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PUBLIC-PRIVATE WAGE DIFFERENTIAL IN A POST-TRANSITION ECONOMY: A COPULA APPROACH TO THE SWITCHING REGRESSION MODEL

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Public-private wage differential in a post-transition economy: a copula approach to the switching regression model

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Abstract

In this study, we estimate the public sector wage premium in a post-transition economy, a quarter of a century since the collapse of the old regime. Our methodology uses a copula method to estimate the switching regression model, which allows for the relaxation of the restrictive assumption of joint normality. We control for employment selection into both sectors using an instrument based on information regarding learned professions. We use data from the Polish Survey of Earnings by Occupations (2012). Contrary to earlier results for Poland, we found positive selection into employment in both sectors, with positive ATET and negative ATEU. The results suggest that both private and public sector employees select themselves into the sector in which they earn more than they would in a counterfactual scenario.

Keywords:
public sector, private sector, wage differentials, switching regression

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1 Introduction

More than a quarter of a century has passed since the beginning of the economic transition of the Central European countries. Although these countries adopted different strategies on the path to market-oriented economies, one element was common – the dynamic growth of the role of the private sector, both in the formation of GDP and in employment. Nevertheless, the public sector still constitutes a significant portion of labour demand in Central and Eastern European countries. In 2013, among 11 post-socialist economies then belonging to the EU, the share of total employment constituted by public sector employees varied between 25% in Poland and 34% in the Czech Republic (Eurostat, 2016) – among the highest shares in the whole EU. The importance of the public sector to a national labour market extends beyond its borders. For reasons both institutional (bargaining mechanisms and wage setting processes) and strictly economic (wage arbitrage), the level and structure of wages in the public sector impact their private counterparts, thereby affecting the overall competitiveness of the economy, the inflation rate and other macroeconomic variables.

In transition economies, a negative public sector pay gap has been commonly estimated, contrary to the results of numerous analyses of the public-private wage gap in developed countries. The size of the penalty was found to be particularly high in the initial years of the transition. This finding clearly runs counter to the results established for developed and developing countries, where a public sector pay gap has been usually found to be positive. It was expected that these wage differentials would make it difficult for the public sector to attract and retain skilled employees. In addition, lower wages in the public sector might have encouraged moonlighting and compromised the efficiency of the public sector (Adamchik and Bedi, 2000). In the first years of the transition, public sector employment was often regarded as a dead-end jobs sector, with low wages and – most importantly – poor career prospects. At the same time, the private sector was dynamically growing with many branches offering attractive salaries and development opportunities. Now, a quarter of a century since the beginning of the economic transition, following significant modifications in the structure of the labour force (for example, the boom in tertiary education), changes induced by globalization, and growing levels of economic development and openness, questions regarding the public sector wage premium are still relevant. There are many reasons for us to expect the relative attractiveness of public sector employment to have grown, particularly given recent economic turmoil and the growth of insecurity of employment in the private sector.

Poland is no exception in this regard. It has been demonstrated in several papers that, after controlling for structural differences in employment, the public sector wage premium in Poland is negative (Adamchik and Bedi, 2000; Socha and Weisberg, 2002; Newell and Socha, 2007; Grotkowska and Wincenciak, 2014). The wage penalty was found to be particularly high for persons with tertiary education, whose share in total employment has grown significantly since the transition. The most recent studies, referring to the latest data from the post-EU accession period, suggest a reversal of the sign of the public sector wage premium. However, none of these recent studies took into account the question of the sector selection mechanism, which may significantly impact estimates of the public-private wage gap.

The aim of this article is to estimate the size of the public wage premium in Poland, almost 25 years after the beginning of the transition to a market economy. The methodology adopted in the study allows us to take into account selection into employment in both sectors and to show that, in fact, the public sector has become a desirable employment opportunity. Additionally, we use the copula method to estimate a well-known switching regression model to relax the restrictive assumption of joint normality (adopted in most of the existing literature).

This article consists of three parts. The first part presents an overview of the literature, with a special focus on key strategies and the main results of estimations of the public sector wage premium for transition economies in Central and Eastern Europe generally, and Poland in particular. The second part describes the employment structure and the differences in wage structure in both sectors. The final section presents the econometric model and the estimation strategy. Data used in the analysis are taken from the survey on the structure of earnings by occupations (SEO) for the year 2012. Using the copula method, we estimate the parameters of the switching regression model for wages, taking into account selection into public or private sector employment and calculating the expected conditional wages for both groups of workers. The article ends with conclusions and suggestions for further research.

2 Review of studies on public sector wage premia in transition economies

The issue of the sectoral wage gap has been intensively empirically explored over recent decades. In fact, research on the public-private sector pay differential has gone through a significant methodological evolution. For developed countries, the results of most studies, irrespective of the econometric method used, seem to be consistent, revealing positive public sector wage premia. The results have been more ambiguous in relation to developing countries and, in particular, post-communist economies. In the latter case, public sector pay penalties have been identified, but tend to diminish with the progress of transformation and development (Laušev, 2014).

Estimations of public-private sector wage gaps may use both macro and micro data. A macroeconometric approach is usually based on macro level panel data (see, for example: Katz and Krueger, 1991; Elliott and Duffus, 1996; Friberg, 2007; Lamo et al., 2012). Microeconometric methods use individual level data to isolate the effects of so-called observables on differences in earnings and to estimate wage gaps using worker and job characteristics in both sectors. Generally, there are three main methodological problems to be addressed in this kind of research.

First of all, if public sector employees differ in their characteristics as compared to their private sector counterparts (for example, if they are, on average, better educated), a standard parametric approach may yield misleading results due to the common support problem. That is to say, there may be no – or not enough – comparable private sector employees to ensure the parametric estimates are relevant. Second, there may be non-random selection into public sector employment, which may lead to biased estimates of the parameters showing the impact of employment sector on wages. Third, adjusted wage premia may differ in different sections of the wage distribution.

Another source of methodological difficulty is the quality and accuracy of the data. This is a particularly acute issue in cases of transition and post-communist countries in which dynamic changes in employment patterns have been observed (Svejnar, 1999). Common problems in this area include measurement errors, sampling biases and omitted variables (Laušev, 2014). In such cases, even sector definitions vary due to the complicated ownership structure of firms in some countries (Jovanović and Lokshin, 2004; Brainerd, 2002; Telegdy, 2006; Laušev, 2012) or measurement error in sector identification due to, for example, changes in the ownership structure of the economy (Brainerd, 2002). Wage definition is sometimes problematic due to unobservable non-wage components of pay or wage arrears that are non-randomly distributed between sectors (Jovanović and Lokshin, 2004).

