

SPATIAL VARIATION OF PUBLIC-PRIVATE WAGE DIFFERENTIALS¹

Gabriela Grotkowska

Department of Macroeconomics and International Trade Theory
Faculty of Economic Sciences
University of Warsaw
e-mail: ggrotkowska@wne.uw.edu.pl

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Abstract

The aim of this paper is to estimate the adjusted sectoral wage gap in Poland and to examine its spatial differences in terms of the size of settlement units. In particular, a hypothesis that there is a negative relation between the public-sector wage premium and the size of a settlement unit is tested. We use a set of individual data from the representative survey *Human Capital Balance* (BKL) carried out in Poland for the period from 2010 to 2014. We apply the control function approach (both with homogeneous and heterogeneous impacts) to address the problem of selection mechanism. We show that, after controlling for structural differences in employment, generally there is a moderate positive premium related to public employment. However, this premium differs between types of settlement units, with public employment being most attractive in medium-sized cities. This may pose a challenge for the public sector regarding attracting highly qualified employees in the biggest cities. As a consequence, the efficiency of public-sector services provision (education, healthcare, administration) may be seriously threatened.

ZRÓŻNICOWANIE PRZESTRZENNE RÓŻNIC W PŁACACH MIĘDZY SEKTOREM PUBLICZNYM A PRYWATNYM

Gabriela Grotkowska

Katedra Makroekonomii i Teorii Handlu Zagranicznego
Wydział Nauk Ekonomicznych
Uniwersytet Warszawski

Słowa kluczowe: różnice w płacach między sektorem publicznym a prywatnym, premia płacowa z zatrudnienia w sektorze publicznym, funkcja sterowania, przestrzenne zróżnicowanie wynagrodzeń.

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A b s t r a k t

Celem opracowania jest oszacowanie skorygowanej sektorowej luki płacowej w Polsce oraz zbadanie jej przestrzennego zróżnicowania ze względu na wielkość jednostek osadniczych. W szczególności jest testowana hipoteza, że istnieje negatywna relacja między wielkością premii płacowej z zatrudnienia w sektorze publicznym a wielkością jednostki osadniczej. W pracy wykorzystano dane jednostkowe pochodzące z badania *Bilans kapitału ludzkiego* (BKL), które przeprowadzono w latach 2010–2014. Aby rozwiązać problem nielosowej selekcji do sektora, zastosowano metodę funkcji sterowania (zarówno w wersji zakładającej wpływ homogeniczny, jak i heterogeniczny). Wykazano, że po uwzględnieniu różnic w strukturze zatrudnienia na ogół występuje umiarkowana dodatnia premia związana z zatrudnieniem w sektorze publicznym. Premia ta różni się jednak między typami jednostek osiedleńczych. Zatrudnienie w sektorze publicznym jest najbardziej atrakcyjne w średnich miastach. Zjawisko to może stanowić wyzwanie dla sektora publicznego w aspekcie przyciągania wysoko wykwalifikowanych pracowników w miastach największych. W konsekwencji efektywność zapewnienia usług sektora publicznego (edukacji, służby zdrowia, administracji) może być tam poważnie zagrożona.

Introduction

Among the European Union economies, Poland is a country with a relatively high share of public-sector employment (ILO 2016). Despite the dynamic development of private economic activity during the process of economic transition, almost a quarter of jobs in Poland are still generated by the public sector. In the first quarter of 2016, there were almost 3.8 million individuals employed in public institutions or state enterprises (*Aktywność ekonomiczna ludności Polski* 2016a). Yet the role of the public sector in labour market performance exceeds its borders. One of the most important channels through which it impacts other areas of the national economy is the wage-setting process. The evolution of public-sector wages is important for the equilibrium of public finances, the inflation rate and other macroeconomic variables.

It is a long-run regularity, observed in many countries, that the average wage in the public sector exceeds that in its private counterpart. However, it would not be correct to simply conclude that any individual stands to earn more once employed in the public sector rather than in the private. The difference in average wages may be to a large extent explained by reference to differences in the personal characteristics of earners that are relevant to the labour market (e.g., level of education, experience, occupation, etc.). The public sector employs persons that are, on average, older, have higher levels of education and have greater firm-specific job experience (longer job tenure) than the average private sector employee. Moreover, there are several theoretical explanations for why wages may also depend on employer characteristics such as industry, firm size or profitability. Since the structure of both ownership sectors differ in these aspects, such explanations may also apply to intersectoral wage differentials.

