	0.177***	0.137***	0.201***	0.190***	0.217***	0.260***	0.212***	0.328***	0.203***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Countycent	0.147***	0.089***	0.055***	0.084***	0.073***	0.091***	0.125***	0.094***	0.185***	0.084***	0.241***	0.059***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
City	0.029***	0.048***	0.026***	0.053***	0.021***	0.049***	0.018***	0.056***	0.029***	0.039***	0.044***	0.017***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Rural	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Firm size												
Size 21-50	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Size 51-300	0.059***	0.109***	0.024***	0.139***	0.032***	0.142***	0.046***	0.109***	0.058***	0.077***	0.079***	0.065***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
S301-1000	0.100***	0.240***	0.048***	0.297***	0.063***	0.296***	0.078***	0.253***	0.087***	0.197***	0.126***	0.158***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
S1001-3000	0.011***	0.326***	0.033***	0.412***	0.028***	0.397***	-0.005***	0.338***	-0.015***	0.271***	-0.002	0.229***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Size> 3000	0.009***	0.327***	0.033***	0.504***	0.033***	0.437***	0.013***	0.340***	-0.016***	0.239***	-0.016***	0.174***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Occupation												
Manager	0.738***	0.695***	0.664***	0.485***	0.670***	0.575***	0.696***	0.657***	0.759***	0.771***	0.902***	0.884***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Profession	0.351***	0.387***	0.359***	0.387***	0.336***	0.392***	0.345***	0.376***	0.351***	0.397***	0.384***	0.424***
	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
Technician	0.269***	0.309***	0.179***	0.238***	0.205***	0.286***	0.292***	0.309***	0.334***	0.328***	0.332***	0.354***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Clerk	0.186***	0.207***	0.122***	0.187***	0.120***	0.206***	0.187***	0.209***	0.239***	0.190***	0.263***	0.178***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)

Service	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Farmer	-0.026***	0.138***	-0.022***	0.009***	-0.107***	0.083***	-0.019***	0.160***	0.022***	0.175***	0.036***	0.140***
	(0.004)	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)	(0.006)	(0.003)
Industrial	0.026***	0.125***	0.028***	0.061***	0.012***	0.110***	0.010***	0.137***	0.047***	0.144***	0.069***	0.132***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)
Operator	-0.085***	0.218***	-0.134***	0.172***	-0.150***	0.198***	-0.215***	0.219***	-0.043***	0.227***	0.034***	0.213***
	(0.001)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)	(0.006)	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)
Labourer	-0.159***	-0.070***	-0.132***	-0.102***	-0.157***	-0.091***	-0.175***	-0.071***	-0.168***	-0.070***	-0.146***	-0.078***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Year												
1995	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
1996	-0.100***	0.023***	-0.105***	-0.002**	-0.103***	0.009***	-0.098***	0.020***	-0.101***	0.027***	-0.089***	0.038***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
1997	-0.061***	0.018***	-0.044***	-0.026***	-0.046***	-0.010***	-0.052***	0.008***	-0.066***	0.028***	-0.060***	0.055***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
1998	-0.012***	0.056***	-0.007***	-0.002**	-0.011***	0.017***	-0.013***	0.044***	-0.014***	0.072***	0.011***	0.105***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
1999	0.007***	0.105***	0.013***	0.045***	0.018***	0.069***	0.012***	0.094***	-0.002***	0.116***	0.010***	0.142***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Constant	10.22***	10.37***	10.04***	9.889***	10.14***	10.08***	10.22***	10.34***	10.34***	10.66***	10.46***	10.94***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
Observation	192128	193762	192128	193762	192128	193762	192128	193762	192128	193762	192128	193762
Rsq;												
Pseudo Rsq	0.629	0.49	0.42	0.23	0.43	0.26	0.42	0.29	0.4	0.32	0.38	0.36
Root MSE	0.29	0.41										

Notes to Table A5.9 See Notes to Table A5.7

Data Source: The Harmonised Hungarian Wage Survey (WS), 1995-1999

Table A5.10: Estimation of real monthly gross earnings in Hungary for women, 2001-2003