There are numerous techniques used in the research on public-private wage differentials to address these methodological issues. They can be grouped into the following categories: single equation wage models (using OLS estimations) with sector dummy variables (for example, Jacobsen, 1992; Dustmann and Van Soest, 1997; Disney and Gosling, 2003), quantile regression models (Koenker and Basset, 1978; Lucifora and Meurs, 2006), double equation models with Oaxaca-Blinder decomposition (Oaxaca, 1973; Oaxaca and Ransom, 1994) and absolute differential measures (Belman and Heywood, 2004) as the development of the latter, and switching regression (Adamchik and Bedi, 2000; Jovanović and Lokshin, 2003; 2004; Falaris, 2004; Heitmueller, 2006; Tiagi, 2010). Some of these methods are applied with Heckman selection correction (Heckman, 1979) to compensate for non-random sector sorting (Dustmann and Van Soest, 1998; Melly, 2006; Depalo and Giordano, 2011; Chernozhukov and Hansen, 2005). In cases of analyses using a panel data approach, fixed-effect estimators may be inconsistent if sector choices vary over time due to unobservable variables, such as mass privatization (Vella, 1998; Disney and Gosling, 2003). There is probably no single method that could resolve all methodological challenges faced by this type of research. The selection of a specific approach for a given study is instead driven by the particular research question and type of data available.

The literature concerning developed economies shows stable public sector wage premia, particularly for low-skilled workers and women (Ehrenberg and Schwarz, 1986; Gregory and Borland, 1999). These results are in line with empirical findings for developing countries where public wage premia are even more substantial (Glinskaya and Lokshin, 2007; Christofides and Pashardes, 2002; Nielsen and Rosholm, 2001; Terrel, 1993; Stelcner et al., 1989; Van der Gaag and Vijverberg, 1988; Lindauer and Sabot, 1983). The results for European post-transition economies are largely inconsistent with the findings for other countries (see, for Romania: Christou, Klemm and Tiffin, 2007; for Poland: Newell and Socha, 1998; Adamchik and Bedi, 2000; Adamchik, Hyclak and King, 2003; Keane and Prasad, 2006; Newell and Socha, 2007; for Poland and Russia: Lehmann and Wadsworth, 2000; for Serbia and Montenegro: Jovanović and Lokshin, 2003; for Bulgaria: Falaris, 2004; for Russia: Brainerd, 2002; Jovanović and Lokshin, 2004; for Estonia: Leping, 2006; for Hungary: Telegdy, 2006; Laušev, 2012; for Ukraine: Gorodnichenko and Sabirianova, 2007; for Serbia: Krstić, Litchfield and Reilly, 2007). The developing post-communist economies in the early transition stages experienced

dynamic development of the private sector resulting in a substantial increase in earnings, while the public sector was burdened with overemployment and institutional regulations inherited from the previous regime (Boeri and Terrell, 2002; Gorodnichenko and Sabirianova, 2007). Another explanation for a public pay penalty in Eastern European countries is the 'brain drain' phenomenon, benefiting the growing, recapitalized private sector (Nickell and Quintini, 2002), as well as first-mover advantage (Jurajda and Terell, 2003). This process resulted in a decrease of human capital quality in the public sector due to negative selection (Adamchik and Bedi, 2000). Public sector pay-penalties seem to have disappeared as economic transitions reached maturity and institutional residues of communism have faded away (Leping, 2006; Gorodnichenko and Sabirianova, 2007; Laušev, 2012).

On average, a 15% pay penalty for public sector workers was observed in the early stage (1990-1995) of transitions in most of the post-communist countries. The maximum private sector premium of between 20% and 28% (for example, Serbia: Krstić, Litchfield and Reilly, 2007; Hungary: Lausev, 2012) was reached during the late 1990s. This declined over time and by between 2002 and 2008 had seemingly faded away or turned negative (Laušev, 2014). Poland has gone through a similar but slightly accelerated such pattern of public sector wage premium evolution. Adamchik and Bedi (2000) found that the public wage premium was negative in the early transition stage in Poland. The wage premium for the private sector was around 20% (this effect was particularly strong for individuals with higher education). Socha and Weisberg (2002) showed that, in the late 1990s, wages in the private sector were higher by approximately 10% as compared to the public sector, after controlling for personal and job characteristics. Moreover, Socha and Weisberg (2002) suggested that this can be linked to the fact that Polish trade unions did not press for wage increases, given their commitment to economic and governing reforms. The study by Newell and Socha (2007) demonstrated the process of a decreasing positive wage premium for the private sector in the late 1990s (with an hourly wage gap of 11% in 1994 declined to 8% by 1998) and the lack of a sectoral wage premium after 2000 (finding an hourly wage gap of 0% in 2002 and 2004). However, the evolution of public sector wage premia in the final phase of these transitions has been relatively weakly documented in most of the post-communist countries. Poland, for which the evolution was slightly anticipatory by comparison with other transition economies, is a particularly interesting case for investigation.

3 Data and empirical study

3.1 Data description

For the empirical part of this paper, we use individual data from the survey on the SEO carried out by the Central Statistical Office in Poland (CSO). The SEO data set is based on a large-scale firm survey carried out biennially. It is a sample survey and covers those entities of the national economy with more than nine employees (both full- and part-time). In 2012 (the last year for which individual data are available) the sample included 725,239 employees. The greatest advantage of this data set is its precise information on gross salaries.

A minor weakness of this data set is its limited information on the personal characteristics of employees (for example, a lack of information on employees' family backgrounds or labour market histories). Information on a worker's human capital includes their level of education, job tenure and occupation. Firm characteristics are limited to their size according to number of employees, ownership and industry type. It should also be borne in mind that the firm size restriction might have an important impact on average wages, given that the share of small firms is considerably higher in the private sector. Details of the survey methodology can be acquired from the CSO (2015).

We also considered labour force survey (LFS) data as an interesting alternative to the SEO. However, the LFS suffers from several shortcomings which render it an unreliable data source. Firstly, wage information is based on respondents' declarations. This results in a certain inconsistency, since many respondents may knowingly understate or overstate the level of their declared wage, while others may simply be able only to provide an approximate value. Secondly, the LFS suffers from missing data on wages. In 2013, the share of missing values accounted for 27.6% of the surveyed population. The problem of missing values is even more important if one suspects a non-random selection of refusals. Taking this all into consideration, we determined SEO data to be a better fit for our topic of interest.

3.2 Selection into employment in the public sector and the wage premium: basic facts

Table 1 presents basic statistics on the structure of the population employed in the 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 60% of employees in the public sector are women. In the private sector, by contrast, this share is just slightly above 40%. This situation has persisted for several years and may be related to the specific structures of economic activity in both sectors. Most workers in the public sector are employed in occupations specific to non-market services (healthcare, education, administration) and these are clearly more often performed by women.