The objective of this paper is to examine spatial differences of the public-private wage gap in Poland in terms of the size of settlement units. In particular, a hypothesis that there is a negative relation between the public-sector wage premium and the size of a settlement unit is tested. We use a fairly comprehensive collection of data taken from the *Human Capital Balance* (BKL) carried out in Poland for the period from 2010 to 2014. The main advantage of this data set in the context of our study is its classification of settlement units, which is more detailed than that of Labour Force Surveys (LFS).

As for methodology, we apply the control function approach (both with homogeneous and heterogeneous impacts) to address the problem of selection mechanism. We show that, after controlling for structural differences in employment, there is generally a moderate positive premium related to public employment. However, this premium differs between types of settlement units, with public employment being most attractive in medium-sized cities. To the best of our knowledge, this is the first study on the public-private wage gap in the spatial context and also the first paper applying the methodology of the control function approach with heterogeneous impacts to the problem of public-sector wage premiums in Poland.

The paper is structured as follows. First, we shortly discuss the theoretical foundations of the public-private wage differential and its spatial variation. Second, we offer a survey of the relevant literature, focusing on existing research on the Polish labour market and spatial aspects of the adjusted sector wage premium. Third, we describe the properties of the sample taken from the BKL data set and discuss differences in employment structures between the two sectors of the Polish economy in the spatial context. Finally, we report the estimates of an adjusted wage gap and its variation across different types of the settlement units. The paper ends with conclusions.

Public-private wage differentials: theoretical background

There are a number of other potential reasons why an individual with given characteristics may earn a different wage based on employment in the private or public sector. Profit maximization is usually the main goal of private companies, while a significant portion of the public sector is focused on delivering public goods and services, realizing social and political goals or redistributing wealth. Consequently, the wage formation mechanism in the public sector is to a large extent regulated by political process, while in the private sector it is strongly determined by economic mechanisms and is subject

to efficiency criteria. Wages in the public sector are weakly correlated with workers' marginal productivity (FOGEL, LEWIN 1974), although in recent years the role of efficiency criteria have grown in the public sector (LAUSEV 2014). The wage structure in the public sector is more compressed than that in the private sector, which favours low-skilled workers and discriminates against high-skilled workers, especially managers. Both sectors are subject to principal-agent problems. Better monitoring of effort might reduce the need to pay more across all employees, but in the public sector it is not always clear who should play the role of principal (BEBCHUK, FRIED 2004). The public sector is usually more unionized than the private, which strongly affects the wage-setting mechanism, giving more power to the labour supply side in wage negotiations.

The public and private sectors differ also in the structures of their economic activity. Public-sector wages are less closely related to the business cycle, while private sector wages seem to be strongly procyclical. As a result, public-sector relative wages are countercyclical: they increase in times of economic slump, which would justify the potential attractiveness of public-sector employment in times of economic crises (MACZULSKIJ 2013). The literature has also highlighted that public-sector wages are related to electoral cycles (BORJAS 1984).

Lastly, there are significant differences between institutions that may explain the observed empirical regularities in the wage distributions (SILVESTRE, EYRAUD 1995, ELLIOTT et al. 1999). Although many countries have implemented reforms to introduce more market-oriented mechanisms to the public sector, differences in the recruitment process, wage setting and collective bargaining coverage prevail. The public sector is characterized by strict rules of promotion and remuneration, related mainly to job tenure (MAKEPEACE, MARCENARO-GUTIERREZ 2006, BURGESS, METCALFE 1999). Lower wages can be somewhat compensated by other employment benefits, like greater job security or more flexible hours.

In many local labour markets, the public sector has monopsony power as it remains the only source of demand for workers with higher education (MUELLER 1998), which allows it to dictate wage levels. Monopsony in this context should not be understood as a situation involving only a single buyer of labour, but rather as a situation in which the supply of labour to an individual firm is not infinitely elastic. The reason for this lies in the existence of significant frictions in the labour market and the fact that, in most cases, it is employers who set wages. The barriers to labour force mobility (both in terms of qualifications and space) are the main sources of such frictions, and may result in differences between wages offered by similar employers to similar employees located in different areas.

