Empirical Economics (2005) 30:505–520
DOI 10.1007/s00181-005-0251-y

EMPIRICAL
ECONOMICS

Public-private sector wage differentials in Germany: Evidence from quantile regression

Blaise Melly

Swiss Institute for International Economics and Applied Economic Research (SIAW), University of St. Gallen, Bodaustraßes, 9000 St. Gallen, Switzerland (e-mail: blaise.melly@unisg.ch)

First version received: April 2002/Final version received: June 2004

Abstract. This paper measures and decomposes the differences in earnings distributions between public sector and private sector employees in Germany for the years 1984–2001. Oaxaca decomposition results suggest that conditional wages are higher in the public sector for women but lower for men. Using the quantile regression decomposition technique proposed by Machado and Mata (2004), we find that the conditional distribution of wages is more compressed in the public sector. At the low end of wages, differences in characteristics explain less than the raw wage gap when it is the opposite at high wages. Separate analyses by work experience and educational groups reveal that the most experienced employees and those with basic schooling do best in the public sector. All these results are stable over the 80s and 90s.

Key words: Quantile regression, public-private wage differential, Germany

JEL classification: J3, J45

1. Introduction

Public sector pay has always attracted policy attention. Obviously the size of the public sector wage bill has implications for both monetary and fiscal policy. The government remains by far the largest employer in Germany. In 2001, 13.1% of the labor force or 4.82 million people received their wage or

I thank Michael Lechner and the Centre for European Economic Research (ZEW), Mannheim, for letting me work with the full sample of the German Socio-Economic Panel (GSOEP). I am grateful to an anonymous referee and particularly to the editor, Bernd Fitzenberger, for providing me detail comments and suggestions that have significantly improved the paper. I have also benefited from discussions with Michael Lechner and Ruth Miquel.

salary from the public sector (Federal Statistical Office 2002). Furthermore, the wage settlements in the public sector could have a substantial impact on those in the private sector. Because of this spillover effect, the existence of a public sector wage gap may induce private sector employers to pay higher wages to their employees. The concern is that such general wage increases can jeopardize competitiveness in the global economy and further fuel inflation.

There are a number of reasons that earnings differentials between the private and the public sector could exist. The public sector is subject to political constraints and not to profit constraints. In a perfectly competitive market, employers that pursue other goals than competitiveness, such as discriminating employers, will be driven out of the marketplace over the long run (Becker 1957). On the contrary, the political system may have different objectives from those of the private sector. Issues of pay equity and fairness can survive in the political market place more than in the economic market place. Governments are also under pressure to be a model employer and not pay low wages to its less skilled workforce. Similarly, voters seem to refuse that high-level officials receive comparable remuneration to the high salaries of the private sector. Nevertheless, the pursuit of theses equity goals could have a serious impact on the efficiency of the labor market. If the government pays too much, employees in the private sector may decide to queue for relatively high-paying jobs in the public sector. Moreover, this policy leads to higher taxes or budget deficits. If the public sector pays wages that are too low, it will not find skilled and loyal employees. The consequences will be public services of poor quality.

Given these differences in the wage setting procedures and the possible consequences for the labor market, many researchers have sought to ascertain whether an identical employee working in the same job in the public and in the private sector would earn the same or a different amount. Early research comparing the earnings of public sector employees has been undertaken in the United States by Smith (1976 and 1977). She found that rates of pay were higher for public sector than private sector employees and that the earnings premium was larger for female than for male public sector employees. Subsequent research has taken up the same question as Smith and confirmed her findings. Ehrenberg and Schwarz (1986) and Gregory and Borland (1999) have surveyed this voluminous literature. Such wage comparisons using German data are not as numerous. Dustmann and Van Soest (1997) used data from the German Socio-Economic Panel for the years 1984–1993 to analyze developments and differences in public and private sector wage distributions. They found that conditional on education, marital status and age wages are higher in the private sector for males but higher in the public sector for females. Dustmann and Van Soest (1998) estimated switching regression models for males and models that endogenize education. Their later results are stronger than the results that they reported in 1997.

Poterba and Rueben (1995) were the first to apply quantile regression to study public-private wage differentials. This is a natural arena for quantile regression, since there is a suspicion that the public sector compresses the distribution of earnings of employees who work in that sector relative to private sector employees. Therefore, the least squares estimate of the mean public sector wage premium gives an incomplete picture of the conditional distribution. Evidence of this effect is available for Canada (Mueller 1998), UK (Disney and Gosling 1998) and Zambia (Nielsen and Rosholm 2001).

Quantile regression has apparently not yet been applied to study the wage structure in the private and public sectors in Germany. This is the object of this paper.

Section 2 describes the data set along with some descriptive statistics. In Sect. 3, the quantile regression decomposition technique proposed by Machado and Mata (2004) is presented. The next section is dedicated to the empirical results for the year 2001. Section 5 shows how the decomposition results have evolved from 1984 to 2001. Finally Sect 6 gives some concluding remarks.

2. Data description

The analysis in this paper draws on data from the German Socio-Economic Panel (GSOEP)[1]. In this and the fourth section, we focus on the year 2001. In Sect. 5 we analyze the evolution from 1984 to 2001. After the reunification, the panel was extended to include the eastern part of Germany, but we focus here on West Germany only because undeniable economic differences subsist between East and West Germany. Since many public sector jobs are not open to foreign nationals, the analysis is based on the subsample of Germans only. Furthermore, the sample is restricted to include those who were between 18 and 65 years old and were in full-time or part-time employment. Finally, all observations with a missing value for one of the variables have been excluded. The final data set has 4770 observations.