Percentile	Mean		10		25		50		75		90	
Sector	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
Experience	0.024***	0.012***	0.027***	0.027***	0.025***	0.022***	0.021***	0.007***	0.008***	0.010***	0.012***	0.014***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ExperiencS	-0.027***	-0.020***	-0.033***	-0.033***	-0.030***	-0.023***	-0.019***	-0.010***	-0.012***	-0.015***	-0.019***	-0.022***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education												
Unskilled	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Lowskilled	0.087***	0.040***	0.076***	0.079***	0.085***	0.087***	0.091***	0.022***	0.034***	0.034***	0.051***	0.080***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Middleskill	0.167***	0.204***	0.121***	0.132***	0.147***	0.179***	0.197***	0.085***	0.136***	0.190***	0.247***	0.284***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)
Highskilled	0.526***	0.699***	0.453***	0.486***	0.508***	0.574***	0.607***	0.370***	0.563***	0.722***	0.814***	0.864***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)	(0.001)	(0.002)	(0.003)
Urban type												
Budapest	0.192***	0.111***	0.081***	0.108***	0.160***	0.236***	0.307***	0.034***	0.062***	0.105***	0.149***	0.139***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Countycenter	0.071***	0.030***	0.020***	0.023***	0.047***	0.094***	0.138***	0.020***	0.019***	0.024***	0.029***	0.035***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
City	0.011***	0.012***	0.016***	0.010***	0.009***	0.006***	0.022***	0.014***	0.011***	0.009***	0.011***	0.017***
	(0.002)	(0.001)	(0.001)	(0.000)	(0.0004)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Rural	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Firm size												
Size 21-50	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
Size 51-300	0.098***	0.143***	0.041***	0.057***	0.075***	0.106***	0.122***	0.106***	0.123***	0.136***	0.131***	0.117***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)
S 301-1000	0.178***	0.248***	0.068***	0.098***	0.142***	0.196***	0.227***	0.202***	0.241***	0.248***	0.226***	0.205***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
S 1001-3000	0.089***	0.280***	0.041***	0.059***	0.070***	0.101***	0.115***	0.241***	0.266***	0.276***	0.265***	0.243***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Size> 3000	0.123***	0.222***	0.067***	0.129***	0.130***	0.116***	0.171***	0.281***	0.272***	0.238***	0.175***	0.110***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Occupation												
Manager	0.667***	0.694***	0.525***	0.558***	0.625***	0.727***	0.809***	0.315***	0.493***	0.647***	0.845***	1.022***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Professional	0.272***	0.520***	0.255***	0.254***	0.266***	0.247***	0.273***	0.435***	0.508***	0.518***	0.581***	0.642***
	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
Technician	0.231***	0.381***	0.137***	0.201***	0.265***	0.266***	0.256***	0.207***	0.320***	0.393***	0.442***	0.482***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Clerk	0.078***	0.225***	0.014***	0.058***	0.086***	0.099***	0.110***	0.109***	0.170***	0.223***	0.260***	0.281***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Service	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*

Farmer	-0.046***	0.152***	-0.010*	-0.020***	-0.005	-0.028***	-0.186***	0.033***	0.084***	0.153***	0.212***	0.192***
	(0.004)	(0.002)	(0.006)	(0.004)	(0.003)	(0.004)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
Industrial	-0.073***	0.118***	-0.053***	-0.074***	-0.071***	-0.072***	-0.104***	0.008***	0.059***	0.114***	0.144***	0.156***
	(0.003)	(0.001)	(0.003)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Operator	-0.184***	0.175***	-0.116***	-0.090***	-0.140***	-0.157***	-0.288***	0.047***	0.112***	0.181***	0.224***	0.224***
	(0.006)	(0.001)	(0.003)	(0.005)	(0.005)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Labourer	-0.142***	-0.040***	-0.100***	-0.100***	-0.128***	-0.162***	-0.189***	-0.075***	-0.055***	-0.036***	-0.025***	-0.033***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Year												
2001	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*	*f*
2002	0.150***	0.073***	0.150***	0.146***	0.144***	0.161***	0.169***	0.132***	0.090***	0.068***	0.049***	0.039***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
2003	0.348***	0.106***	0.426***	0.406***	0.368***	0.328***	0.273***	0.143***	0.111***	0.101***	0.088***	0.072***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	10.40***	10.73***	10.21***	10.29***	10.41***	10.55***	10.69***	10.49***	10.59***	10.74***	10.93***	11.16***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Observations	106084	115939	106084	115939	106084	115939	106084	115939	106084	115939	106084	115939
Rsq;												
Pseudo Rsq	0.655	0.518	0.43	0.17	0.45	0.24	0.45	0.31	0.44	0.37	0.43	0.36
Root MSE	0.29	0.39										

Notes to Table A5.10 See Notes to Table A5.7 *Data Source:* The Harmonised Hungarian Wage Survey (WS), 2001-2003