The spatial distribution of private economic activity is to a large extent driven by mechanisms described by the new economic geography (NEG). One of the most important results described by NEG is the emergence of industrial clusters and spatial variations of wages. These are explained by reference to linkages between centripetal and centrifugal forces, especially those related to economies of scale, with certain roles played by the relational, social and contextual aspects of economic behaviour (FUJITA, KRUGMAN 2004). Public activity – given its nature – is more related to the distribution of the domestic population. As a result, it is significantly more evenly distributed over the territory of a given state, with smaller spatial variations of wages. We may then expect that public-sector wage premiums may differ between regions and between particular types of settlement units. This may lead to substantial differences in the relative attractiveness of public-sector employment and may impact the efficiency of the provision of public services, particularly in certain locations. We may thus expect that there would be a negative relation between the public-sector wage premium and the size of a settlement unit. This hypothesis is tested below.

Review of the empirical literature on public-private wage differentials in Poland

For the majority of developed countries, evidence of positive public-sector wage premiums has been found. However, the scale of this premium varies between studies. On the other hand, research for developing countries generally reveals a negative public-sector wage premium, which seems to vanish as these countries reach economic maturity (LAUSEV 2014). Poland, similarly to other transition economies, seems to be an interesting case demonstrating the impact of institutional changes on the sectoral pay gap. Numerous studies have employed various methodological approaches in analysing this group of countries. Their results are largely inconsistent with the findings for the developed countries. The initial period of transformation is found to adversely affected the public-sector wage premium (the wage gap is estimated to be on average about 20% in favour of the private sector). With progress in the transition process, the absolute value of the wage gap decreases over time to zero, and has become positive in some countries. Several studies of the sectoral wage gap in the Polish labour market have been undertaken by Socha. In his study conducted with NEWELL (1998), based on LFS data from 1992 and the single equation estimation, a positive private sector wage premium was revealed (5.1% for men and 8.6% for women). Moreover, a study by SOCHA and WEISBERG (2002) using LFS data for November 1995 showed that human

capital was found to be a stronger determinant of wages in the private sector than in the public. A similar type of analysis was also conducted by LEHMANN and WADSWORTH (2000), ADAMCHIK et al. (2003) and NEWELL and SOCHA (2007). The fact that the private sector in Poland offers higher rewards for higher qualifications than does the public sector was also confirmed by RUTKOWSKI (1996, 1997). One of the most regularly cited papers in the literature is by ADAMCHIK and BEDI (2000). The authors applied the endogenous switching regression model in order to control a selection of public-sector employment. As an instrument, they used age and whether an individual entered the labour market before or after 1989. Their results revealed a significant public pay penalty that was particularly large for tertiary graduates. In recent years, research on public-private wage differentials in Poland has been scarce. GROTKOWSKA and WINCENCIAK (2014) used LFS data for Poland for the year 2010 to show that, despite 20 years of economic transition, the public-sector wage premium in Poland is still negative. They used a methodology similar to that of the majority of earlier studies (Mincerian wage regression), yet they addressed the problem of selection in employment (by adding a Heckman correction) and the potential variation of the premium across different parts of the wage distribution (by using quantile regression). The public-sector wage penalty was found to be particularly strong for women, young people and those with higher levels of education.

Although there has been some research on the spatial variation of public-private wage differentials, this has mainly concerned regional dimension and highly developed countries. DELL'ARINGA et al. (2007) showed that significant differences exist in public-private wage differentials across Italian regions, and that this can be partly explained by reference to local labour market conditions affecting the private sector and only marginally the public sector. GARCIA-PEREZ and JIMENO (2007) used data from the European Community Household Panel for the period from 1995 to 2001 to show that there are sizeable public-sector wage differences among Spanish regions. Moreover, regional differences in public-sector wage gaps vary across gender, educational levels and occupations. Additionally, they display a positive correlation with regional unemployment, while correlating negatively with regional labour productivity. MEURS and EDON (2007) analysed the spatial variation of the public-sector wage premium for France. Using standard methods of estimation and geographically-weighted regressions for 2002, they showed that the average public-private wage differential does not differ widely across regions. However, quantile regressions estimated by region revealed that the pattern of public wage premiums varies according to gender and skill. According to our best knowledge, analysis of this kind has not yet been performed for Poland.

Data source and econometric strategy

Data description

The data source used in our study was the general population survey realized in one of the largest studies of the labour market in Central and Eastern Europe – BKL – carried out by the Polish Agency for Enterprise Development in cooperation with the Jagiellonian University. The surveyed population included people of working age (i.e., women aged 18-59 and men aged 18–64) living in Poland at the time of the study. The sample was drawn from the Universal Electronic System for Registration of the Population (i.e., the PESEL register). The sample was stratified and proportional. The strata were based on the division of the sample into subregions (NUTS3) according to GUS and the classes of settlement units. Additionally, for every independent region, the stratification of the drawn sample encompassed the breakdown by gender and age group for individual town size classes.