As the sample includes only wage earners, the results must be interpreted conditional on the selected sample. Issues of sample selection bias and the potential problem of endogeneity of sector choice and education are considered outside the scope of the present paper, which concentrates on distributional aspects. This is, of course, a more descriptive approach and some caution must be exercised in interpreting the results.

Table A.1 in Appendix describes the variables we use for our descriptive analyses and in the decompositions. Table A.2 presents descriptive statistics for male and female public and private sector employees. Means of relevant variables show that average hourly earnings are higher in the public sector than in the private sector. They also show that public sector employees are, on average, better educated than private sector employees. For instance, 18% of the employees in the public sector have achieved a university degree (*Ed level 6*), while they are only 8% in the private sector. Public sector employees have acquired more labor market experience and tenure, too. These differences in work experience, education and tenure may explain the higher average wages of public sector employees. Another cause of the disparity between average compensation in the public and the private sectors may be the greater concentration of professionals and technicians in the public sector.

A first visual summary of the public and private sector wage distributions is provided in Fig 1. The density functions were estimated using an Epanechnikov kernel estimator. It can be seen from these figures that the distributions are quite distinct between sectors. For both genders, the public

[1] For an English language description of the GSOEP see SOEP Group (2001).

Table 1. Decomposition of the public/private sector wage differential

	Mean	$\theta = 0.10$	$\theta = 0.25$	$\theta = 0.50$	$\theta = 0.75$	$\theta = 0.90$
Men						
Differences in ln(wage)	11.2	30.0	14.4	7.9	2.5	0.0
Price differential	−6.9 (−10.0, −3.6)	5.0 (−5.0, 10.9)	1.3 (−5.0, 4.9)	−6.1 (−11.6, −3.3)	−13.0 (−18.8, −8.7)	−17.4 (−25.5, −10.6)
Char. differential	18.1 (14.4, 22.0)	26.5 (18.1, 35.5)	13.1 9.7, 18.6	14.3 (10.4, 18.0)	15.1 (11.6, 18.8)	15.8 (10.3, 18.7)
Residuals		−1.5 (−8.0, 8.4)	0 −3.7, 4.0	−0.2 (−1.9, 3.4)	0.4 (−2.4, 4.4)	1.5 (−2.3, 7.0)
Women						
Differences in ln(wage)	28.2	53.3	37.3	25.9	16.9	11.7
Price differential	8.2 (4.0, 12.3)	29.6 (16.4, 37.9)	22.1 (14.3, 26.5)	9.3 (4.3, 12.7)	−2.1 (−7.5, 2.0)	−6.9 (−14.9, −0.6)
Char. differential	20.1 (16.4, 24.1)	17.8 (10.5, 27.0)	16.6 (14.0, 24.4)	18.7 (15.2, 23.0)	20.4 (16.5, 25.7)	19.2 (16.0, 26.8)
Residuals		5.9 (−0.4, 15.3)	−1.5 (−5.5, 2.3)	−2.0 (−4.2, 1.0)	−1.3 (−3.8, 1.7)	−0.6 (−5.5, 3.1)

Note: Oaxaca and Blinder decomposition in the first column, Machado and Mata decompositions based on Eq. (3) in the other columns. All numbers are in percent. Totals may not sum exactly due to rounding. A 95% percentile bootstrap confidence interval (1000 replications) is reported in brackets

Table 2. Unexplained public sector wage gap by levels of education and experience

Education	Low	Medium	High	University
Men	−2.9 (−8.7, 2.5)	−5.4 (−10.9, 1.2)	−10.1 (−17.1, −2.8)	−13.9 (−24.7, −2.3)
Women	11.8 (5.6, 17.9)	10.5 (4.2, 17.0)	6.8 (−3.2, 17.2)	1.3 (−21.2, 26.3)
Experience	Expr $\leq$ 10	10 < Expr $\leq$ 20	20 < Expr $\leq$ 30	30 < Expr
Men	−8.4 (−22.1, 6.0)	−0.6 (−6.7, 5.6)	−6.9 (−12.8, −1.1)	−11.1 (−17.3, −4.7)
Women	−5.4 (−16.9, 6.5)	7.4 (−1.3, 16.6)	9.3 (2.2, 18.1)	9.6 (1.2, 17.9)

Note: Oaxaca and Blinder decompositions. All numbers are in percent. A 95% percentile bootstrap confidence interval (1000 replications) is reported in brackets.

