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GDAŃSK UNIVERSITY OF TECHNOLOGY
FACULTY OF MANAGEMENT AND ECONOMICS

SALARY AND RESERVATION WAGE GENDER GAPS IN POLISH ACADEMIA

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Salary and reservation wage gender gaps in Polish academia

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Abstract

By using unique web-survey data, this paper assesses the gender wage gap in Polish academia. We conduct a detailed study of the gender gap considering monthly salaries and reservation wages. The study involves regression analysis, Oaxaca-Blinder decomposition of mean wage differentials and decomposition of differences in distributions using quantile regression. The results from the Oaxaca-Blinder wage decomposition imply that differences in total salary are mostly due to academic rank. For reservation wages there is evidence of a mean residual gap of 10%. In addition, both differences in raw salary and the reservation wage between females and males are more pronounced at the top of the distribution.

JEL: J16, J31, J71

Keywords: gender wage gap, reservation wage, higher education

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1. Introduction

Inequalities in wages paid to females and males with the same characteristics (age, education, skills etc.) are the basic outcome of labour market discrimination (Berik et al. 2009). The problem of gender wage discrimination is not limited to workers with a low education level and neither is it restricted to low income countries (Wolszczak-Derlacz, 2013).

In this paper we focus on the specific labour market of the higher education sector (HES). Analysis of the HES can serve as a natural experiment to test discrimination in well-educated occupations (all employees have a higher degree) and has the advantage that there is a clear indicator of promotion (academic rank) and productivity is measurable (publications) (Blackaby, 2005).

With this in mind, we use unique web-survey data to perform one of the first detailed studies of the salary and reservation wage gender gap in Polish academia. The pay scheme in Polish public universities is based on a national salary scale with salary brackets for each academic position.¹ In general, salaries paid at Polish higher education institutions (HEIs) are extremely uncompetitive² and as a result members of the academic staff teach additional hours in their university or have a second job at another university (usually private ones) or outside the education sector. Holding two jobs at the same time lowers the standard of the work performed and is a main concern in Polish academia nowadays (Wolszczak-Derlacz, Parteka 2010).

As far as gender discrimination is concerned, equal pay for women for work of equal value is guaranteed both by Polish legislation and EU law.³ Nevertheless, as universities in Poland are non-profit organisations they may be more prone to discrimination. Additionally, it has been pointed out that females might be less aggressive in asking for pay rises and their

¹ Calculated as a percentage of a base amount stated in the official Budget Act, which changes every year. The minimum salaries for each academic position are centrally regulated in Article 151 of the 27 July 2005 Act on Higher Education and the Ministry of Science and Higher Education (MSHE) regulation of 5 October 2011 (Journal of Laws No. 243, item 1447).

² Salaries paid at Polish HEIs are uncompetitive both from the national and international perspective. For example, according to aggregate statistics from Eurostat, the mean monthly earnings in Poland in 2010 for services in the total economy were €812 but only €786 for the education sector, while the average in the EU27 for the education sector was €2441 and, e.g., in Germany €3405.

³ In EU member states and candidate countries, legislation on equal pay is mandatory. According to Article 11 of The Polish Labour Code, any direct or indirect discrimination in employment, particular based on gender, age, disability, race, religion, nationality, political preferences, trade union membership, ethnic origin, religion, sexual orientation, or type of employment contract (temporary versus permanent; full-time versus part-time) is prohibited.

potentially lower reservation wage could have an impact on their factual level of salary relative to their male counterparts (Brown et al., 2011).

The remainder of this paper is structured as follows: in Section 2, we present the theoretical basis of our investigation, together with a literature review. In Section 3, we conduct a detailed examination of the salary and reservation wage gender gap. We start with descriptive statistics, and then move on to earnings regressions both for our pooled sample and with separate estimations for females and males, the starting point being an Oaxaca-Blinder decomposition of mean wage differentials. The empirical analysis is completed with a decomposition of the differences in distributions using quantile regression. Our conclusions, together with policy implications and suggestions for future studies are presented in Section 4.