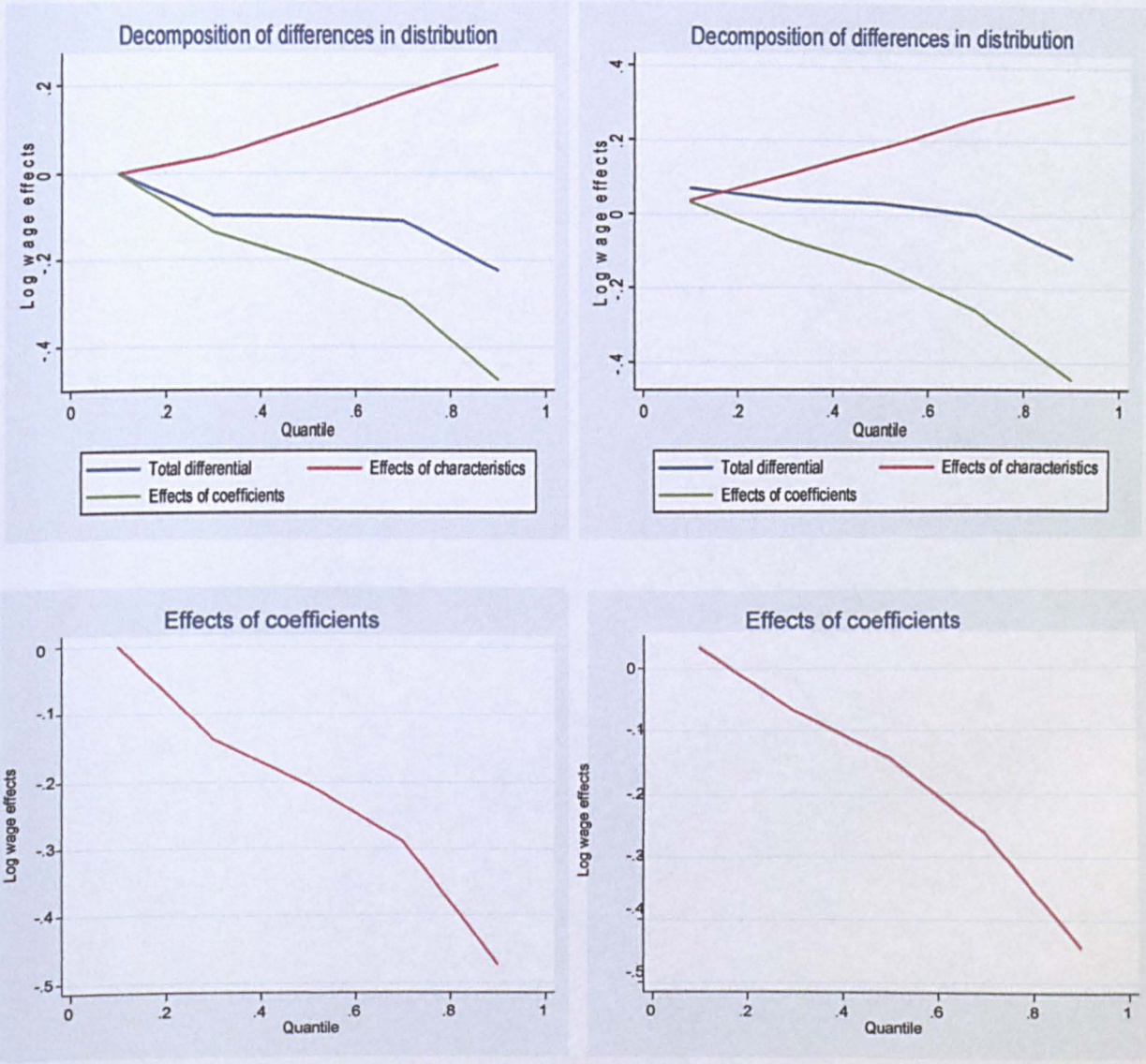
Table A5.11: Decomposition of public-private sector earnings differential at different quantiles for men and women in Hungary

	1995-1999				2001-2003			
	Men		Women		Men		Women	
Percentile:	Total differential	Effects of Coefficients	Total differential	Effects of Coefficients	Total differential	Effects of Coefficients	Total differential	Effects of Coefficients
10th	0.000	-0.001	0.072***	0.034***	0.141***	-0.002**	0.129***	0.046***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.005)	(0.001)	(0.001)	(0.000)
30th	-0.097***	-0.136***	0.038***	-0.069***	0.188***	-0.054***	0.212***	-0.012***
	(0.001)	(0.000)	(0.003)	(0.001)	(0.006)	(0.001)	(0.000)	(0.002)
50th	-0.098***	-0.204***	0.033***	-0.143***	0.233***	-0.160***	0.235***	-0.122***
	(0.001)	(0.000)	(0.004)	(0.001)	(0.005)	(0.000)	(0.001)	(0.004)
70th	-0.109***	-0.289***	0.000	-0.261***	0.257***	-0.273***	0.203***	-0.256***
	(0.001)	(0.000)	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)
90th	-0.225***	-0.472***	-0.117***	-0.443***	0.176***	-0.406***	0.039***	-0.439***
	(0.002)	(0.001)	(0.004)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)

Notes to Table A5.11: See Notes to Figures A5.1 and A5.2. *Data Source:* The Harmonised Hungarian Wage Survey (WS), 1995-2003

Figure A5.1: Decomposition of public-private sector earnings differential at different quantiles for men and women in Hungary, 1995-1999