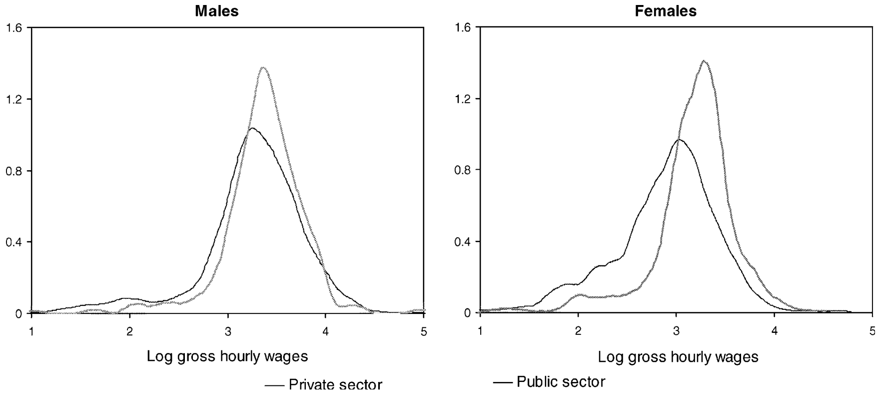

Fig. 1. Kernel density estimates of the wage distributions.
Note: Epanechnikov kernel density estimates; the bandwidths were chosen using Silverman's rule of thumb

sector earnings distribution is characterized by a higher density function around the mode and a lower dispersion. For males, the public sector earnings distribution lies "within" the private distribution. Public sector employees at the 5th quantile of the public sector earnings distribution enjoy an earnings advantage over private sector employees at the same point in the private sector distribution of wages; but the reverse holds for employees at the 95th quantile of the public sector and private sector earnings distribution. With "higher floors" and "lower ceilings", the public sector compresses the unconditional wage distribution.

Methodology

OLS and most statistical techniques focus on mean effects. They restrict the effect of the covariates to operate in the form of a simple "location shift". However, the descriptive statistics in the preceding section show that the impact of the public sector on the distribution of the wages is probably more complex. The quantile regression model introduced by Koenker and Bassett (1978) is more flexible than OLS and allows to study the effects of a covariate on the whole conditional distribution of the dependent variable. There is a rapidly expanding empirical quantile regression literature as the special issue of *Empirical Economics* on this subject edited by Fitzenberger et al. (2001) witnesses. Applications of quantile regression on the structure of earnings in West Germany can be found in Fitzenberger and Kurz (2003).

Let y_i be the log wage of worker i and X_i a vector of covariates representing the individual characteristics. The statistical model used in this paper specifies the θth quantile of the conditional distribution of y_i given X_i as a linear function of the covariates,

$$Q_\theta(y_i|X_i) = X_i\beta_\theta, \theta \in (0,1). \tag{1}$$

As shown by Koenker and Bassett (1978 and 1982), the quantile regression estimator of β_θ solves the following minimization problem

$$\hat{\beta}_\theta = \underset{\beta}{argmin}\left[\sum_{i:y_i \geq X_i\beta} \theta|y_i - X_i\beta| + \sum_{i:y_i < X_i\beta} (1-\theta)|y_i - X_i\beta|\right]. \tag{2}$$

This problem can be shown to fit into a GMM framework which has been used to prove consistency and asymptotic normality of $\hat{\beta}_\theta$ and to find its asymptotic covariance matrix (Buchinsky 1991, 1998).

Following Blinder (1973) and Oaxaca (1973), the difference in average earnings between workers in each sector can be decomposed into differences in personal characteristics and differences in coefficients (price differential or unexplained differential). Since this approach considers only differences at the means of the two earnings distributions, Mueller (1998) and Garcia et al. (2001) suggested to combine the decomposition technique with quantile regressions to determine the rent component at various points in the wage distribution. The problem with this technique is that only one point in the covariates distribution is considered: the mean. Differences in higher moments of the distribution of the independent variables are not controlled for. Therefore we will not present results using this technique.

Machado and Mata (2004) propose a decomposition procedure which combines a quantile regression and a bootstrap approach. First, in the quantile regression model the conditional quantiles of y are given by (1) and can be estimated by quantile regression. The second idea underlying their technique is the probability integral transformation theorem from elementary statistics: If U is uniformly distributed on $[0,1]$, then $F^{-1}(U)$ has distribution F. Thus, for a given X_i and a random $\theta \sim U[0,1]$, $X_i\beta_\theta$ has the same distribution as $y_i|X_i$. If, instead of keeping X_i fixed, we draw a random X from the population, $X\beta_\theta$ has the same distribution as y. Formally, the estimation procedure involves 4 steps:

1. Generate a random sample of size m from a $U[0,1]$: $u_1 \ldots, u_m$.
2. Estimate for each sector m different quantile regression coefficients: $\hat{\beta}^{pub}_{u_i}, \hat{\beta}^{priv}_{u_i}; i = 1, \ldots, m$.
3. Generate for each sector a random sample of size m with replacement from the covariates of X, denoted by $\{\tilde{X}^{pub}_i\}^m_{i=1}$ and $\{\tilde{X}^{priv}_i\}^m_{i=1}$.
4. $\{\tilde{y}^{pub}_i = \tilde{X}^{pub}_i\hat{\beta}^{pub}_{u_i}\}^m_{i=1}$ and $\{\tilde{y}^{priv}_i = \tilde{X}^{priv}_i\hat{\beta}^{priv}_{u_i}\}^m_{i=1}$ are random sample of size m from the marginal wage distributions of y consistent with the linear model defined by (1).
5. Generate a random sample of the counterfactual distribution. $\{\tilde{y}^{cf}_i = \tilde{X}^{pub}_i\hat{\beta}^{priv}_{u_i}\}^m_{i=1}$ is a random sample from the wage distribution that

would have prevailed in the private sector if all covariates had been distributed as in the public sector.