Our main findings are the following: (i) on average, raw earnings (basic salary, additional salary) and reservation wages are higher for males in Polish academia; (ii) the differences in total salary are mostly due to academic rank; (iii) the unexplained part (discrimination component) is between ranks; within ranks this disappears; (iv) for reservation wages there is evidence of a mean residual gap of 10%; (v) both the differences in raw salary and reservation wage between females and males are more pronounced at the top of the distribution.

Our analysis has straightforward policy implications. The results indicate that rigid pay scale seems to be a successful tool in eliminating a gender salary gap. Additionally, our analysis of the reservation wage gap can be useful for establishing salaries at particular levels to guarantee that members of academic staff in Poland need hold only one contract.

2. Theoretical background and literature review

The classical theory of wage discrimination is based on Becker's (1971) model, in which a gender wage gap occurs as a result of employers' taste for discrimination – employers are willing to pay more for marginal productivity differences due to their preferences. According to this approach, in a competitive market discrimination will not persist as it is costly to employers. However, when the market is not competitive wage discrimination can remain. The main arguments put forward concerning the academic labour market are connected with the monopsonistic power of HEI employers, lower female job mobility (Ransom 1993) and discrimination against female promotion resulting in crowding of women in the lower ranks (Ward, 2001). Johnson and Stafford (1974) explain the gender salary gap in US academia by

the amount of household work which is done by women at the expense of academic activities and females' time out of the labour force, e.g. due to maternity leave and childbearing. However, Takahashi and Takahashi 2011 do not confirm that household work is the source of the gender wage gap in Japanese HEIs. Additionally, Blackaby et al. (2005) in their study of UK academics found a gender promotion gap and within-rank gap, and explain the phenomena with the role of outside offers: men receive more outside offers than women of comparable ability and gain higher pay increases in response to outside offers.

The problem of the gender wage gap has been most thoroughly analysed in the US and UK higher education sectors. Among others, the US academia gender wage gap has been studied by Burke et al. (2005), Ehrenberg et al. (2006), Ginther (2003), Monks and Robinson (2000) and Toutkoushian (1998). For UK academia, research has been done by Blackaby et al. (2005) and Ward (2000). Finally, Moore et al. (2007) conduct a comparison of the gender wage gap between US and UK HEIs. They found that rewards for research are more immediate and direct in the United States but payoffs to experience and seniority are greater in the United Kingdom. Additionally, equality in Scandinavian academia has been questioned by Healy and Seierstad (2012). Recently, some more exotic countries have also been examined (e.g. China by Congbin et al. (2010), Japan by Takahashi and Takahashi, (2011) and Taiwan by Lin (2010)).

To the best of our knowledge the problem has not yet been analysed for Polish academia.⁴ In terms of empirical analysis, previous studies have consistently reported that women are on average paid less than men in the academic labour market, with the unexplained part of wage differentials (the discrimination component) constituting up to 10%.⁵

One of the crucial questions in the literature on the gender wage gap in academia is whether discrimination occurs within ranks or is a result of barriers to female promotion. The existence of a gender salary gap within ranks (proved, e.g., by a significant gender coefficient in earnings regressions when rank is controlled for) is confirmed by Blackaby et al. (2005) and Takahashi and Takahashi (2011), among others. In contrast, Ginther and Hayes (2003) find negligible gender salary differences within rank, but substantial differences in rank

⁴ The gender wage gap in Poland has been analysed by Adamchik and Bedi (2003), Grajek (2003), Newell and Socha (2005), Ruzik and Rokicka (2010), Cieřlik and Rokicki (2013) among others, but without looking directly at the gap in the higher education sector.