In the period from 2010 to 2014, the total number of interviews equalled 88,560, out of which 52,032 interviewees were identified as working (according to LFS criteria). However, the sample used in our study included only 22,784 of these observations. Since the wage question in the survey questionnaire refers to average monthly earnings from all income sources, we decided to limit our sample to only those hired workers who declared that they had only one job at the time of the survey. Since the survey covered several years, it was necessary to deflate wages to PLN for the year 2014.

Statistical description of the sample

Table 1 presents basic statistics on the structure of the population employed in public and private sectors in the sample used for empirical analysis. One of the most characteristic features of the public sector in Poland is its feminization. More than 61% of employees in the public sector are women. In the private sector, this share is slightly above 43%. This trend is probably related to the specific structure of economic activity in both sectors. Large portions of workers in the public sector are employed in occupations specific to non-market services (healthcare, education, administration), and these are clearly more regularly performed by women.

The public sector, on average, also employs older workers than does the private sector: the mean age of an employee in the private sector is 37.7 years, while in the public sector it is 42.9 years. The difference is even bigger when we use the median as a measure of central tendency. However, the most important area of difference between the employment structures of the public and private

Table 1

Structure of the sample: public versus private sectors

Specification	Private sector	Public sector	Total
Gender [%]			
Men	56.65	38.96	50.60
Women	43.35	61.04	49.40
Educational level [%]			
Tertiary	15.80	41.34	24.53
Secondary vocational	29.06	26.11	28.05
General secondary	11.68	8.44	10.57
Basic vocational	34.89	18.50	29.28
Primary	8.57	5.59	7.55
Class of settlement unit [%]			
Rural areas	37.45	33.41	36.07
Towns up to 19 th.	14.84	16.73	15.48
Towns 20–199 th.	27.84	30.32	28.69
Cities 200 th. + (excluding Warsaw)	16.54	16.94	16.67
Warsaw	3.34	2.59	3.09
Occupational group [%]			
Managers	2.90	2.80	2.86
Professionals	7.37	32.17	15.85
Technicians	9.25	16.09	11.59
Clerks	7.55	11.84	9.02
Salesmen	22.59	10.36	18.41
Farmers	1.78	1.38	1.65
Craftsmen	26.01	7.89	19.82
Machine operators	13.23	7.71	11.34
Elementary occupations	9.31	9.75	9.46
Methods of job acquisition [%]			
Direct contact with employer	46.88	58.35	50.8
Family members' contacts	33.13	22.29	29.42
Advert	6.92	3.45	5.73
Job centre	5.66	7.33	6.23
Internet	4.36	2.08	3.58
School	1.57	3.86	2.36
Other	1.47	2.63	1.87
BKL edition [%]			
2010	19.20	19.77	19.40
2011	17.98	18.47	18.15
2012	18.17	17.88	18.07
2013	21.99	22.42	22.14
2014	22.65	21.47	22.24
Age [years]			
Mean	37.70	42.88	39.47
Median	36.00	43.00	38.00
Standard deviation	10.97	10.30	11.03
Job tenure [years]			
Mean	7.69	14.44	10.00
Median	5.00	12.00	7.00
Standard deviation	8.01	10.70	9.57

Source: own calculations based on the BKL data set.

sectors is human capital. More than 40% of public-sector workers have higher education, and more than a quarter have vocational secondary education or post-secondary education. In the private sector, the largest group of workers are those with vocational education – both basic and secondary. The public-sector remains the main source of demand for higher qualifications, which is related to the specific occupational structure of its employment. In recent years, the share of craft workers and plant and machine operators has significantly decreased, accompanied by an expansion of the share of professionals. The latter is now the largest group of public-sector workers (more than 32% of the sample).

The distribution of public-sector workers among different types of settlement units is clear. The private sector is over-represented in rural areas and in Warsaw. In all other classes of towns and cities, the share of public-sector jobs is higher than average.