Men **Women**



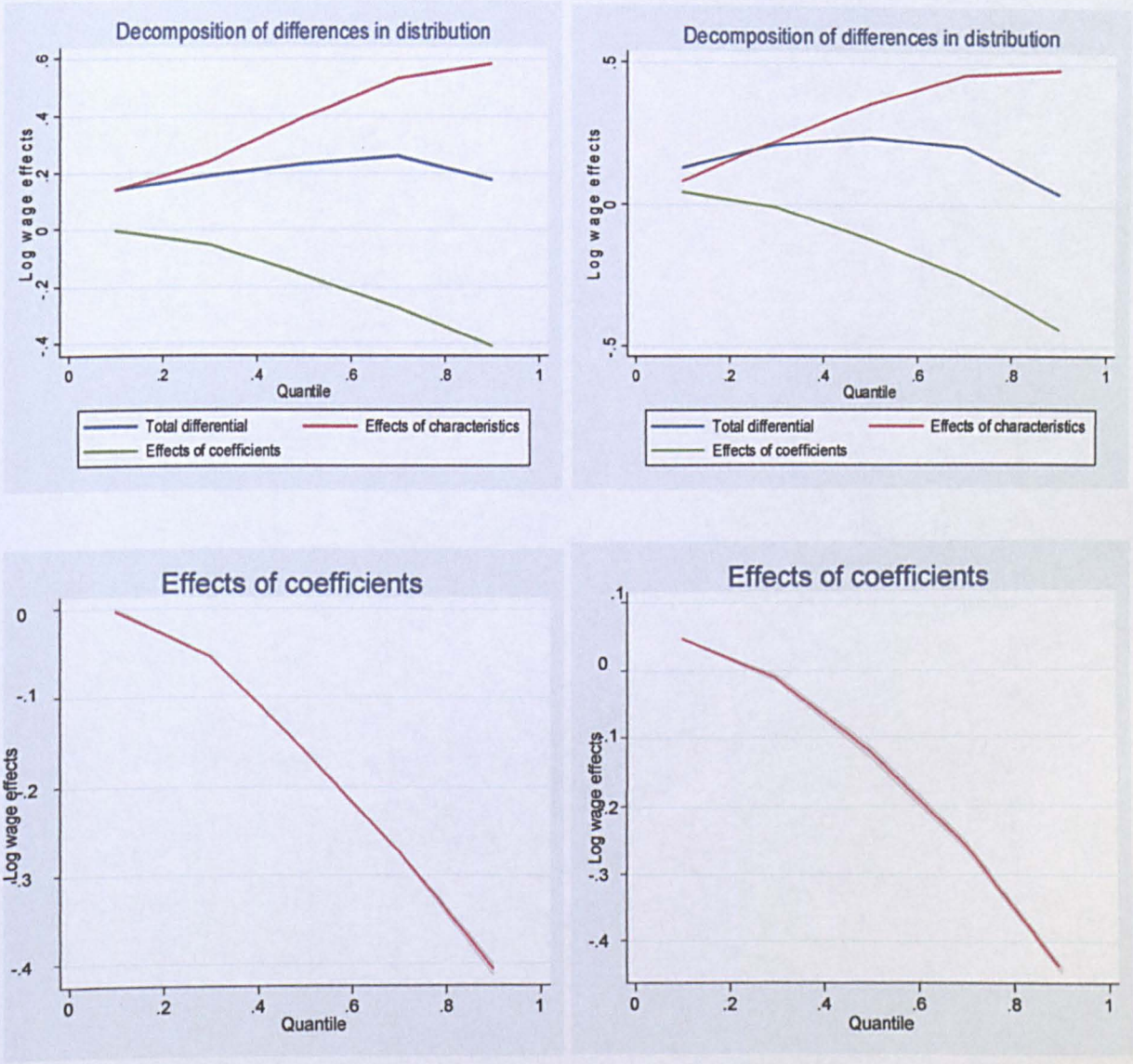
Notes to Figure A5.1: a) The samples used relate to full time male and female employees, aged between 15 and 64. The depended variable is the log of real monthly gross earnings. Monthly gross earnings are defined as monthly gross wage in May plus bonuses and plus regular premia and bonuses in May plus one twelfth of the sum of all other payments and irregular incomes connected to the full-time job paid over the previous year, denoted in HUF and converted to 2003 earnings by the annual consumer price index.

b) Decomposition estimation procedure implemented by estimating 100 traditional quantile regressions in each sector accounting for worker's labour force experience, its quadratic form, educational qualification, occupational affiliation and employer's urban type, region and size and year. The variance has been estimated by bootstrapping the results 100 times. Effects of coefficients presented with 95% confidence interval.

Data Source: The Harmonised Hungarian Wage Survey (WS), 1995-1999

Figure A5.2: Decomposition of public-private sector earnings differential at different quantiles for men and women in Hungary, 2001-2003

Men **Women**



Notes to Figure A5.2: See Notes to Figure A5.1.
Data Source: The Harmonised Hungarian Wage Survey (WS), 2001-2003

A5.12: OLS and Quantile Regression Estimates of Public Sector Pay premia and penalties, by Highest Educational Qualification and Gender