Table 1: Structure of the population employed in public and private sectors

	Private	Public	Total	Public /Private
Sex				
Men	59.09	38.05	49.6	0.644
Women	40.91	61.95	50.4	1.514
Education				
Tertiary	29.05	52.27	39.53	1.799
Secondary vocational	28.26	24.56	26.59	0.869
Secondary general	9.97	5.60	8.00	0.562
Basic vocational	26.09	13.28	20.31	0.509
Basic general	6.63	4.29	5.58	0.647
Type of contract				
Permanent	66.65	87.16	75.90	1.308

Table 1 – cont.

	Private	Public	Total	Public /Private
Fixed-term	31.90	12.04	22.94	0.377
Civil contract	0.25	0.33	0.28	1.320
Probation	1.20	0.47	0.87	0.392
Firm size				
up to 20	11.55	5.63	8.88	0.487
21-50	13.11	17.31	15.00	1.320
51-100	10.30	16.08	12.91	1.561
101-250	16.72	14.94	15.92	0.894
251-1000	26.13	21.63	24.10	0.828
1001+	22.20	24.41	23.20	1.100
NACE section				
Agriculture	0.74	1.07	0.89	1.446
Mining	1.13	3.89	2.37	3.442
Manufacturing	40.13	4.81	24.20	0.120
Electricity and gas	2.27	2.01	2.15	0.885
Water supply	0.77	2.87	1.72	3.727
Construction	6.69	0.78	4.02	0.117
Trade	19.13	0.39	10.67	0.020
Transportation	3.55	7.93	5.52	2.234
Accommodation	1.84	0.69	1.32	0.375
Information	3.97	0.94	2.60	0.237
Finance and insurance	5.37	2.29	3.98	0.426
Real estate	1.67	1.04	1.38	0.623
Professional activities	2.76	1.99	2.41	0.721
Administration	4.55	0.54	2.74	0.119
Public administration	0.00	16.36	7.38	NA
Education	1.70	29.02	14.02	17.071
Human health	2.87	20.55	10.85	7.160
Arts	0.36	2.68	1.41	7.444
Other	0.53	0.15	0.36	0.283
Occupational group				
Managers	8.99	6.56	7.90	0.730
Professionals	16.65	42.42	28.28	2.548
Technicians	10.77	14.45	12.43	1.342
Clerks	8.71	9.64	9.13	1.107
Salesmen	12.58	4.69	9.02	0.373
Farmers	0.17	0.20	0.19	1.176
Craftsmen	18.95	6.49	13.33	0.342
Machine operators	15.38	6.90	11.55	0.449
Elementary occupations	7.80	8.65	8.19	1.109
Age				
mean	39.0	43.8	41.2	1.123
p25	30.0	36.0	32.0	1.200
p50	38.0	45.0	41.0	1.184
p75	48.0	52.0	50.0	1.083
sd	10.9	10.1	10.8	0.923
Tenure				
mean	8.3	13.4	10.6	1.613
p25	2.0	4.8	2.8	2.375

Table 1 – cont.

	Private	Public	Total	Public /Private
p50	5.2	11.1	7.1	2.143
p75	11.6	20.9	16.1	1.807
sd	8.8	10.1	9.7	1.154

Source: Own calculations, SEO 2012.
Note: Names of occupational groups and NACE were abbreviated (ISCO-08).

The public sector, on average, employs older workers than does the private sector: the mean age of an employee in the private sector is 39.0 years, while in the public sector it is 43.8 years. Perhaps the most important area of difference between the public and private sectors is human capital. According to the SEO (2012), more than half of public sector employees have higher education, and almost a quarter have vocational secondary or post-secondary education. In the private sector, the largest group are workers 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 (at more than 42%).

Table 2 summarizes the basic descriptive statistics of wage distribution in both sectors. These statistics were calculated using information on hourly gross wage rates. Generally, the average wage level is higher in the public sector across almost all labour force characteristics. Nevertheless, the scale of the gross premium is different for particular groups of workers, and also depends on the location measure used in comparisons.

The average gross premium in the sample is almost 19.0%. This figure is significantly higher if we take the median as the measure of the central tendency of wage distribution (30.9%). This is due to the fact that, for the top percentiles of wage distribution, the private sector offers considerably higher wages than do public employers. The public/private average wage ratio falls below 1 at the 96th percentile and falls to 0.72 for the top 1% of earners.

Table 2: Wage distribution characteristics: public versus private sector

	Private			Public			Public/private	
	Mean	p50	Sd	Mean	p50	Sd	Mean	p50
Total	21.32	16.12	20.38	25.38	21.10	15.72	1.190	1.309
Sex								
Men	22.98	17.39	22.52	26.68	22.46	17.69	1.161	1.291
Women	18.93	14.37	16.54	24.57	20.24	14.32	1.298	1.408
Education								
Tertiary	32.60	24.18	31.24	31.38	28.12	17.38	0.963	1.163
Secondary vocational	18.44	15.72	11.80	20.01	18.30	9.83	1.085	1.164
Secondary general	17.19	14.10	13.02	18.67	16.54	14.60	1.086	1.173
Basic vocational	15.25	13.35	8.51	17.67	15.17	8.90	1.159	1.136
Basic general	14.33	12.58	6.74	15.45	12.97	7.50	1.078	1.031

Table 2 – cont.