⁵ A direct comparison between studies is difficult due to the use of different datasets describing the academic labour market in distinct countries, different estimation methods, and different explanatory variables. For example, for the US academic labour market, Toutkoushian (1998) reports an unexplained wage gap between men and women between 7% and 10%, Ginther (2003) attributes 6% of the gap in total salary to discrimination, Burke et al. (2005) put the figure at 10.5%, and Toumanoff (2005) finds an unexplained and statistically significant differential in salary between men and women between 2.9% and 8.4%.

attainment and conclude that gender discrimination for academics tends to operate through differences in promotion.

In our empirical analysis we study not only the gender salary gap but also the reservation wage gap. In job search theory the reservation wage is understood to be the lowest wage at which an individual is willing to accept work (McKenna, 1990). Among other determinants of the reservation wage (e.g. duration of unemployment: Lancaster and Chesher, 1983) there is also a potential difference due to sex (Brown et al., 2011). Gender reservation wage differentials can have a crucial impact on the labour supply and different labour market participation rates between females and males (Blackaby et al., 2007). Unlike analysis of the gender salary gap, reservation wage differences between women and men have been less explored in the literature.

Finally, there can exist a dichotomy between the existence or lack of gender discrimination and perception of treatment of females. However, Robst et al. (2003) in their examination of American post-secondary faculty show that almost three-quarters of faculty perceive the treatment of female academics to be fair.

In previous studies considering the gender wage gap, the Oaxaca-Blinder approach is the most-used methodology. This decomposes total wage differentials into explained and unexplained components, the latter being interpreted as discrimination (used among others by Burke et al. (2005), Ginther (2003), Monks and Robinson (2000) and Ward (2001)). The shortcomings in decompositions of mean wage differentials can be overcome by decomposition of differences in distributions using quantile regression. Quantile analysis has been utilised in gender studies by Albrecht et al. (2003), Arulampalam et al. (2007), Booth (2009) and Garcia et al. (2001), among others.

3. Empirical analysis

3.1. Data

The data is obtained from an internet survey designed especially for the purpose of this study.⁶ Information about the survey was sent by email to the heads (deans) of each department of all public HEIs in Poland administered by the Ministry of Science and Higher Education (MSHE). The study does not cover entities that are subject to other ministries, e.g. medical or military schools. In the cover letter, we asked the deans to advertise the survey among their academic employees and send them a link to the online questionnaire. In this sense we can say that the process was random, because we had no influence on whether heads of the departments decided to pass on the information about the survey or not. We informed the respondents that the questionnaire was anonymous and only for a scientific purpose. The survey was carried out in the first half of 2012, and eventually we received 3181 responses, which constitute 6% of the whole population. However, almost half of the responses were dropped during the cleaning process, mostly due to missing salary or reservation wage information⁷ and mistakes in filling in the questionnaire. Outliers were also excluded.⁸ These exclusions left us with a sample of 1581 respondents (928 males, 653 females). The percentage of females in our final sample is 41% and corresponds very well to the proportion of women in the population of academic staff in Poland (40% according to government data). However, in other respects, such as type of HEI or distribution among ranks, we over- or under- sampled the given category. For example, in our sample we had a lower proportion of full professors (5.5% in our sample compared to 8.3% according to government data). Finally, because there was no statistically significant difference (at $\alpha=0,05$) for gender proportion, we weighted the observations with post-stratification weights based on rank and type of institution. Moreover, we also needed to recalculate self-reported reservation wages from net to gross values, because the other questionnaire answers about income were given as gross.

⁶ The questionnaire is deliberately keep brief, contains open and closed questions on individual and job characteristics (25 questions). The English translation of the original questionnaire in Polish is presented in Appendix.

⁷ We dropped the observation if a respondent does not report his/her salary and reservation wage. However, we leave the observation if other information is incomplete.

⁸ Detection of outliers was based on Tukey's (1977) graphic methods, in particular eliminating all observations deviating from the median by about four interquartile ranges.

We had decided to ask about reservation wages as a net value because in our opinion such a question was easier to be answered.