When we want to apply the control function methodology, we must include in the model at least one variable that is highly correlated with treatment (in our case: public-sector employment) and not significantly correlated with the outcome variable (in our case: net hourly wage). We discovered that the populations of workers in both sectors differ significantly in terms of the ways in which they found their jobs. Jobs in the public sector are more regularly found through public job intermediation (job centres), direct contacts with employers or through the assistance of schools. In the case of private employment, three channels seem to be used more often than usual: the internet, adverts and family members' contacts and acquaintances. Since the variable describing the means by which the job was found is not a significant predictor of wages, it was included in the econometric model in the selection equation.

Table 2 summarizes the basic descriptive statistics of wage distribution in both sectors in the sample. It was calculated using information on hourly declared net wage rates (only for hired workers holding just one job). A glimpse at Table 2 shows that the wage level is higher in the public sector across almost all labour force characteristics, yet the scale of the gross premium is different for particular groups of the labour force.

The average gross premium in the sample is 20.0%. The difference is significantly larger for women than for men. The average wage is higher in the public sector for all educational levels, with the exception of primary education. However, in cases of individuals with tertiary education, the averages are almost equal and the median is lower in the public sector. The same pattern may be noted in the results for occupational groups. There are significant differences in gross public/private wage rates across different classes of settlement units. The ratio is highest for small- and medium-sized cities. In Warsaw, the average wages offered in the private sector are higher than in its public counterpart.

Table 2

Wage distribution characteristics within the sample: public versus private sector

Specification	Private [PLN]			Public [PLN]			Public/ Private ratio	
	mean	p50	SD	mean	p50	SD	mean	p50
Total	13.40	10.63	15.36	16.01	12.99	17.58	1.200	1.222
Gender								
Men	14.34	11.69	17.41	16.85	13.79	16.69	1.175	1.180
Women	12.17	9.74	12.07	15.48	12.60	18.10	1.272	1.294
Educational level								
Tertiary	19.93	16.56	25.54	20.06	16.33	22.91	1.006	0.986
Secondary vocational	13.15	11.03	11.61	13.70	12.50	7.42	1.042	1.133
General secondary	12.80	10.42	13.74	13.98	11.36	17.72	1.092	1.091
Basic vocational	11.86	10.00	12.90	12.16	10.11	13.57	1.025	1.011
Primary	11.09	9.38	9.44	10.51	8.85	7.26	0.948	0.943
Class of settlement unit								
Rural areas	12.26	10.11	17.15	13.58	11.10	11.08	1.108	1.098
Towns up to 19 th.	12.83	10.59	13.21	16.41	12.64	24.97	1.279	1.193
Towns 20–199 th.	13.67	11.04	11.90	16.27	13.24	12.20	1.190	1.199
Cities 200 th. + (excluding Warsaw)	14.93	11.69	16.48	17.69	13.50	25.32	1.185	1.155
Warsaw	18.99	15.39	20.33	18.62	15.01	17.97	0.980	0.975
Occupational group								
Managers	21.54	17.41	19.52	20.32	17.82	9.60	0.943	1.024
Professionals	19.79	15.63	18.70	20.97	16.43	25.83	1.060	1.051
Technicians	16.10	13.19	15.80	15.01	13.24	9.57	0.932	1.004
Clerks	13.05	11.22	11.08	13.64	11.69	9.22	1.045	1.042
Salesmen	10.94	9.09	16.72	12.80	10.43	11.95	1.170	1.147
Farmers	12.33	10.19	9.32	13.92	11.75	7.99	1.129	1.153
Craftsmen	12.63	10.71	14.23	14.06	11.97	19.02	1.113	1.118
Machine operators	13.35	11.20	11.77	14.31	12.50	8.78	1.072	1.116
Elementary occupations	11.92	9.10	16.37	9.59	8.40	5.24	0.804	0.923

Source: own calculations based on the BKL data set.

Econometric strategy

There are many statistical procedures that are used for wage gap analyses that allow us to isolate the effects of so-called observables on differences in earnings. However, there is probably no single method that would allow us to address all the methodological problems that arise while studying intersectoral wage gaps. We use an endogenous treatment-regression model, also known as an endogenous dummy-variable model. It uses a linear model for the outcome and a constrained normal distribution to model the deviation from the conditional independence assumption. The model was brought into the modern literature by HECKMAN (1976). MADDALA (1983) derived the maximum

likelihood and two-step estimators of the version implemented here, reviewed some empirical applications of this model, and described it as a constrained endogenous-switching model. BARNOW, CAIN and GOLDBERGER (1981) derived the conditions for which the self-selection bias of the simple OLS estimator of the treatment effect, δ , is non-zero and of a specific sign.