	Private			Public			Public/private	
	Mean	p50	Sd	Mean	p50	Sd	Mean	p50
Type of contract								
Permanent	24.71	18.89	23.10	25.93	21.53	15.97	1.050	1.140
Fixed-term	14.56	12.23	10.43	21.48	17.96	12.92	1.475	1.469
Civil contract	14.50	10.18	20.81	25.13	16.96	21.21	1.733	1.665
Probation	14.73	11.27	10.58	21.68	18.18	14.67	1.471	1.613
Firm size								
up to 20	15.24	10.89	13.23	24.38	19.94	14.25	1.600	1.831
21-50	18.53	13.78	17.19	26.39	22.66	15.13	1.424	1.645
51-100	20.14	15.19	19.94	28.21	24.46	16.03	1.401	1.610
101-250	20.89	15.80	20.28	23.97	19.38	14.87	1.148	1.227
251-1000	23.37	17.93	22.02	23.26	19.87	13.84	0.995	1.108
1001+	24.61	18.91	22.39	25.75	21.94	17.81	1.046	1.160
NACE section								
Agriculture	16.93	14.25	10.61	26.80	25.12	12.84	1.583	1.764
Mining	30.85	28.44	20.18	32.59	30.36	14.26	1.056	1.068
Manufacturing	20.13	16.34	17.13	22.47	19.40	13.59	1.116	1.188
Electricity and gas	33.70	29.80	17.54	28.32	24.14	14.69	0.840	0.810
Water supply	20.14	16.85	15.34	20.93	19.12	10.04	1.039	1.135
Construction	19.62	15.30	17.50	24.01	20.92	12.50	1.223	1.368
Trade	18.20	13.37	17.83	22.30	19.25	12.78	1.225	1.440
Transportation	18.06	14.29	14.35	23.81	19.94	20.45	1.318	1.395
Accommodation	14.56	11.18	11.69	19.09	15.27	11.73	1.311	1.365
Information	35.56	27.50	32.11	34.62	27.16	30.57	0.974	0.988
Finance and insurance	33.08	23.93	33.84	33.99	27.17	23.84	1.027	1.136
Real estate	20.55	16.33	19.90	20.53	17.12	11.99	0.999	1.049
Professional activities	31.85	22.68	34.78	26.66	22.21	19.69	0.837	0.979
Administration	14.69	10.00	14.10	17.44	14.39	10.05	1.188	1.439
Public administration	–	–	–	23.62	19.63	13.20	–	–
Education	20.87	17.14	14.12	30.03	29.56	16.09	1.439	1.725
Human health	19.76	15.94	14.63	20.83	17.81	12.85	1.054	1.118
Arts	15.42	10.87	12.15	18.29	15.61	9.44	1.186	1.436
Other	18.64	12.89	18.52	19.46	17.41	10.20	1.045	1.351
Occupational groups								
Managers	47.71	34.02	47.36	38.44	31.74	22.75	0.806	0.933
Professionals	29.08	24.41	19.58	31.56	28.63	15.26	1.085	1.173
Technicians	22.58	19.80	12.90	20.56	17.74	15.76	0.911	0.896
Clerks	16.93	14.94	8.98	18.28	17.00	7.12	1.080	1.138
Salesmen	12.47	10.75	5.95	14.65	12.55	6.80	1.175	1.168
Farmers	14.53	12.17	7.25	16.38	14.26	7.84	1.127	1.172
Craftsmen	16.49	14.90	7.64	21.18	19.20	8.85	1.285	1.288
Machine operators	16.89	15.15	7.85	22.95	20.68	9.77	1.359	1.364
Elementary occupations	12.46	11.00	5.04	12.19	10.80	4.64	0.978	0.981
Age groups								
16-19	11.23	10.28	4.01	13.02	11.04	5.12	1.159	1.074
20-24	13.52	12.05	5.76	16.77	14.02	9.28	1.241	1.163
25-29	18.28	15.65	10.94	20.10	17.40	10.59	1.100	1.112
30-24	22.51	17.59	18.46	23.98	20.63	13.57	1.065	1.173
35-39	24.39	17.58	23.30	26.75	22.50	16.11	1.097	1.280

Table 2 – cont.

	Private			Public			Public/private	
	Mean	p50	Sd	Mean	p50	Sd	Mean	p50
40-44	24.19	16.85	27.59	27.48	22.96	16.96	1.136	1.363
45-49	21.85	16.09	23.95	27.11	22.29	16.18	1.241	1.385
50-54	20.61	15.97	19.10	25.33	20.83	15.87	1.229	1.304
55 and older	22.14	16.63	21.91	25.35	20.78	16.64	1.145	1.250
Job experience								
up to 3 months	17.67	13.19	17.61	21.61	17.64	14.34	1.223	1.337
3-5 months	20.37	15.48	19.74	22.76	18.97	14.29	1.117	1.226
5-10 months	22.05	16.82	20.18	24.70	20.44	15.33	1.120	1.215
10-15 months	25.55	18.69	25.35	27.48	22.66	16.24	1.076	1.212
15-20 months	25.93	19.75	25.92	26.79	22.05	16.91	1.033	1.116
20-30 months	25.27	21.44	17.53	27.50	23.07	15.94	1.088	1.076
more than 30 months	25.07	21.26	18.67	26.19	22.09	15.60	1.045	1.039

Source: Own calculations, SEO 2012.

Note: Names of occupational groups and NACE were abbreviated (ISCO-08).

The difference in wages between the two sectors is significantly larger for women than for men (29.8% versus 16.1%, respectively; if we consider the median, the rate exceeds 40% for women and 29% for men). This effect stems from the fact that, in the private sector, women's wages are considerably lower than men's (the ratio of their average wages is 0.82, while it is 0.92 in the public sector).

We observe a U-shape relationship between age and the ratio of wages in the public and private sectors. The gross premium is highest for the youngest employees (20-24 years) and for workers in the immobile age range (45-54 years). When we attend to medians, the public sector wage advantage for the youngest workers falls somewhat, yet it becomes even greater in cases of workers aged 40 and above.

As for levels of education, employees with tertiary education are the only group that, on average, earn less in the public than in the private sector (per hour of work). For all other groups, the public sector appears to include the more generous employers, with workers having basic vocational education being particularly favoured. Yet this general picture changes considerably when we look at medians: from this perspective, the public sector pays better for all workers, with similar gross premia of 14-17% for all levels of education (except for those with only a primary education, who are subject to a 3% premium). In the case of tertiary education, we observe a considerable dispersion of wages, particularly in the private sector, with the coefficient of variation equalling 95.8%.

Another measure of human capital is job tenure. Generally, the longer a worker's job experience, the smaller their public sector gross wage premium. This relationship holds both for wage average and for median wages. This picture is consistent with the occupational structure of wages. There are only three groups of occupations for which the average wage (measured both according to the statistical average and the median) is higher in the private than in the public sector. These are managers, technicians and persons performing elementary occupations. The greatest premium for working in the public sector is observed for craftsmen and machine operators.

Although wage rates grow in both sectors with increasing firm size, the difference between the public and private sector is lowest in the larger entities (251-1000 employees). In fact, for the largest firms, the average wages in both sectors are almost equal. This is probably a result of the significantly higher wages of top earners in big private firms: if we compare medians, by contrast, the public sector offers higher wages even in firms employing more than 251 people.

The highest values of the ratio of public to private average wage rates are observed in agriculture, forestry and fishing (1.58), education (1.44), transportation and storage (1.32), accommodation and catering (1.31), trade (1.23) and construction (1.22). There are only three areas in which, on average, the private sector offers higher wages. These are: professional, scientific and technical activities; electricity and gas; information and communication. The kernel density functions of log gross hourly wages in both sectors are presented in Figure 1.

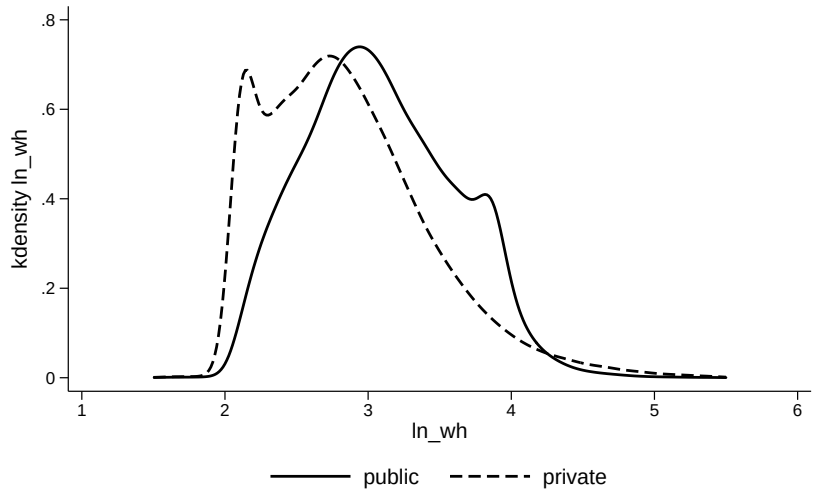

Figure 1: Log of hourly net nominal wage distributions in the private and public sectors.
Source: Own calculations, SEO 2012.