	Men				Women			
	Monthly Gross Earnings			Hourly	Monthly Gross Earnings			Hourly
	1992-1999 (1)	2001-2003 (2)	Change (3)=(1)-(2)	2001-2003 (4)	1992-1999 (5)	2001-2003 (6)	Change (7)=(5)-(6)	2001-2003 (8)
Unskilled								
Mean	-0.146***	-0.059***	*-0.087*	-0.047***	-0.145***	-0.022***	*-0.123*	0.002**
	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)		(0.001)
10th	0.025***	0.064***	*-0.039*	0.071***	0.066***	0.081***	*-0.015*	0.100***
	(0.001)	(0.001)		(0.001)	(0.001)	(0.000)		(0.00
25th	-0.089***	0.028***	*-0.061*	0.034***	-0.071***	0.062***	*-0.134*	0.078***
	(0.001)	(0.002)		(0.001)	(0.001)	(0.001)		(0.001)
50th	-0.169***	-0.061***	*-0.108*	-0.041***	-0.195***	-0.035***	*-0.160*	-0.013***
	(0.001)	(0.001)		(0.002)	(0.001)	(0.001)		(0.001)
75th	-0.235***	-0.132***	*-0.103*	-0.114***	-0.244***	-0.084***	*-0.160*	-0.060***
	(0.001)	(0.002)		(0.002)	(0.001)	(0.001)		(0.001)
90th	-0.277***	-0.165***	*-0.112*	-0.144***	-0.252***	-0.118***	*-0.134*	-0.090***
	(0.001)	(0.003)		(0.002)	(0.001)	(0.001)		(0.001)
Skilled								
Mean	-0.167***	-0.100***	*-0.067*	-0.086***	-0.057***	0.013***	*-0.070*	0.0290***
	(0.001)	(0.001)		(0.001)	(0.000)	(0.001)		(0.001)
10th	0.025***	0.073***	*-0.048*	0.087***	0.120***	0.145***	*-0.025*	0.158***
	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)		(0.000)
25th	-0.123***	-0.012***	*-0.111*	0.003***	0.007***	0.111***	*-0.104*	0.132***
	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)		(0.001)
50th	-0.228***	-0.107***	*-0.121*	-0.093***	-0.057***	0.047***	*-0.104*	0.064***
	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)		(0.001)
75th	-0.254***	-0.215***	*-0.039*	-0.200***	-0.120***	-0.052***	*-0.068*	-0.037***
	(0.001)	(0.002)		(0.002)	(0.000)	(0.001)		(0.001)
90th	-0.265***	-0.269***	*0.004*	-0.255***	-0.206***	-0.160***	*-0.046*	-0.151***
	(0.001)	(0.002)		(0.002)	(0.001)	(0.001)		(0.001)
High-skilled								
Mean	-0.338***	-0.293***	*-0.045*	-0.299***	-0.439***	-0.362***	*-0.077*	-0.362***
	(0.001)	(0.002)		(0.002)	(0.001)	(0.002)		(0.002)
10th	-0.014***	0.152***	*-0.166*	0.152***	-0.046***	0.119***	*-0.165*	0.126***
	(0.001)	(0.002)		(0.002)	(0.001)	(0.001)		(0.001)
25th	-0.209***	-0.149***	*-0.060*	-0.157***	-0.311***	-0.204***	*-0.107*	-0.197***
	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)		(0.001)
50th	-0.372***	-0.362***	*-0.010*	-0.377***	-0.512***	-0.449***	*-0.063*	-0.462***
	(0.001)	(0.002)		(0.001)	(0.001)	(0.001)		(0.001)
75th	-0.533***	-0.500***	*-0.033*	-0.506***	-0.669***	-0.566***	*-0.103*	-0.575***
	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)		(0.001)
90th	-0.614***	-0.605***	*-0.009*	-0.597***	-0.715***	-0.655***	*-0.060*	-0.649***
	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)		(0.002)

Notes to Table A5.12:

a) The samples used relate to full time employees, aged between 15 and 64. The dependent variable is the log of real monthly and hourly gross earnings.

c) The unskilled group includes workers with primary educational qualification or less. The skilled group includes workers with both vocational (low skilled) and high school degree (middle skilled). The high-skilled group includes workers with university degree.

d) Public sector pay gap estimates obtained conditional on labour force experience and its quadratic form and a set of employer's urban type, region and year dummies. The estimation procedure for the mean regression is OLS and robust standard errors reported in the parentheses are computed on the basis of White (1980). *** denotes significance at the 0.01 level. Quantile regression procedures are used to obtain the coefficient estimates for the selected percentiles: 10th, 25th, 50th, 75th and 90th percentiles of the log earnings distribution. The estimated standard errors reported in parentheses for the quantile regressions are based on the bootstrapping procedure with 200 replications in all cases. OLS and quantile regression analysis reported used STATA 10.0.

Data Source: The Harmonised Hungarian Wage Survey (WS), 1992-1999 and 2001-2003

Chapter 6

6 Conclusions

6.1 Introduction

This thesis has examined the effects of public sector restructuring by means of wholesale privatisations on the labour market in transition economies with a particular focus on Serbia and Hungary. The purpose of the thesis was to analyse the implications of different pay-setting arrangements between the private and public sectors on pay inequality. Labour market changes that took place during the economic transition in Eastern Europe seem to be a proper case study for this kind of research. This period was characterised by labour market conversion from public sector ownership domination to competitive market structure due to the wholesale privatisation of public sector activities.

This thesis first set a theoretical framework to explain trends in pay inequality both within sectors and between the public and private sector. Empirically this thesis examined how individual groups of workers in the public sector have fared during the process of public sector restructuring in the context of the Serbian and Hungarian experience. This chapter summarises the key findings and merits of the thesis on each of these topics.

6.2 A Public Sector Monopsony Model

Chapter Three developed a theoretical framework to explain differences in pay-setting arrangements across the public sector and the emerging private sector during the process of economic transition. The chapter showed that a rationale for the public sector paying more equal wages to workers of differing productivity is that it was exploiting monopsony power rather than an 'egalitarian' wage policy as such. The former is more likely given the empirical evidence which showed the negative public sector pay gap across the whole earnings distribution. The main arguments are as follows.

Since the public sector was the dominant purchaser of labour in the pre-transition time it had some monopsony power, which could be exploited according to the varying elasticities of supply of different types of workers. However, unlike in the private sector monopsony model, the public sector's objective function was not to maximise profit but to hire labour until its available budget is exhausted, assuming each sector faced a hard budget constraint. Hence, it was assumed that during pre-transition the objection function of the public sector was output maximisation subject to a budget constraint. This is equivalent to maximising total output where profit (or surplus) is zero.

Given this context, the restructuring associated with transition took place against a background of a decline in public sector labour market monopsony power. Unlike under the public sector dominance, economic transition meant that although the government might initially continue to impose restrictions on pay, workers could opt to change the sector of employment as there was a private sector job alternative.