Now we can decompose the change of any statistics from one sector to the other into the contribution of the coefficients and the contribution of the covariates. Machado and Mata (2004) analyze the changes in the wage density. In order to simplify the comparison with the Oaxaca decomposition, we will decompose the quantiles of the wage distribution:

$$Q_\theta\left(y^{pub}\right) - Q_\theta\left(y^{priv}\right) = \left[Q_\theta\left(\tilde{y}^{pub}\right) - Q_\theta\left(\tilde{y}^{cf}\right)\right] + \left[Q_\theta\left(\tilde{y}^{cf}\right) - Q_\theta\left(\tilde{y}^{priv}\right)\right] + residual \quad (3)$$

The first term is the contribution of the coefficients and the second term is the contribution of the covariates to the difference between the θth quantile of the public sector wage distribution and the θth quantile of the private sector wage distribution. The residual term comprises the simulation errors which disappears with more simulations, the sampling errors which disappears with more observations and the specification error induced by estimating linear quantile regression. In this paper, we assume that the linear quantile regression model is correctly specified[2]. Thus, asymptotically, the residual vanishes and Eq. (3) is a true decomposition of the differences in quantiles.

4. Empirical results

4.1. Decomposition of the public-private sector wage differential

In order to decompose the differences in the wage distribution into differences in the coefficients and differences in the workers attributes, we apply the Oaxaca and Blinder decomposition and the Machado and Mata procedure described in Sect. 3 with the number of replications, m, set to 10000. The vector of regressors X_i includes experience (specified in a quartic form), job tenure, marital status, part-time status, education and occupation. The descriptive statistics of these variables are given in Table A.2. The reference educational category is the lowest educational group and the reference occupational category is *Service Worker*.

The results are summarized in Table 1. In addition to a point estimate, the second line in each cell presents the 95% bootstrap confidence interval for this estimate. These are the quantiles 2.5% and 97.5% of the distribution of the relevant statistic obtained by a design matrix bootstrap with 1000 replications. The price differential estimated by the Oaxaca/Blinder decomposition (mean) equals –6.9% for men, indicating that wages in the public sector are about 7% lower than wages in the private sector. For females, on the other hand, the public sector employees earn an unexplained public sector wage differential of 8.2%. Both results are strongly significant and are similar to those of Dustmann and Van Soest (1997).

[2] Little is known in the case of misspecification. Angrist, Chernozhukov and Fernandez-Val (2005) give first results on this subject.

The Oaxaca/Blinder decomposition does not consider the possibility that the distribution of actual wages around their predicted values differ across sectors. In fact, both the unconditional and the conditional wage distribution in the public sector are more compressed than those in the private sector. Therefore, to complete the analysis, Table 1 presents also results from the Machado/Mata decomposition with $\theta = 0.10, 0.25, 0.5, 0.75$ and 0.90. The estimated unexplained public sector wage gap varies strongly with θ. For males this price differential decreases from 5% at $\theta = 0.10$ to –17.4% at $\theta = 0.90$. For females, this differential varies from 29.6% at $\theta = 0.10$ to –6.9% at $\theta = 0.90$. The public sector compresses the pay dispersion and, therefore, reduces the within-group pay inequality. On the contrary, the characteristics differential seems to be stable over the wage distribution and does not vary with θ. Finally, the residual component is never significantly different from zero. Therefore, we cannot reject the null hypothesis that the linear model is well-specified.

The quantile regression model can be used to characterize the entire conditional distribution. Figure 2 present a concise visual summary of the Machado and Mata decomposition results. 99 decompositions have been estimated with $\theta = 0.01, \ldots, 0.99$. The 95% confidence interval is also plotted. The monotone decrease of the public sector unexplained differential as we go from the lowest to the highest quantiles appears clearly. The pattern is the same for both genders.

A consequence of these results is that the gender wage gap is smaller in public employment than in private employment. Interestingly, it contradicts standard economic theory. Unlike the private sector, the public sector is not

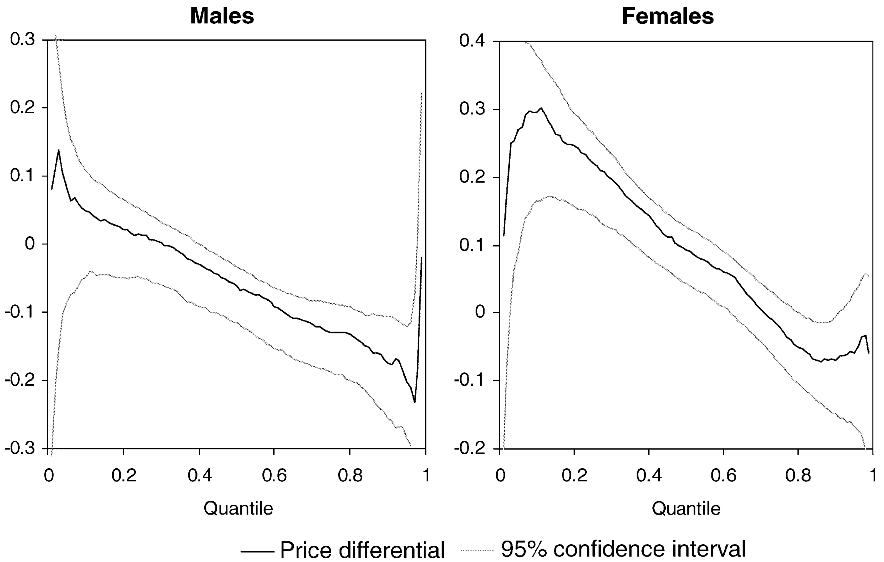

Fig. 2. Machado and Mata decomposition of the public/private sector wage differential.
Note: Variables controlled for in the regressions are education, experience, occupation, marital status, tenure and part-time status. The confidence intervals have been estimated by a percentile bootstrap with 1000 replications