3.3 Econometric model

3.3.1 Model specification

We assume that workers choose between the public and the private sector of the economy, and that their decision to select a particular sector depends on the comparison of expected wages. This decision is also related to the personal characteristics of workers, reflecting the probability of their being selected into a particular sector. Wage equations for public and private sector employees would yield biased results if the process of selection into sectors were (possibly) non-random, and a standard OLS method was thus applied. In the case of non-random selection, we employ an endogenous switching regression model (Maddala, 1983) to study the effects of job and personal characteristics on wages for public and private sector employees. Let's define a latent variable S^*:

$$S^* = \gamma Z \ + \varepsilon_s, \tag{1}$$

with $S = 1$ for $S^* > 0$ if an individual is employed in the public sector and $S = 0$ for $S^* \leq 0$ if an individual is employed in the private sector. Z is a vector of personal characteristics which might importantly impact on the probability of choosing the public over the private sector (we include here: sex, age, education level, regional dummies and a selection variable constructed on the basis of learned professions), γ is a vector of parameters and ε_s is the selection equation error term. The two wage equations for the two regimes (sectors) are then defined as follows:

$$y_1 = \beta_1 X_1 + \varepsilon_1 \qquad \text{if} \ \ S = 1, \tag{2}$$
$$y_0 = \beta_0 X_0 + \varepsilon_0 \qquad \text{if} \ \ S = 0, \tag{3}$$

where X_1 and X_0 are vectors of job and personal characteristics for the public and private sectors, respectively (we include here: sex, age, current job tenure, firm size, type of contract, industry dummies and occupational dummies at the one-digit level), β_1 and β_0 are vectors of parameters, and ε_1 and ε_0 are wage equation error terms. The variance-covariance matrix is given by:

$$\Sigma = \begin{bmatrix} \sigma_{11} & \sigma_{10} & \sigma_{1s} \\ \sigma_{01} & \sigma_{00} & \sigma_{0s} \\ \sigma_{s1} & \sigma_{s0} & 1 \end{bmatrix}.$$

The likelihood function of the standard endogenous switching regression model described above can be written in the general form:

$$L = \prod_{S=0} \int_{-\infty}^{-\gamma Z} f_{s0}(\varepsilon_s, \varepsilon_0) d\varepsilon_s \prod_{S=1} \int_{-\gamma Z}^{\infty} f_{s1}(\varepsilon_s, \varepsilon_1) d\varepsilon_s,$$

where $f_{sj}(\varepsilon_s, \varepsilon_j)$ is the joint density of ε_s and ε_j. Following Smith (2005), this likelihood function can be rewritten as:

$$L = \prod_{S=0} \frac{\partial F_{s0}(0, \varepsilon_0)}{\partial \varepsilon_0} \prod_{S=1} \left(f_1 - \frac{\partial F_{s1}(0, \varepsilon_1)}{\partial \varepsilon_1} \right).$$

It has become standard practice in the labour economics field to estimate the endogenous switching regression model by imposing the rather strong assumption that all errors are jointly normally distributed. Here, we instead use the copula approach, which allows for much greater flexibility in the choice of marginal distributions and the functional form of the copula itself. The standard model assuming trivariate normality is then a special case of the copula approach, taking normal margins and assuming Gaussian copula functions. We will estimate this model alongside a benchmark case.

After estimation, we use the switching regression model to compare the expected earnings of public and private sector employees. Conditional expected wages in both sectors can be calculated as follows:

$$E(y_1|X, S = 1) = \beta_1 X + E(\varepsilon_1|S = 1), \tag{4}$$
$$E(y_0|X, S = 0) = \beta_0 X + E(\varepsilon_0|S = 0), \tag{5}$$
$$E(y_0|X, S = 1) = \beta_0 X + E(\varepsilon_0|S = 1), \tag{6}$$
$$E(y_1|X, S = 0) = \beta_1 X + E(\varepsilon_1|S = 0). \tag{7}$$

The difference between (4) and (5) is the value of expected versus observed (conditional on selection) differences in the earnings of the two groups of workers. Two counterfactual expected earnings can be calculated: the expected earnings of public sector employees had they been working in the private sector, which is given by (6), and the expected earnings of private sector employees had they been working in the public sector, which is given by (7).

3.3.2 A short note on copulas

By contrast to standard endogenous switching regression models assuming joint normality, the copula approach allows for the generation of a joint distribution given known marginal distributions with a specific function called the copula. The concept of copulas was introduced by Sklar (1959). Let ω_1 and ω_2 be two continuous random variables and $v_i = F_i(\omega_i)$ be the cumulative distribution function (c.d.f.) of ω_i. Let $F(\omega_1, \omega_2)$ be the bivariate joint c.d.f. The copula function $C(\cdot)$ transforms two marginal c.d.f.s to generate a bivariate c.d.f.:

$$F(\omega_1, \omega_2) = C\{F_1(\omega_1), F_2(\omega_2); \theta\} = C(v_1, v_2; \theta),$$

where θ is a parameter of the degree of dependence. The copula function $C(\cdot)$ exhibits the following properties:

- $C(v_1, 0; \theta) = C(0, v_2; \theta) = 0$,
- $C(v_1, 1; \theta) = v_1$ and $C(1, v_2; \theta) = v_2$,
- $\partial^2 C / \partial v_1 \partial v_2 \geq 0$.

Many copula functions are available with the special case of the Gaussian copula. For a discussion on copula functions and their properties see, for example, Trivedi and Zimmer (2007).