Analysis of the gender wage gap in the academic labour market based on a survey is common in the literature (e.g. Blackaby et al. (2005), Takahashi and Takahashi (2011) and Moore et al. (2007)). We argue that utilising a web survey for the academic labour market can have an additional advantage to the standard benefits of an internet-based survey (low costs in terms of time and money): all members of academic staff in Poland have internet connections and are avid internet users (e.g. they all possess email addresses). Furthermore, we do not assume that our sample suffers from respondent bias since in the cover letter we stated the scientific purpose of the study without mentioning that the data would be used to examine the gender wage gap. However, because salary information in Poland is confidential, the voluntary character of the survey is its main disadvantage: it might lead to underrepresentation of persons who are less interested in wages or who are more satisfied with their salaries.

3.2. Raw gender wage gap – descriptive statistics

Table A1 in the Appendix presents summary statistics of all the variables by gender. We gathered information on different kinds of salaries. First of all, we report information on the basic monthly salary (including taxes) obtained from the home university (*Salary*). Then we have information on any additional salary also received from the home university: *Salary_add_homeuniv* includes awards, bonuses and the so-called 13-month salary, *Salary_overhours* is extra salary for teaching additional hours (over the teaching hours settled by the employment contract), *Salary_grants* is remuneration for conducting research, and *Salary_other* – includes any other earnings from the home institution. In Poland it is common to also work at other HEIs (especially private universities) and/or in another sector. According to our results, 56% of female and 60% of male academics had an additional income (see the variable *Income_add* in Table A1). We report information about their additional earnings from full-time (*Income_add_fulltime*) or part-time activities (*Income_add_parttime*), from running their own enterprise (*Income_add_owntent*), from research grants not connected to the home institution (*Income_add_research*) and from all other earnings (*Income_add_other*).

Next, we report the reservation wage. All respondents were presented with a hypothetical contract which imposed the requirement of not taking any extra work outside the

home university, even for free. Respondents could determine the number of working hours to guarantee them adequate time for research and development, and the minimum acceptable net monthly salary for this contract.

In the next section we are going to conduct a regression analysis with dependent variables standardised monthly salary (*Salary_stand*) and standardised reservation wage (*Wage_res_stand*) with reference to 180 teaching hours per year. On the basis of summary statistics we see that on average males receive a higher basic salary as well as higher additional earnings. Additionally, on average males are older and more experienced. Academic degree differs by gender, with 16% of males and only 6% of females holding a professorship (and 23% and 14% respectively possessing habilitation). This has consequences for the distribution of ranks: 12% of males and 3% of females are employed as full professors.

Interestingly, on average the teaching load regulated by the employment contract is slightly lower for male academics (*Pensum_contract*) but the difference is not big. The inverse is true for the actual teaching load realised (the difference between *Pensum_contract* and *Pensum_real* gives the extra hours of teaching that are paid extra).

It is not easy to measure the productivity of academics as far as research activity is considered. The publication variable (*Publications*) gives the value of the points obtained by a given academic for publications (articles, books etc.) calculated according to a scale provided by the Polish MSHE. This ranks articles by, e.g., assigning a larger number of points to those published in top international journals than in national ones (the higher the impact factor the greater the number of points). In some sense the ministry list is a way of controlling for publication quality. The drawback of this variable is its subjective nature, since a respondent could over- or under-value his/her publication record (the ministry list often changes). On average, male academics obtain a higher number of publication points.