subject to profit constraints. Becker (1957), for instance, suggests that profit-maximizing behavior is incompatible with the existence of discrimination. Following this argument, we might expect the adjusted male-female earnings differential to be smaller in the private sector. Why should nevertheless the male-female earnings differential be smaller for public sector than private sector employees? First, the pay system for all public sector employees is uniform and centralized. It is regulated in the Federal Act on the Remuneration of Civil Servants (Bundesbesoldungsgesetz), which requires equal pay for all individuals with the same seniority and qualifications who are employed in a given job. Equal opportunity and anti-discrimination policies are therefore more effectively implemented in public sector than private sector labor markets. Second, we have found that the distribution of wages is more compressed in the public than in the private sector. Blau and Kahn (1992) have shown that the more compressed the pay distribution, the lower the level of gender discrimination. Their evidence relies on cross-national comparisons of the impact of different wage distribution on the gender wage inequality. Here, there are two different pay systems within one land.

A consequence of this large wage advantage of females in the public sector is the overrepresentation of women in the public sector. They represent 51% of the public sector employees but only 42% of the private sector employees. Whether this wage policy is efficient or not depends on the interpretation of the gender earnings differentials. If it is believed that wage discrimination against females in private sector labor markets is causing inefficient resource allocation decisions, the presence of the positive public sector wage gap for women will reduce the degree of wage discrimination and improve the efficiency of the labor market.

4.2. Decomposition of the public sector wage differential by educational attainment

Since the wage differential may vary across education levels, the public sector wage differential is now decomposed separately for four ranges of schooling: *Low education* (corresponds to *Ed level 1* and *2*), *Medium education* (*Ed level 3*), *High education* (*Ed level 4* and *5*) and *University* (*Ed level 6*). The other regressors and the number of replications are the same as above. Table 2 and Figure 3 give the results of the Oaxaca and Blinder and of the Machado and Mata decompositions separately for each category.

The left-hand panel of Fig. 3 provides the information for men. Quantile regression estimates show the same pattern for the 4 educational categories: the price differential declines as we move up the income distribution. Thus, the story of Fig. 2 is confirmed: the public sector reduces the within-group inequality by compressing the wage distribution. The comparison of the price differential for the four educational groups in Table 2 shows that it decreases monotonically as the educational qualification increases. The public sector unexplained wage differential falls from –2.9% for the lowest education group at –5.4% for the second group, -10.1% for the third and –13.9% for the top education category. Since the average wage increases with the number of years of schooling, there is an equalizing effect between educational groups attached to public sector status.

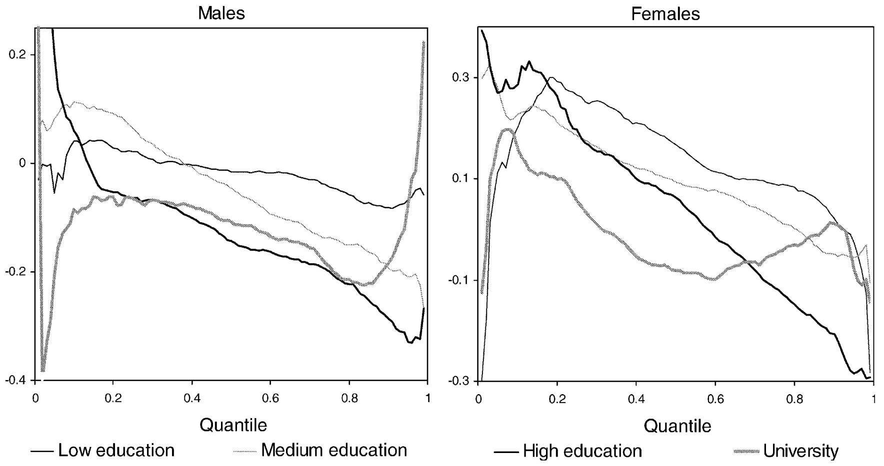

Fig. 3. Price differential by educational attainment.
Note: Machado and Mata decomposition. Variables controlled for in the regressions are experience, occupation, marital status, tenure and part-time status

The right-hand panel of Figure 3 illustrates the results for women. There is again evidence of a negative gradient in price differential across the income quantiles. As for men, there is evidence of an equalizing effect between groups attached to public sector status. While the level of the price differential is about 15% higher for women than for men, the differences between the educational levels are similar for both genders. The political pressure on the government not to pay low wages to its less skilled employees could explain why the return to education is higher in the private then in the public sector. An implicit minimum wage in the public sector arises from this policy. Similarly, the government has the tendency to underpay its most skilled workforce. Very high salaries in the public sector seem to be not accepted by voters.

4.3. Decomposition of the public sector wage differential by levels of experience

The decomposition of the public sector wage differential may also vary across different levels of experience. The observations are now segmented in four experience groups: those with less than 11 years of experience, 11–20 years, 21—30 years and more than 30 years. The other regressors and the number of replications are the same as above. Figure 4 combines the results by experience and quantile in the same way as Fig. 3 did. The bottom part of Table 2 gives the results of the Oaxaca and Blinder decomposition separately for each category.

With a few exceptions, we observe again the equalizing effect of the public sector relative to the private sector, with a negative gradient in the unexplained public sector wage gap as we move up the income distribution. The less experienced groups seem to make exceptions.