3.3.3 Treatment effects

Based on the formulated model, we can calculate the average treatment effects (ATE) of the sector choice (Heckman and Vytlacil, 2007). The average treatment effect (ATE) can be calculated as follows:

$$ATE = \beta_1 X - \beta_0 X.$$

The average treatment effect of the public sector choice on the treated ($ATET$) is the difference between the conditional expected earnings of the public sector employees (equation 4) and their counterfactual earnings had they been working in the private sector (equation 6):

$$ATET = E(y_1|X, S = 1) - E(y_0|X, S = 1) = ATE + E(\varepsilon_1|\varepsilon_s > -\gamma Z) - E(\varepsilon_0|\varepsilon_s > -\gamma Z).$$

The average treatment effect on the untreated ($ATEU$) can be calculated as the difference between the conditional expected earnings of the private sector employees had they been working in the public sector (equation 7) and their conditional expected earnings in the private sector (equation 5):

$$ATEU = E(y_1|S = 0) - E(y_0|S = 0) = ATE + E(\varepsilon_1|\varepsilon_s < -\gamma Z) - E(\varepsilon_0|\varepsilon_s < -\gamma Z).$$

3.3.4 Econometric strategy and identification

Two wage equations and a probit selection equation constitute the switching regression model. As mentioned above, it has become common practice in labour economics to estimate the model using the Full Information Maximum Likelihood method assuming joint normality. Here we propose the use of a more general approach – copula-based maximum likelihood estimation. It is essential to make a few choices before implementing this method. We must decide which marginal distribution to use. We can choose between the normal, logistic or Student's t. Generally, Student's t is considered to be the most flexible, but in a large sample it is asymptotically equivalent to normal distribution. Since we have more than 700,000 observations in our sample, we opt for normal marginal distributions. The selection equation is based on the standard probit model. Then, based on these two assumptions, we must choose the copula that best fits the data. In order to make this choice, we employ a procedure of sequential estimation of all combinations of the set of copulas: Gaussian, Farlie-Gumbel-Morgenstern (FGM), Plackett, Ali-Mikhail-Haq (AMH), Clayton, Frank, Gumbel and Joe.

The copulas are not nested relative to one another, so generally the information criteria (Akaike or Bayesian IC) should be used to determine the copula that best fits. However, if the marginal distributions are set and the number of parameters to be estimated is constant, the copula with the smallest IC is the one with the largest log likelihood function value. Selection of the appropriate model can then be tested using the Vuong test (Vuong, 1989).

Out of all tested combinations, the Plackett-Plackett turned out to be the best fitting copula. The Vuong test strongly rejects the equality of the chosen benchmark case, which was Gaussian-Gaussian. The log likelihood for the benchmark model is -5075.147 (with BIC = 11366.392 and AIC = 10434.293), while for the Plackett-Plackett combination it is -5040.381 (with BIC = 11296.86 and AIC = 10364.761). The Vuong test statistic is -22.01 with a p-value of 0.000.

The key problem in many similar empirical studies is to find suitable instruments for the selection equation. Identification of the model requires that at least one variable is included in Z which is not included in X, that is, the variable which has influence on the probability of employment in the public (or private) sector but has no direct impact on the wage. In this

paper, we decided to use a synthetic variable based on the idea that some learned professions predestine workers to employment in a particular sector. To construct this instrument, we used LFS statistics and the fact that learned professions correlate strongly with actual occupations. In the first step, learned professions with high public or private employment shares were identified in LFS data in order to find sector-specific professions. We assumed that, if the ratio of the shares of public to private sector employees within a particular two-digit occupational group is greater than 1.2, this learned profession predestines its members to work in the public sector and is thus labelled as public sector specific. A ratio lower than 0.8 assigns the relevant occupational groups to private sector-specific professions. Ratios between 0.8 and 1.2 classify occupational groups as unspecific. The synthetic instrumental variable defines 14 occupations as public specific, 10 as private specific and 15 as unspecific. The definition of this variable is discussed in the appendix. In the second step of this process, the appropriate category of the synthetic variable was assigned to each two-digit occupation in the SEO data set.

3.4 Results of the model

Table 3 shows the estimates of the selection equation into the public sector, where column (1) presents the estimates for the benchmark model (assuming Gaussian copulas), while column (2) presents the estimates for the model based on the Plackett-Plackett combination of copulas. For the sake of brevity we omit the parameters for regional dummies. The results are in line with expectations and are generally sensible. The variable chosen as an instrument for the selection equation proved to be significant in explaining the probability of employment in the public sector.

The probability of being employed in the public sector is greater for women. Tertiary education is also a very strong and positive predictor of being employed in the public sector. Generally, the higher one's education level, the greater the probability of being employed in the public sector. The results of our synthetic selection variable are sensible, demonstrating that performing a job which is considered to be public sector specific, on the basis of learned professions, has a strong and positive impact on the probability of being employed in the public sector.

The estimates of wage equations for the model formulated in the previous section are reported in Table 4. For the sake of brevity, industry, occupational and regional dummies are omitted. Columns (1) and (2) present the estimates of the standard switching regression model assuming joint normality, while (3) and (4) show the estimates for the copula approach based on the Plackett-Plackett combination and normal c.d.f.s for margins. We employ a user-written command 'switchcopula' for STATA (version 1.2.0, August 7, 2012), as described in Hasebe (2013), to estimate the model.

Table 3: Estimates of the selection equation into the public sector

	(1)	(2)
Female	0.0746**	0.0831**
	[0.000]	0.000]
Tertiary	0.6602**	0.6707**
	[0.000]	[0.000]
Secondary vocational	0.2751**	0.2764**
	[0.000]	[0.000]
Secondary general	0.1504**	0.1521**
	[0.000]	[0.000]
Basic vocational	0.0750**	0.0723**
	[0.000]	[0.000]
Age	0.0297**	0.0297**
	[0.000]	[0.000]
Selection variable 1	0.4716**	0.4106**
	[0.000]	[0.000]
Selection variable 2	1.4546**	1.3824**
	[0.000]	[0.000]
Constant	−2.6308**	−2.5824**
	[0.000]	[0.000]
Observations	725 239	725 239

Note: Regional dummies are omitted for brevity.
Significance levels: ** – 1%, * – 5%.
Source: Own calculations, SEO 2012.

Table 4: Estimates of wage equations for the public and private sector

	(1)	(2)	(3)	(4)
	private	public	private	public
Female	−0.1657**	−0.1074**	−0.1519**	−0.1123**
	[0.000]	[0.000]	[0.000]	[0.000]
Tertiary	0.3352**	0.3279**	0.3652**	0.2864**
	[0.000]	[0.000]	[0.000]	[0.000]
Secondary vocational	0.0915**	0.0888**	0.1048**	0.0748**
	[0.000]	[0.000]	[0.000]	[0.000]
Secondary general	0.0733**	0.1101**	0.0770**	0.1064**
	[0.000]	[0.000]	[0.000]	[0.000]
Basic vocational	0.0191**	0.0198**	0.0194**	0.0186**
	[0.000]	[0.000]	[0.000]	[0.000]
Age	0.0028**	0.0050**	0.0045**	0.0034**
	[0.000]	[0.000]	[0.000]	[0.000]
Job experience	0.0064**	0.0040**	0.0066**	0.0041**
	[0.000]	[0.000]	[0.000]	[0.000]
Fixed term contract	−0.1783**	−0.1477**	−0.1760**	−0.1505**
	[0.000]	[0.000]	[0.000]	[0.000]
Civil contract	−0.2376**	−0.0287**	−0.2350**	−0.0569**
	[0.000]	[0.009]	[0.000]	[0.000]
Probation	−0.2760**	−0.1737**	−0.2724**	−0.1852**
	[0.000]	[0.000]	[0.000]	[0.000]
Firm size: 21−50	0.1204**	0.0479**	0.1199**	0.0481**
	[0.000]	[0.000]	[0.000]	[0.000]

Table 4 – cont.