It is important to acknowledge that incremental pay structure explained by the bureaucratic model also implies wage compression. But the bureaucratic model does not necessarily predicts the same implications about the negative sign of the public-private sector pay gap as public sector monopsony model. The monopsony model presented in this chapter aimed to explain primarily the public sector pay compression as a result of 'exploitation' rather than the outcome of the government redistribution efforts or ideology. The model derived, therefore, demonstrated that the increase in the wage inequality associated with economic transition may be considered as effect of decline in public sector monopsony power rather than simply the erosion of an 'egalitarian' wage policy.

In particular, the chapter suggested that the differential elasticities of labour supply of skilled and unskilled workers as indicated by other studies on the supply of labour might be important for understanding public sector wage compression. The chapter argued that these factors are connected: low productivity workers have a more elastic supply and therefore, the ability of the public sector to exploit its monopsony power is less for low productivity (i.e. unskilled) workers than for high productivity (i.e. skilled) workers. The chapter showed that public sector monopsony model implies different result than private sector monopsony model. In particular, whereas private monopsony decreases both wages and employment, the public monopsony faces a trade-off between wages and employment (i.e. decreases wages and increases employment).

Based on these arguments, first, the chapter showed that the relative wage of skilled workers obtained under monopsony solution is lower than under competitive solution (i.e. more compressed pay structure); second, that the relative employment of skilled workers under monopsony solution was greater than under competitive solution (i.e. 'over-employment'); and third, that a decline in the relative public sector monopsony power over skilled workers implied a decline in the relative employment and an increase in the relative wage of skilled workers in the public sector.

All this was consistent with the qualitative and quantitative evidence on pay-empoyment determination in transition economies. A final suggestion of the model where transition implies an erosion in the differential monopsony power of the state is that earnings inequality in the competitive private sector would be greater than in the public sector but this differential would decline over the course of economic transition. This is consistent with the empirical evidence surveyed in the literature review. Finally, this is found consistent with the evidence presented in subsequent empirical chapters which considered the evolution of public-private sector wage differentials at greater length.

6.3 Public-Private Sector Pay Differentials in Serbia

The first empirical chapter estimated public-private sector earnings differentials during the economic transition in Serbia, from 1995 until 2008. The privatisation process during 1990s was mainly directed towards local investors and ownership transfers by enterprises

were voluntary. Hence, the private sector mainly consisted of a large number of small (in terms of employment) newly established firms. These firms had been emerging in a 'spontaneous' manner in small but profitable segments of a market (such as trade, services and processing industry) and determined wages by free market forces. Systematic economic reforms and large-scale privatisation programs were launched from 2001. The concept of privatisation changed radically from the insider's model to commercial sales.

Given the different stages of economic transition as well as due to the break in Labour Force Survey (LFS) methodology in 2004 the empirical analysis in the chapter was based on annual estimates whereas the pooled estimates are obtained for the 1995-2003 and the 2004-2008 periods separately. These periods also correlate with a change in sign of the estimated public sector pay gap which we argue was caused mainly by large-scale privatisation. The Living Standard Measurement Survey (LSMS) data is used as an additional source of individual level data for 2002 and 2003 to show changes in the public sector pay gap relative to 2004-2008. Finally, administrative data from official statistics is explored as a third source of data. This dataset is only used for the purpose of instrumental variable creation which corrects for measurement error in public sector status arising from the large-scale privatisations during the 2004-2008 period.

The chapter presented the public sector pay effects based on four analyses. First, the cross-sectional differences in earnings between the public and private sectors are estimated by OLS using a 'dummy variable' approach. Second, the same estimation procedures are applied at the selected percentiles of the earnings distribution by using the bootstrapped quantile regressions. In addition, earnings equations are estimated for public and private sectors separately. Third, the differences in distributions are decomposed into a part explained by differences in characteristics and into a part explained by differences in returns to characteristics. Four, instrumental variable (IV) procedures are applied to estimate average public sector pay effects which are robust to measurement error. For this purpose, an instrument constructed from an employer-provided aggregated data is matched into a self-reported individual level data. The instrument was based on the changes in the proportions among industry branches in the public sector. The chapter argued that these changes were caused mainly by privatisation. The public sector pay effects are then estimated for groups of

workers according to their educational qualification by using two stage least squares (2SLS) and treatment effects instrumental variable procedures. The main results of interest are as follows.

Conditional annual OLS estimates showed that increasing public sector penalties during the 1990s came down to zero by 2003. From 2004, the average sector pay gap translated into a significant and increasing public sector premia for both men and women. Hence, if the results are interpreted in terms of changes in the public sector wage determination, the chapter revealed a noteworthy improvement in the financial position of public sector workers once the systematic economic reforms and large-scale privatisation started.

Similar to the mean, annual quantile regression estimates proved sensitive to stages of the economic transition. The sign of the public sector pay gap at most of the percentiles was negative until 2003 and positive afterwards. Moreover, quantile regressions revealed that the public sector pay gap was related to a worker's position in the earnings distribution. In particular, conditional estimates across the pay distribution disclosed that public sector workers at the upper-end of the earnings distribution relative to their private sector counterparts tended to lose more during 1995-2003 and to gain less during the 2004-2008 period. Therefore, quantile regression estimates suggested a compression of the conditional public sector earnings distribution in both periods.