If we compare the level of the price differential for the four experience groups for men in Table 2, it seems that the results do not vary with the

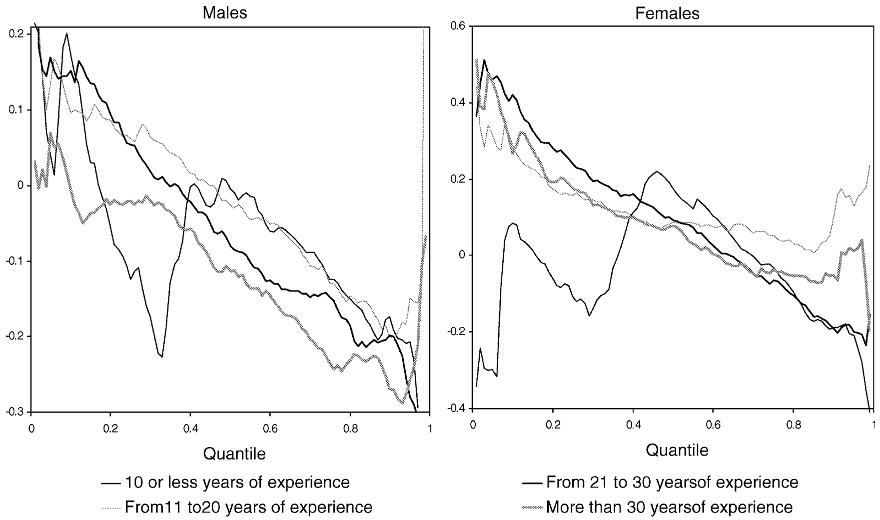

Fig. 4. Price differential by levels of experience.
Note: Machado and Mata decomposition. Variables controlled for in the regressions are education, occupation, marital status, tenure and part-time status

experience of the workers. On the contrary, the level of the unexplained public sector wage gap depends significantly on experience for women. It is –5.4% for the least experienced groups and increases monotonically to 9.6% for the most experienced groups. This difference between both sectors could be explained by the rigid hierarchical pay structure in the public sector. Salaries increase more or less mechanically with seniority. Wage decreases are difficult if not impossible. Moreover, a part of the discrimination of women takes the form of slower promotion rates. The centralized pay system in the public sector could reduce this form of discrimination. On the other hand, it may be easier to retain the same job after a maternity break or to change from full-time employment to part-time employment in the public sector. Therefore, females in the public sector could have more human capital than females in the private sector with the same age and the same education level (Dustmann and Van Soest 1997). It should be noted, however, that the experience pattern reflects a combination of age, experience and cohort effect.

5. Evolution over time

Differences in the cyclical responsiveness of earnings of public sector and private sector employees may induce short-run changes of the public sector wage gap. Earnings of private sector employees generally vary pro-cyclically. Thus, if the pay structure is less flexible in the public sector and cannot react after an economic boom or a crisis, the public sector wage gap will vary counter-cyclically. Borjas (1984) presents another theory of why public/private earnings differential may vary over time. In his model, electoral wage cycles are generated as a result of optimizing behavior on the part of voters, bureaucrats, and the government. His empirical analysis for USA indicates that federal wage rates rise significantly more in election years.

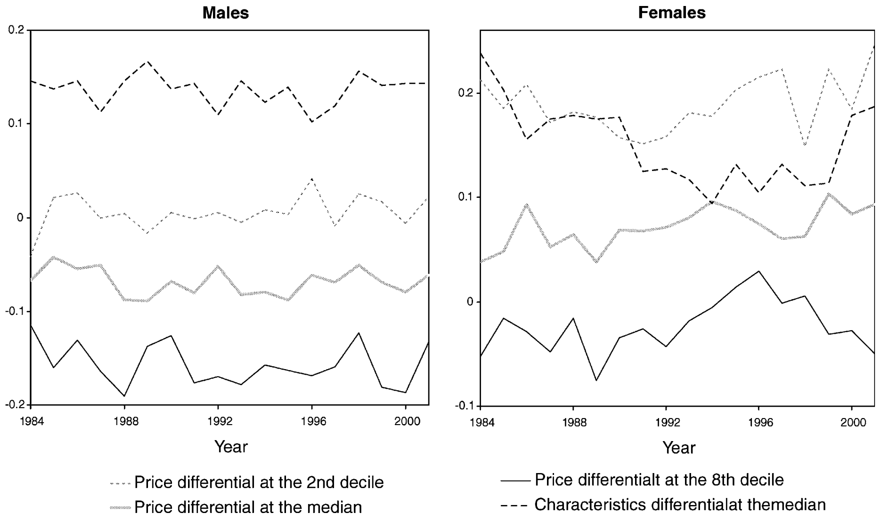

Fig. 5. Evolution from 1984 until 2001.
Note: Machado and Mata decomposition. Variables controlled for in the regressions are education, experience, occupation, marital status, tenure and part-time status

Therefore, it would be restrictive to study the issue of wage inequality between the public and the private sector based on only one cross-section of data and we expand now the analysis on the first 18 years of the SOEP. The same procedure as in Sect. 4 has been applied for each of the 18 years. A concise visual summary is given in Fig. 5. Since the characteristics differential is almost the same at all quantiles, only the estimate for $\theta = 0.5$ is shown. The estimates of the price differential are given for $\theta = 0.2, 0.5$ and 0.8.