	(1)	(2)	(3)	(4)
	private	public	private	public
Firm size: 51−100	0.1807**	0.0762**	0.1793**	0.0770**
	[0.000]	[0.000]	[0.000]	[0.000]
Firm size: 101−250	0.2226**	0.0240**	0.2197**	0.0291**
	[0.000]	[0.000]	[0.000]	[0.000]
Firm size: 251−1000	0.3014**	0.0174**	0.2986**	0.0247**
	[0.000]	[0.000]	[0.000]	[0.000]
Firm size: 1001+	0.3454**	0.0122**	0.3437**	0.0248**
	[0.000]	[0.000]	[0.000]	[0.000]
Constant	2.3071**	2.3638**	2.2893**	2.5384**
	[0.000]	[0.000]	[0.000]	[0.000]
σ_i	0.4037	0.3717	0.4129	0.3907
	(0.0005)	(0.0006)	(0.0005)	(0.0007)
θ_i	0.0661	−0.2999	2.9826	0.1754
	(0.0053)	(0.0072)	(0.0450)	(0.0030)
LR	1492.67		1102.04	
	[0.000]		[0.000]	
Observations	398 024	327 215	398 024	327 215

Source: Own calculations, SEO 2012.
Note: Regional, occupation and industry dummies are omitted for brevity.
p-values in square parentheses, significance levels: ** – 1%, * – 5%.
Standard errors are reported for the parameters of σ_i and θ_i.
LR is the test statistic for the independence of the wage and selection equations.

The results reveal a number of interesting facts. Women earn less than men, on average. This imbalance appears to be slightly less severe in the public sector, as one could expect. The wage disadvantage for women is 15.2% in the private sector and only 11.2% in the public sector.

The results also indicate that there are significant returns to education in both sectors. Workers with tertiary education in the public sector earn 28.6% more than the reference group (basic education), when corrected for selection. This premium is even higher in the private sector, amounting to 36.5%. Secondary vocational education yields a higher return in the private sector, while secondary general education is more beneficial in the public sector. Returns to age and job experience are higher in the private sector.

Larger firms offer higher wages and this effect is much stronger in the private sector. Those employed in the largest companies (1000+) enjoy a premium of roughly 34.4% over those employees of the smallest firms in the private sector. The analogous premium in the public sector is only 2.5% and we can see a very flat wage structure according to firm size here. Wage penalties for non-standard employment contracts (fixed, civil, probation) are much higher in the private sector.

3.5 Conditional expected wages in the public and private sector

Based on the estimated model, we generated the conditional expected earnings for public and private sector employees. The average conditional expected gross monthly earnings (given actual monthly working hours) are predicted for public sector workers who selected themselves into the

public sector at a level of 4 566.45 PLN. The equivalent level for private sector workers stands at 3 791.09 PLN. This constitutes a conditional premium of 20.5% (the official CSO statistics for Poland indicate a premium for gross wages at 22.3%[1]). The average treatment effect for a random person is estimated at 395.88 PLN.

Table 5 summarizes the calculated average conditional expected gross monthly earnings of public and private sector employees by education levels for the individuals who actually selected themselves into their respective sector, as well as for counterfactual states. The average gross monthly earning of public sector employees, had they been working in the private sector, is 3 375.58 PLN. This is almost 1 200 PLN higher than the actual conditional expected earnings for this group, as the average treatment effect on the treated shows. The value of this effect is much higher than the simple average treatment effect, which suggests that public sector employees select themselves into that sector on the basis of their idiosyncratic gain to treatment. The gain from selecting oneself into the public sector is higher than that for the average person in the sample.

Table 5: Conditional expected earnings of public and private sector workers and the treatment effects according to education level

	Public sector			Private sector		
	(1)	(2)	(3)	(4)	(5)	(6)
	$E(y_1\|S=1)$	$E(y_0\|S=1)$	ATET	$E(y_0\|S=0)$	$E(y_1\|S=0)$	ATEU
Tertiary	4 857.27	3 790.64	1 066.62	5 584.44	4 640.00	−944.44
Secondary voc.	4 314.71	3 211.73	1 102.98	3 428.96	3 307.23	−121.72
Secondary gen.	4 237.04	2 758.73	1 478.31	3 006.65	3 137.57	130.92
Basic voc.	4 322.02	2 591.63	1 730.39	2 773.11	3 089.31	316.21
Basic	3 659.99	2 478.39	1 181.61	2 627.64	2 753.45	125.81
Total	4 566.45	3 375.58	1 190.87	3 791.09	3 585.37	−205.72

Source: Own calculations, SEO 2012.

On the other hand, we can see conditional expected gross monthly earnings for private sector workers had they hypothetically been working in the public sector at 3 585.37 PLN. This is less, by roughly 200 PLN, than they actually earn in the private sector. This means that we observe two distinct subpopulations of workers that differ considerably in their characteristics. It again justifies the chosen approach to quantifying the difference in earnings between the public and private sector employees, given that selection into these two sectors is definitely non-random. Individuals selecting into both sectors are better off where they are in fact employed. The analysis of treatment effects according to education levels reveals that those with tertiary education working in the private sector would suffer substantial decreases of earnings were they employed in the public sector. However, for lower levels of education, this effect is not observed. It seems, then, that the public sector rewards to a greater extent those individuals with lower levels of education, as can be seen in columns (3) and (6). This finding coheres with other studies that indicate the higher wage premia of the public sector are found for lower sections

[1]The gross monthly wage in the public sector in 2013 was 4239.36 PLN, while it was 3466.90 PLN in the private sector.

of the wage distribution (Ehrenberg and Schwarz, 1986; Gregory and Borland, 1999; Glinskaya and Lokshin, 2007; Christofides and Pashardes, 2002).

4 Conclusions

The analysis of the public sector wage premium in Poland presented above not only extends our understating of the developments of the labour market in a post-transition economy, but also allows us to draw some methodological conclusions concerning public-private wage differentials.

First of all, our study confirms non-random selection into both sectors of employment in Poland. It is related not only to the demographic characteristics of workers (sex and age), but even more specifically to their human capital profile. Earlier educational decisions, particularly, predestine workers' choices of private or public employers. We proposed, as an instrument in the selection equation, a synthetic variable based on the distribution of learned professions that was found to be highly correlated with sector choice, while not being significantly correlated with wage level.