The basic intuition behind the model is as follows: if individuals make optimal choices concerning their sector of employment on the basis of their unobserved characteristics (e.g., gains or ability), for the observed subsample of public-sector workers, the error in the wage equation will have a non-zero expected value that is different from that of private sector workers. In order to address this problem, we must recover an estimate of the conditional mean of these unobservables for the public and private sector workers and add it to the wage equation (similar to adding the omitted variable creating bias).

More formally, the endogenous treatment-regression model is composed of an equation for the outcome y_j and an equation for the endogenous treatment t_j :

$$y_j = x_j\beta + \delta t_j + \varepsilon_j,$$

$$t_j = \begin{cases} 1, & \text{if } w_j\gamma + u_j > 0 \\ 0, & \text{otherwise,} \end{cases}$$

where x_j are the covariates used to model the outcome, w_j are the covariates used to model the treatment assignment, and the error terms ε_j and u_j are bivariate normals with mean zero and the covariance matrix:

$$\begin{bmatrix} \sigma^2 & \rho\sigma \\ \rho\sigma & 1 \end{bmatrix}.$$

It is assumed that covariates x_j and w_j are unrelated to the error terms – in other words, they are exogenous.

The dependent variable of the model is the natural logarithm of the hourly net wage rate. The independent variables in the wage equation were chosen based on the Mincerian approach (MINCER 1974) and included: gender, age, age squared, level of education, job experience, occupational dummies, employer ownership sector, class of settlement unit, regional dummies and yearly dummies. The selection equation included several variables: gender, age, level of education, the means by which a given job was found, class of settlement unit, regional dummies and yearly dummies.

Estimate results

Table 3 includes the results of the estimates of the sector selection model. Based on these three specifications, a specification 3 was chosen to be used in the joint two-step estimation of linear regression with endogenous treatment.

Table 3
Model of probability of public-sector employment: results of probit estimates

Specification	1	2	3
Female (Base category = males)	0.2862*** [0.000]	0.2900*** [0.000]	0.2945*** [0.000]
Tertiary	1.0201*** [0.000]	1.0427*** [0.000]	1.0549*** [0.000]
Secondary voc.	0.2663*** [0.000]	0.2634*** [0.000]	0.2711*** [0.000]
Secondary gen.	0.2098 [0.233]	0.2239 [0.206]	0.2620 [0.378]
Basic voc. (Base category = primary)	-0.1205*** [0.000]	-0.1400*** [0.000]	-0.1355*** [0.000]
Age	0.0360*** [0.000]	0.0341*** [0.000]	0.0347*** [0.000]
Direct contact with employer	-	0.6675*** [0.000]	0.6485*** [0.000]
Family members	-	0.3840*** [0.000]	0.2825*** [0.000]
Advert	-	0.0857 [0.126]	0.0665*** [0.005]
Job centre	-	0.7558*** [0.000]	0.6693*** [0.000]
School	-	0.1599 [0.251]	0.1254 [0.185]
Other channel (Base category = internet)	-	0.0752*** [0.000]	0.0565 [0.390]
Towns up to 20 th.	-	-	0.0182 [0.516]
Towns 20–200 th.	-	-	-0.0390* [0.068]
Cities 200 th. +	-	-	-0.0898*** [0.002]
Warsaw (Base category = rural areas)	-	-	-0.2369*** [0.000]
Constant	-2.3411*** [0.000]	-2.1497*** [0.000]	-2.0957*** [0.000]
Regional dummies	no	no	yes
Yearly dummies	yes	yes	yes
Number of observations	22,753	22,746	22,746
Log likelihood	-12,315.879	-12,310.587	-12,306.021

Note: p – values are reported in square brackets.

Significance is denoted by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own calculations based on the BKL data set.

Generally, the results of the probit equation are fairly sensible and cohere with expectations: women have a higher probability of employment in the public sector than men, and this probability increases with age. As for education levels, persons with vocational education have a higher probability of employment in the private sector, while individuals with higher levels of education are more likely to work in the public sector, with this effect being particularly strong in the case of tertiary graduates. Persons that search for jobs via direct contact with employers or with the help of job centres have the highest probability of public-sector employment. By comparison to rural areas, the opportunities for private sector jobs are greater in all types of cities with more than 20 th. inhabitants.