Remarkable in this figure is the stability of the estimates during almost 2 decades. It is very difficult to find a trend or a cyclical component in these time series. All attempts to link the decomposition results with an economic or a political cycle were also unsuccessful. The results for different experience or education categories (not plotted) are also stable although the variance of the estimates is higher. This parallelism between public and private sector wages probably reflect the structure of wage negotiation in Germany. Collective bargaining agreements cover practically all areas of the public and the private sector. Wages of public sector workers are not formally linked with those in the private sector but indirectly they are since the negotiated results of the large private sector unions are often taken as a benchmark for the public sector.

6. Conclusions

The wage structure in the public and private sectors in West Germany has been examined using the data from the GSOEP for the years 1984–2001. Oaxaca decomposition results suggest that conditional wages are higher in the public sector for women but lower for men. Using the quantile regression decomposition technique proposed by Machado and Mata (2004), we find that the conditional distribution of wages is more compressed in the public sector. At the low end of wages, differences in characteristics explain less than the raw wage gap when it is the opposite at high wages. Allowing the decomposition results to be different for four categories of education, we find that the public sector reduces also the between-group inequality. Those with basic schooling obtain the highest unexplained public sector wage gap. The decomposition results by levels of experience suggest that the price differential increases with the years of experience for women. Finally, we examine the evolution of the results from 1984 to 2001 and find no trend or cycle. The wage structure seems to be extremely stable.

Are these differences in wages between the public and private sector "true" premiums, or are there other factors at work? There may be "compensating differentials", such as working conditions and fringe benefits. The differences may also reflect unobserved individual characteristics. Therefore, the results do not necessarily have a causal interpretation. Rather they provide a descriptive comparison of earnings distribution for public and private sector employees. An interesting extension of this work would naturally be to combine the distributional analysis with a correction for the endogeneity of the sector choice. Abadie et al. (2002) and Chernozhukov and Hansen (2005) have proposed different instrumental variable estimators for quantile regression that could be used for this purpose. However, beyond the technical difficulties it remains very difficult to find sensible exclusion restrictions to identify the sector choice equation. This probably explains the lack of robustness of estimators that control for the endogeneity of sector choice.

The Machado and Mata decomposition is a very interesting methodology but has the inconvenience of requiring the estimation of a large number of quantile regressions, which is computationally involved. Further research should try to improve on it. A less computer-intensive procedure would be necessary in order to reduce the computation time, particularly for big data sets. Finally, a formal proof of the consistency of this estimator and its asymptotic distribution should also be the object of further research. Machado and Mata (2004) estimate the asymptotic distribution by a simple bootstrap of the generated samples but give no proof that the bootstrap is consistent.

Appendix

Table A.1. Explanation of variables

Variable	*Description*
Wage	Gross hourly earnings from employment. Gross hourly wage are derived by dividing gross monthly earnings by monthly actual hours worked.
Ln(wage)	The natural logarithm of wage.
Expr	Number of years of potential work experience the individual has accumulated. It is measured by min(age-schooling-6, age –18).
Gender	Dummy; 1 if women.
Tenure	Number of years with current employer
Part-time	Dummy; 1 if the individual is part-time or marginally employed.
Married	Dummy; 1 if married.
Ed level	Ordered variable on education:
Ed level 1	Dummy; 1 if no degree or basic or intermediate schooling with no training.
Ed level 2	Dummy; 1 if basic schooling with apprenticeship.
Ed level 3	Dummy; 1 if intermediate schooling with apprenticeship.
Ed level 4	Dummy; 1 if high school (Abitur or Fachabitur) with no training or with apprenticeship.
Ed level 5	Dummy; 1 if high school with technical school or polytechnic.
Ed level 6	Dummy; 1 if university.
Management	Dummy; 1 if occupation in management.
Professional	Dummy; 1 if professional.
Technician	Dummy; 1 if technician.
Clerk	Dummy; 1 if clerk.
Service worker	Dummy; 1 if service worker.
Agriculture	Dummy; 1 if occupation in agriculture.
Craft	Dummy; 1 if craft and related trades workers.
Plant	Dummy; 1 if plant or machine operator or assembler.
Elementary	Dummy; 1 if elementary occupation.
Psect	Dummy; 1 if employed in the public sector.