Second, we argued that the traditional approach to modelling wages according to sector selection based on the assumption of joint normality is too restrictive. If this assumption is not met, inconsistent estimators in the wage equation and unreliable estimations of the public sector wage premium result. The methodology adopted in our study was instead based on the copula approach to maximum likelihood estimation of the switching regression model. It allowed us to relax the joint normality assumption and thereby obtain consistent estimates. The copula approach is well known and widely used in finance, yet it has been used relatively rarely in labour economics, despite the nature of the data used in empirical analysis in this area seemly calling for this more flexible approach.

Third, we showed that – contrary to the results reported in the literature based on data from the initial period of the transition – there is a positive selection into employment in the public sector in Poland. An average public sector employee earns more than the average worker in our sample. In this regard, it seems that the public sector should no longer be regarded as a sector of dead-end jobs, failing to offer career prospects and forcing its employees to depend on moonlighting. Moreover, there is also evidence of positive selection into the private sector. Both groups of workers are better off in their sector of choice. This is a result of labour market efficiency – on average, workers select themselves into the sector in which they can earn more than they could in the counterfactual scenario.

Fourth, we found that the public sector wage premium (for those who select themselves into this sector) is on average positive, more than 20 years after the beginning of the economic transition. This may be interpreted as a sign of maturity of the Polish labour market and the advancement of the transition process. In this respect, Poland – one of the leaders of the economic transition in the region – seems to have caught up with developed countries in which the positive public sector wage premium is well-documented.

Furthermore, in the case of public sector employees ($ATET$), the positive public sector wage premium was found to be positive for all workers, irrespective of their educational level. It is positive even for individuals with tertiary education, which contradicts the results of studies

regarding developed countries. However, the scale of the premium for this latter group of employees is relatively small. Similarly to studies for other countries, the size of the premium was found the be the highest for those with low levels of education. On the other hand, the public sector wage premium for private sector employees was found to be positive only for workers with lower levels of education (basic and general secondary). Someone with a university degree employed in the private sector would lose much if they were to take up work in the public sector. This result is consistent with numerous studies of developed countries.

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Appendix

Notes on selection variable

The selection variable (Var_sel) was constructed on the basis of learned professions and the public versus private sector share of employment within each two-digit learned profession, as table 1 shows.

Learned professions with high public or private employment shares were identified in LFS data in order to find sector-specific professions. We assumed that, if the ratio of the shares of public to private sector employees within a particular two-digit occupational group is greater than 1.2, this learned profession predestines its members to work in the public sector and is thus labelled as public sector specific. A ratio lower than 0.8 assigns the relevant occupational groups to private sector-specific professions. Ratios between 0.8 and 1.2 classify occupational groups as unspecific. The synthetic instrumental variable defines 14 occupations as public specific, 10 as private specific and 15 as unspecific.

Table 1: Definition of the selection variable

Learned profession	Public	Private	Relation	Var_sel
11: Chief executives, senior officials and legislators	33.5	66.5	0.743	0
12: Administrative and commercial managers	43.1	56.9	0.956	1
13: Production and specialized services managers	38.9	61.1	0.862	1
14: Hospitality, retail and other services managers	23.5	76.5	0.522	0
21: Science and engineering professionals	41.9	58.1	0.929	1
22: Health professionals	83.4	16.7	1.847	2
23: Teaching professionals	93.9	6.1	2.081	2
24: Business and administration professionals	39.6	60.4	0.879	1
25: Information and communications technology professionals	26.9	73.1	0.596	0
26: Legal, social and cultural professionals	79.4	20.6	1.759	2
31: Science and engineering associate professionals	36.5	63.5	0.810	1
32: Health associate professionals	73.5	26.5	1.629	2
33: Business and administration associate professionals	51.3	48.8	1.136	1
34: Legal, social, cultural and related associate professionals	89.8	10.2	1.990	2
35: Information and communications technicians	42.1	57.9	0.934	1
41: General and keyboard clerks	62.5	37.5	1.385	2
42: Customer services clerks	47.6	52.4	1.055	1
43: Numerical and material recording clerks	22.1	77.9	0.490	0
44: Other clerical support workers	73.2	26.8	1.622	2
51: Personal service workers	54.8	45.3	1.213	2
52: Sales workers	4.0	96.0	0.089	0
53: Personal care workers	82.5	17.5	1.828	2
54: Protective services workers	32.2	67.8	0.713	0
61: Market-oriented skilled agricultural workers	51.0	49.0	1.130	1
62: Market-oriented skilled forestry (...) workers	45.6	54.5	1.010	1
71: Building and related trades workers, excluding electricians	28.3	71.7	0.627	0
72: Metal, machinery and related trades workers	23.0	77.0	0.509	0
73: Handicraft and printing workers	16.9	83.1	0.375	0
74: Electrical and electronic trades workers	39.2	60.8	0.869	1
75: Food processing, (...) and related trades workers	4.3	95.7	0.096	0
81: Stationary plant and machine operators	22.8	77.2	0.504	0
82: Assemblers	5.4	94.6	0.121	0
83: Drivers and mobile plant operators	39.4	60.6	0.874	1
91: Cleaners and helpers	63.9	36.1	1.417	2
92: Agricultural, forestry and fishery labourers	22.3	77.7	0.495	0
93: Labourers in mining, constr., manufacturing and transp.	14.7	85.3	0.326	0
94: Food preparation assistants	65.6	34.4	1.453	2

Table 1 – cont.

Learned profession	Public	Private	Relation	Var_sel
95: Street and related sales and service workers	0.0	100.0	0.000	0
96: Refuse workers and other elementary workers	65.4	34.7	1.448	2

Source: Own calculations, LFS 2012.

Table 2 shows the employment shares of each value of selection variables according to performed one-digit occupations (large groups).

Table 2: Selection variable according to large groups of occupations (employment shares in %)

	Var_sel		
Occupation	0	1	2
1: Managers	33.4	66.6	0.0
2: Professionals	4.8	37.9	57.4
3: Technicians and associate professionals	0.0	80.4	19.6
4: Clerical support workers	34.2	18.1	47.8
5: Service and sales workers	73.2	0.0	26.8
6: Skilled agricultural, forestry and fishery workers	0.0	100.0	0.0
7: Craft and related trades workers	84.6	15.4	0.0
8: Plant and machine operators and assemblers	59.9	40.1	0.0
9: Elementary occupations	34.0	0.0	66.0
Total	34.7	34.5	30.8

Source: Own calculations, LFS 2012, SEO 2012.

Table 3 shows the employment shares of each value of selection variable according to sector ownership.

Table 3: Selection variable according to sector ownership (employment shares in %)

Var_sel	Private sector	Public sector	Total
0	81.7	18.3	100.0
1	57.8	42.2	100.0
2	21.4	78.6	100.0
Total	54.9	45.1	100.0

Source: Own calculations, LFS 2012, SEO 2012.

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