In the next stage a full two-step linear model of wages with endogenous decision of sector of employment was estimated. The results are presented in Table 4. Generally, the results of the wage equation are sensible and in accordance with expectations: women, *ceteris paribus*, get lower wages than men (with wage penalties varying between 18% and 23%, depending on the specification). More job experience, both general and specific, increases wages, although the effect reverses once the employee reaches 52–54 years of age (depending on specification). The higher one's level of education, the higher their wage rate. However, the premium for education falls significantly when we include the occupational dummy in the model. A significant effect of agglomeration was found: living in a big city (and in Warsaw in particular) meant a significant wage premium. For cities up to 200 th. inhabitants the wage premium is relatively low (as compared to rural areas), although it is significant. It increases for bigger cities and exceeds 25% for Warsaw. As for the most important variable in the context of the study, the public-sector wage premium (ATE) was found to be significantly positive, although quite moderate (between 2.5% and 4.3%, depending on specification). This may be interpreted as a sign of the maturity of the Polish labour market and the advancement of the transition process. In this aspect, Poland – one of the leaders of the economic transition in the region – seems to have caught up with the developed countries, where the positive public-sector wage premium is well-documented.

In Table 4, the coefficients on the wage covariates do not vary by sector of employment. The differences in wages between public and private sector employees are modelled as a level shift captured by the coefficient on the indicator for sector. Now we want to allow some of the coefficients to vary over employers' sectors and then use margins to estimate the ATE. We begin by estimating the parameters of the model in which the coefficients on gender, education level and class of settlement unit differ for public and private sector workers. The results of these estimates are presented in Table 5. Due to the

Table 4

The results of a two-step linear model of wages with endogenous decision of sector of employment

Specification	1	2	3
Female	-0.2303*** [0.000]	-0.1765*** [0.000]	-0.1945*** [0.000]
Age	0.0315*** [0.000]	0.0217*** [0.000]	0.0321*** [0.000]
Age squared	-0.0003*** [0.000]	-0.0002*** [0.000]	-0.0003*** [0.000]
Tertiary	0.5779*** [0.000]	0.4956*** [0.000]	0.3805*** [0.000]
Secondary voc.	0.2325*** [0.000]	0.1637*** [0.000]	0.1738*** [0.000]
Secondary gen.	0.2361*** [0.000]	0.1438*** [0.000]	0.1936*** [0.000]
Basic voc.	0.0761*** [0.000]	0.0366*** [0.000]	0.0186*** [0.000]
Job experience	0.0075*** [0.000]	0.0064*** [0.000]	0.0068*** [0.000]
Towns up to 20 th.	0.0612*** [0.003]	0.0596*** [0.003]	0.0314*** [0.009]
Towns 20–200 th.	0.0555*** [0.004]	0.0555*** [0.004]	0.0555*** [0.007]
Cities 200 th. + (excluding Warsaw)	0.1917*** [0.000]	0.1517*** [0.000]	0.1139*** [0.000]
Warsaw (Base category = rural areas)	0.3971*** [0.000]	0.2791*** [0.000]	0.2571*** [0.000]
Public (Base category = private)	0.0425*** [0.000]	0.0318*** [0.000]	0.0251** [0.022]
Constant	2.3954*** [0.000]	2.6846*** [0.000]	2.1951*** [0.000]
Lambda	0.0794* [0.072]	-0.0786* [0.098]	-0.0205 [0.458]
Rho	-0.1825	-0.1978	-0.0389
Sigma	0.4351	0.3978	0.5274
Regional dummies	yes	yes	yes
Occupational dummies (1d)	no	yes	no
Occupational dummies (2d)	no	no	yes
Yearly dummies	yes	yes	yes
Number of observations	22,746	22,746	22,746

Note: p – values are reported in square brackets.Significance is denoted by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own calculations based on the BKL data set.

complexity of the model, only one specification has been presented, which controls for 2-digit occupational groups, regions and years of data collection. The results of the estimation show that there are substantial differences in the determinants of wages in both sectors. In accordance with the results of other

studies, women are less discriminated against in the public than in the private sector. Although the public sector is a main source of demand for tertiary education, it is the private sector that better rewards those with the highest qualifications. If you live in Warsaw and work in the public sector, you may enjoy a significant positive wage premium (almost 23%) but, in the case of the private sector, the premium would be substantially higher (almost 35%). In the case of smaller cities similar differences prevail, with the exception of towns of between 20 th. and 199 th. inhabitants. The difference between different types of cities is even more significant if we restrict our sample to only those with a tertiary education.