Estimates from 1995 until 2003 complemented an earlier research on public-private sector earnings differentials in Serbia. In particular, Reilly (2003) used the OLS and quantile regression methods on the same data sets but from 1995 until 2000 for male employees, aged between 18 and 64. Our replication indicated a possible measurement error in that study in relation to the definition of the hourly wage, thereby biasing the estimates of the conditional public sector wage gap. In particular, our estimator obtained by using a total pay compensation (regular wage plus non-wage benefits) is found to be lower by 14% on average. This fits broadly with the difference in the non-wage benefits share in total remuneration between the public and private sectors.

Furthermore, the chapter applied a decomposition of differences across the earnings distribution. Removing differences in characteristics, the results from the decompositions

reinforced the previous finding that public sector workers received statistically significantly: lower earnings during 1995-2003 period and higher earnings during 2004-2008 period than workers in the private sector. Moreover, the estimated differences in returns to characteristics interpreted as the public sector pay effects indicated an increase in a public sector pay penalty with a higher percentile during 1995-2003 and a decrease in a public sector pay premium with a higher percentile during the 2004-2008 period.

Finally, the chapter proposed an instrument for public sector status estimation in the case of measurement error. Given that the large-scale privatisations imply sectoral changes of jobs when people actually do not move jobs the measurement error in self-reported public sector status may loom large. The chapter argued that changes in the proportions among industry branches in the public sector are good indicator of the public sector status since these changes were caused mainly by privatisation. Since this instrument was constructed from an employer-provided aggregated data and matched into a self-reported individual level data the 'noise' should be orthogonal to the difference between reported and actual public sector status. Moreover, the proposed instrument is also suitable to control for endogeneity in the public sector status arising from the large-scale privatisations given that changes in the proportions among industry branches in the public sector capture the effect of privatisation.

The chapter applied the IV procedures on groups of workers according to their educational qualification and gender. The public sector pay gap estimated by both 2SLS and treatment effects indicated that OLS estimates obtained for the period of large-scale privatisations (i.e. 2004-2008 period) may be biased towards zero and that the public sector pay gap declines with the higher educational qualification. If the results are interpreted in the context of measurement error both IV methods indicated that the classical errors-in-variables (CEV) assumption holds. In addition, if the results are interpreted in the context of endogeneity both IV methods indicated that workers in the public sector have lower unobserved earning potential than workers in the private sector.

At the conclusion, drawbacks to the analysis of this chapter that are due to data availability should be acknowledged. Firstly, the self-reported datasets do not contain instruments that would provide rational exclusion restrictions when identifying the individual worker's sector choice. It is acknowledged that correcting for workers' non-random selection

is important, but is only useful when meaningful instrumental variables that affect the sector selection but can be excluded from the wage equation are available. Furthermore in this context, Jovanović and Lokshin (2003) tested a number of potential instruments from Serbian LFS data and found them insignificantly different from zero in the selection equation. Finally, a variable which they used to correct for self-selection was a number of jobholders in the household. This variable had a significant effect on sector choice of females but not of males. We argue that the number of jobholders in the household may pick up partially a tendency towards job security and associated benefits during the early stages of transition but these were not likely to be decisive during the major period of large-scale privatisations of the public sector.

Secondly, the earnings are available only net of taxes and other contributions. Hence, the estimated public sector pay gap does not account for differences in pension and health insurance contributions between sectors.

6.4 Public-Private Sector Pay Differentials in Hungary

The second empirical chapter estimated public-private sector earnings differentials during the economic transition in Hungary, from 1992 until 2003. In contrast to Serbia, Hungary has been considered as one of the most successful countries in economic transition. The organised process of privatising state enterprises started in 1991 and was mainly based on competitive tenders opened to foreign participation. The method of case-by-case privatisation although gradual, was completed earlier than in most other Eastern European countries. Hungary joined the EU in 2004.

There are two distinct periods during the Hungarian economic transition which affected the public-private sector earnings differentials. In particular, during the 1990s the public sector earnings lagged behind the private sector earnings. In order to combat losses of highly skilled labour in the public sector due to the private sector selection the government increased nominally public sector wages by 50% on average between September 2002 and 2003. In addition, the level of minimum wage increased in 2001 by 57% and in 2002 by 25%.

The chapter illuminated changes in the public sector earnings inequality relative to the private sector based on employer-provided microdata from the Harmonised Hungarian Wage

Survey (WS). The data that relate to the period considered represent large cross-sections of around 150,000 observations per each year. The cross-sectional differences between public and private sectors are initially estimated by OLS and quantile regressions using a 'dummy variable' approach. The same estimation methods are also used to estimate earnings in public and private sectors separately. In addition, a method of decompositions of differences in distributions is applied. At the final point of analysis the public sector pay effects across groups differentiated by educational qualifications attained are estimated. The results of the chapter are summarised as follows.

The chapter demonstrated statistically significant public sector pay penalties during economic transition in Hungary. In particular, annual conditional estimates showed that the gap was negative during most of the period of economic transition in Hungary but grew to zero by the end of the period reviewed in this chapter. The results from quantile regressions verified that the public sector pay distribution was more compressed than that of the private sector. Workers at and above the median fared statistically significantly worse having a public sector status even by the end of the period considered.