Table A.2. Descriptive statistics, means

Variable	*All observations*			*Men*			*Women*		
	All	Public sector	Private sector	All	Public sector	Private sector	All	Public sector	Private sector
Ln(wage)	3.15	3.27	3.10	3.28	3.37	3.25	2.98	3.17	2.89
Gender	0.45	0.51	0.42						
Experience	22.17	24.33	21.35	22.55	25.53	21.60	21.70	23.20	21
Tenure	10.57	13.75	9.35	12.07	16.06	10.79	8.71	11.58	7.37
Married	0.63	0.68	0.61	0.67	0.74	0.64	0.59	0.63	0.57
Part-time	0.24	0.27	0.23	0.05	0.06	0.05	0.48	0.47	0.48
Education:									
Ed level 1	0.12	0.08	0.13	0.10	0.05	0.12	0.14	0.10	0.16
Ed level 2	0.31	0.23	0.34	0.35	0.27	0.37	0.25	0.19	0.28
Ed level 3	0.27	0.29	0.26	0.22	0.25	0.22	0.33	0.34	0.33
Ed level 4	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.06	0.09
Ed level 5	0.10	0.14	0.09	0.12	0.15	0.10	0.09	0.13	0.07
Ed level 6	0.11	0.18	0.08	0.12	0.19	0.10	0.10	0.17	0.06
Occupation:									
Management	0.04	0.02	0.05	0.05	0.03	0.06	0.03	0.01	0.04
Professional	0.15	0.28	0.10	0.18	0.31	0.14	0.12	0.25	0.05
Technician	0.25	0.35	0.21	0.21	0.26	0.19	0.31	0.45	0.25
Clerk	0.15	0.11	0.16	0.09	0.08	0.10	0.21	0.13	0.25
Service worker	0.11	0.10	0.11	0.05	0.11	0.02	0.18	0.09	0.22
Agriculture	0.01	0.01	0.01	0.01	0.02	0.00	0.01	0.00	0.01
Craft	0.15	0.04	0.20	0.25	0.08	0.31	0.03	0.01	0.04
Plant	0.07	0.03	0.09	0.11	0.05	0.13	0.03	0.01	0.04
Elementary	0.07	0.05	0.07	0.05	0.05	0.05	0.09	0.05	0.11
Number of observations	4770	1320	3450	2645	642	2003	2125	678	1447

References

Abadie A, Angrist J, Imbens G (2002) Instrumental Variables Estimates of the Effects of Subsidized Training on the Quantiles of Trainee Earnings. Econometrica 70: 91–117
Angrist J, Chernozhukov V, Fernandez-Val I (2005) Quantile regression under misspecification, with an application to the U.S. wage structure. Econometrica (forthcoming)
Becker G (1957) The economics of discrimination. University of Chicago Press, Chicago
Borjas GJ (1984) Electoral cycles and the earnings of federal bureaucrats. Economic Inquiry 22: 447–459
Blau FD, Kahn LM (1992) The gender earnings gap: learning from international comparisons. American Economic Review 82: 533–538
Blinder A (1973) Wage discrimination: reduced form and structural estimates. Journal of Human Resources 8: 436–455
Buchinsky M (1991) The Theory and Practice of Quantile Regression. Ph. D. Dissertation, Harvard University
Buchinsky M (1998) Recent Advances in Quantile Regression Models: A practical guide for empirical research. Journal of Human Resources 33: 88–126
Chernozhukov V, Hansen C (2005) An IV Model of Quantile Treatment Effects. Econometrica 73: 245–261
Disney R, Gosling A (1998) Does it pay to work in the Public Sector? Fiscal Studies 19: 347–374
Dustmann C, Van Soest A (1997) Wage Structures in the Private and Public Sectors in West Germany. Fiscal Studies 18: 225–247
Dustmann C, Van Soest C (1998) Public and private sector wages of male workers in Germany. European Economic Review 42: 1417–1441
Ehrenberg RG, Schwarz JL (1986) Public Sector Labor Markets. In: Ashenfelter O, Layard R (eds.) Handbook of Labor Economics, Volume 2. Elsevier Science Publishers, Amsterdam, pp. 1219–1268
Federal Statistical Office (2002) Statistical Yearbook 2002 for the Federal Republic of Germany. Federal Statistical Office, Wiesbaden
Fitzenberger B, Koenker R, Machado J (2001) Special Issue on Economic Applications of Quantile Regression. Empirical Economics, 26: 1–324
Fitzenberger B, Kurz C (2003) New insights on earnings trends across skill groups and industries in West Germany. Empirical Economics, 28: 479–514
García J, Hernández PJ, López-Nicolás A (2001) How wide is the gap? An investigation of gender wage differences using quantile regression. Empirical Economics 26: 46–67
Gregory RG, Borland J (1999) Public Sector Labor Markets. In: Ashenfelter O, Card D (eds.) Handbook of Labor Economics, Volume 3c. Elsevier, Amsterdam, pp. 3573-3630
Koenker R, Bassett G (1978) Regression Quantiles. Econometrica 46: 33–50
Koenker R, Bassett G (1982) Robust tests for heteroscedasticity based on regression quantiles. Econometrica 50: 43–61
Machado J, Mata J (2004) Counterfactual decompositions of changes in wage distributions using quantile regression. Journal of Applied Econometrics, forthcoming
Mueller R (1998) Public-private sector wage differentials in Canada: evidence from quantile regressions. Economics Letters 60: 229–235
Nielsen HS, Rosholm M (2001) The public-private sector wage gap in Zambia in the 1990s: A quantile regression approach. Empirical Economics 26: 169–182
Oaxaca R (1973) Male-female wage differentials in urban labor markets. International Economic Review 14: 693–709
Poterba J, Rueben K (1995) The Distribution of Public Sector Wage Premia: New Evidence Using Quantile Regression Methods. NBER Working Paper No. 4734
Smith S (1976) Pay differentials between federal government and private sectors workers. Industrial and Labour Relations Review 29: 233–257
Smith S (1977) Equal Pay in the Public Sector: Fact or Fantasy. Industrial Relations Section, Princeton
SOEP Group (2001) The German Socio-Economic Panel (GSOEP) after more than 15 years - Overview. In: Holst E, Lillard DR, DiPrete TA (eds.) Proceedings of the 2000 Fourth International Conference of German Socio-Economic Panel Study Users (GSOEP2000), Vierteljahrshefte zur Wirtschaftsforschung (Quarterly Journal of Economic Research), 70:1, pp. 7–14