Because we interacted the variable denoting ownership sector with three of the covariates, the estimated coefficient on the sector is not an estimate of the ATE. However, we may use margins to estimate the ATE from these results. In our case, ATE was estimated to equal 0.0469 with a standard error of 0.0132, while ATT was estimated to equal 0.0423 with a standard error of 0.0167.

Table 5

The results of a two-step linear model of wages with endogenous decision of sector of employment: heterogeneous impact of sector of employment

Covariates	Total sample	Individuals with tertiary education
1	2	3
Female × Private	-0.2680*** [0.000]	-0.1466*** [0.000]
Female × Public	-0.2059*** [0.000]	-0.1743*** [0.000]
Age	0.0268*** [0.000]	0.0564*** [0.000]
Age squared	-0.0003*** [0.000]	-0.0005*** [0.000]
Tertiary × Private	0.1867*** [0.000]	-
Tertiary × Public	0.1768*** [0.000]	-
Secondary vocational × Private	0.0899*** [0.000]	-
Secondary vocational × Public	0.1165*** [0.000]	-
Secondary general × Private	0.1023*** [0.000]	-
Secondary general × Public	0.1229*** [0.000]	-
Basic vocational × Private	0.0639*** [0.000]	-
Basic vocational × Public	0.0647*** [0.000]	-

cont. table 5

1	2	3
Job experience	0.0062*** [0.000]	0.0041*** [0.000]
Towns up to 20 th. × Private	0.0350*** [0.001]	0.0550*** [0.000]
Towns up to 20 th. × Public.	0.0066 [0.667]	0.1111*** [0.000]
Towns 20–200 th. × Private	0.0601*** [0.000]	0.0501*** [0.000]
Towns 20–200 th. × Public	0.0797*** [0.000]	0.1397*** [0.000]
Cities 200 th. (excluding Warsaw) + × Private	0.1180*** [0.000]	0.2180** [0.029]
Cities 200 th. (excluding Warsaw) + × Public	0.0959*** [0.000]	0.1759** [0.047]
Warsaw × Private	0.3494*** [0.000]	0.5194** [0.033]
Warsaw × Public	0.2332*** [0.000]	0.1332* [0.071]
Public	0.0511*** [0.000]	0.0102* [0.081]
Constant	1.7589*** [0.000]	1.4744*** [0.000]
Regional dummies	yes	yes
Occupational dummies (1d)	no	no
Occupational dummies (2d)	yes	yes
Yearly dummies	yes	yes
Number of observations	22,491	5,569
Log pseudolikelihood	-24,536.25	-7,121.76

Note: p – values are reported in square brackets.

Significance is denoted by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: own calculations based on the BKL data set.

Conclusions

The objective of this paper was to investigate public-private wage differentials in Poland and their spatial variation in terms of types of settlement units. We applied the control function methodology (both with homogeneous and heterogeneous impacts) to show that, after controlling for structural differences in employment, there is generally a moderate positive premium related to public employment. However, this premium differs between types of settlement units, with public employment being most attractive in medium-sized cities. It may be related to several facts. First, the level of wages in the public sector is generally less spatially differentiated than wages in the private sector, where the correlation between wages and size of settlement unit is positive and

statistically significant. This brings about an effect of the relative attractiveness of private sector employment in the biggest cities. In rural areas, the public sector is relatively underdeveloped, which often results in lack of alternatives for employment in the public sector. Moreover, the average level of educational requirements in the private sector is considerably higher in the biggest cities than in smaller town and rural areas. These are the biggest cities where private economic activity requiring the highest level of qualifications is concentrated (information and communication, financial and insurance activities, professional, scientific and technical activities, administrative and support service activities). As a result, these are the biggest agglomerations where the private sector is an attractive alternative to employment in the public sector for persons with tertiary education and a negative public sector wage premium is observed.

This phenomenon poses a considerable challenge for the public sector in the biggest cities regarding attracting highly qualified employees, which may seriously threaten the efficiency of public-sector services provision (education, healthcare, administration). Due to the low wage attractiveness of public-sector jobs, the public sector in the biggest cities may face serious difficulties in attracting and retaining qualified employees. In addition, low wages could encourage moonlighting, which might similarly weaken the efficiency of the public sector.

The rate of return on higher education in smaller cities is lower than in major centres. Meanwhile, the inputs necessary to attain a tertiary level of education are not similarly reduced. This raises a question of the effectiveness of the educational choices of young Poles.

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