Furthermore, the evolution of the public sector earnings distribution relative to the private sector is analysed for two distinct periods, pre-2000 and post-2000. This distinction is based on wage reforms initiated in the early 2000s. The pooled quantile regressions suggested that: (1) the public-private sector pay differential was greater for workers at higher percentiles for both men and women during both periods of economic transition; (2) the gap was higher for men than for women during both periods of economic transition; (3) the gap declined from earlier to later period of economic transition. Moreover, removing differences in characteristics, the decomposition results reinforced the previous finding that the earnings distribution was more compressed in the public than in the private sector. This difference in distributions declined in the second relative to the first period reviewed.

Finally, the quantile regression estimates for each group defined according to highest educational qualification confirmed that the public sector compressed the pay in two dimensions: by reducing between-group inequality and by reducing within-group inequality. Both public sector inequality-reducing features were especially pronounced among high-skilled workers.

A disproportionately larger public sector pay penalty for Hungarian university graduates than for other educational groups is consistent with the results reported by Hámori (2007) which used the same dataset for full-time male employees. Although the pay gap declined during 2001-2003 (i.e. the period of public sector wage reforms), the pay inequality reducing effect for graduates remained. If the estimates are compared to the international evidence, for example with estimates for UK graduates in Disney and Gosling (1998), the public sector pay compression was found to be three times greater for Hungarian graduates than it was for UK graduates.

There are several advantages of the data used in this chapter. Firstly, the data is provided by employers. Hence there is less measurement error in the public sector status. Secondly, the information on gross earnings is provided. Hence, the estimated sector pay gap accounts for the differences in social contributions for health and pensions between sectors. Thirdly, large cross-sections (about 150,000 observations per year) contain rich data on worker's and job characteristics on which the estimated sectoral gap is conditioned.

However, there are two main data limitations. First, employer supplied data does not contain the instruments to control for differences in workers' unobserved heterogeneity between sectors. Moreover, the public sector includes only budgetary institutions and hence, unlike in the chapter 4, we were not able to use changes in the proportions of industry branches or occupations within public sector caused by large-scale privatisations as an instrument. However, we can refer to the conclusions of the chapter 4 which suggested that the public sector workers are more likely to have lower unobserved earning potentials than private sector workers. Second, the sample relates to private sector employers with more than 20 employees. Therefore, both data limitations tend to over-estimate the public sector pay penalty.

6.5 Concluding Remarks

Despite the data limitations outlined in the previous section economic transition represents a fruitful case-study of the evolution of the wage structures between the private and public sectors. The two countries considered in this thesis differed significantly in speed and type of the privatisation process. Hungary has been considered as one of the most successful

countries in transition to a market economy. On the other hand Serbia was one of the very last countries of Eastern Europe to initiate a process of economic transition.

However, a unified story consistent with the predictions of the theoretical model derived in this thesis can be drawn from both countries. In particular, the public sector monopsony model presented in the chapter 3 suggested that the earnings distribution is expected to be more compressed in the public sector than in the private sector given that the public sector exerts greater power over skilled than over unskilled workers. In addition, the public sector pay gap is expected to be negative initially but to close down due to decline in the public sector monopsony power over the period.

Indeed, the public sector pay penalty in both countries considered in this thesis had been found first to increase and later to close down. Moreover, in both countries the public sector was found to compress the pay relative to the private sector. It is important to note that the public sector pay compression estimated in both transition economies has been found greater than in any other developed market economy (as given by the empirical literature review at the beginning of the thesis).

The data available for Serbia showed that the decline in the public sector pay penalty was correlated to the size of the public sector in terms of employment. We argued that the public sector pay penalty transferred into a premium as a result of large-scale privatisations. The data available for Hungary allowed consistent analysis over the whole period of economic transition. The estimates showed that the unskilled workers were more similar in terms of pay between sectors than the skilled workers. In addition, the public sector pay compression has been found to increase with the skill level. Therefore, the empirical results in this thesis verified two main characteristics of the public sector explained by the theoretical model: greater wage equality than in the private sector and differential monopsony power over skilled and unskilled workers.

6.6 Future Research

At the conclusion of this thesis topics for further research are suggested. This thesis has suggested three areas for further work. Firstly, on the elasticity of labour supply. The comprehensive surveys of the labour supply literature, such as Boal and Ransom's (1997) and

Bashkar, Manning and To's (2002) reveal a great deal of uncertainty in the estimates of the relevant elasticities. This is in part because the literature considers different approaches to measure the market power of employer, different time horizons (short and long run) as well as different types of workers. However, no attempts have been made so far to estimate the elasticity of labour supply in transition economies. This was largely due to data limitations, but future researchers may have access to suitable data. Secondly, this thesis has suggested several drawbacks for precise estimation of public-private sector pay differentials during economic transition. One of the most important relates to a lack of good instruments to control for unobserved worker characteristics (e.g. risk aversion, ability) which may be decisive for a worker's sector choice. In this context, comparison of the results obtained by using the empirical methods in this thesis with panel data estimates would be useful. The literature on public-private pay differential will also benefit from data that are able to provide evidence based on 'treatments'. For this purpose, the case studies of privatisations of certain industry branches or occupations would be the most appropriate. Finally, it will be interesting to pursue a similar research jointly with other transition economies in order to disclose comprehensively the relationship between the post-transition process and the public-private sector pay differentials. The European Union Statistics on Income and Living Conditions (EU-SILC) set to collect timely and comparable cross-sectional and longitudinal multidimensional microdata offers a promising venue for this type of future research.

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