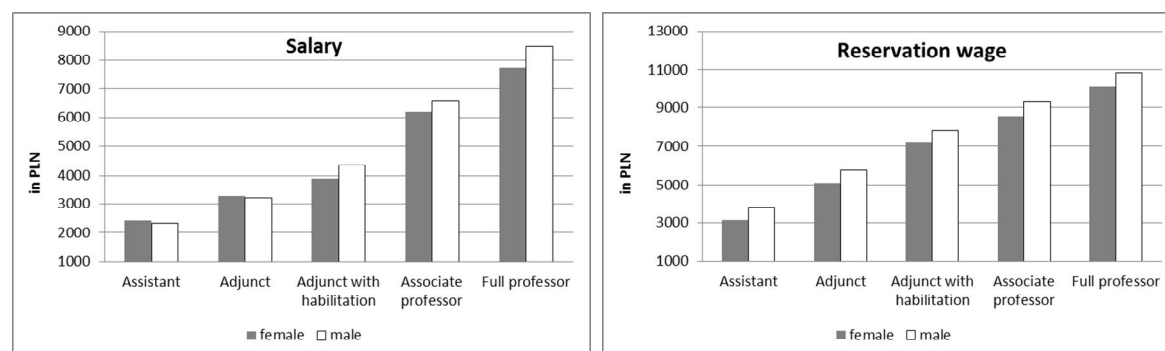
There are some noteworthy differences according to gender concerning area of academic study. More women report their main field of study as being biology, the humanities or social science, while men's area of study is concentrated in science and technical science. Consequently, more women work at the general universities while men are more present at the technical universities. Finally, we report information about the category of HEI as assigned by the MSHE (from 1 - very good, to 4 – poor). This can be important from the perspective of the individual academic's remuneration because the financial situation of an HEI depends on this category.⁹ Most of the academics in the survey work at HEIs in the

⁹ In Poland, the allocation of public (government) funding for the research activities of HEIs is based on their research assessment. HEIs are given a category (1 - very good, 4 – poor), with better units getting higher grants

better categories: 73% of the males and 69% of the females are employed at an HEI in the 1st or 2nd category.

When we look at the summary statistics we can conclude that on average men receive higher earnings (both at the home university and outside) and declare a higher reservation wage. However, when we look more closely at the wage distribution, the existence of a wage gap is not so clear. Figure 1 presents salary and reservation wage disparity by rank categories (both variables standardised by the number of teaching hours). As far as salary is concerned, we can see that at the assistant and adjunct level females seem to earn a slightly higher salary than males, while males start to receive higher earnings from the rank of adjunct with habilitation and above. However, for all ranks male reservation wages are higher than female ones. From Figure 1 it is clear that in the analysis of the gender wage gap it is crucial to take into account different rank categories as the gender gap can be concentrated among particular groups.

Figure 1. Average monthly gross salary and reservation wages by gender for different academic ranks



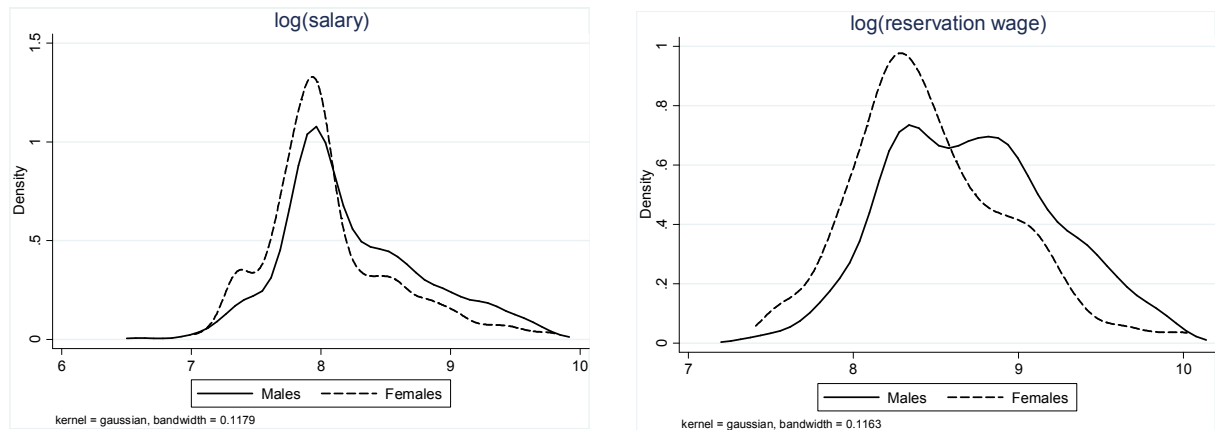
Notes: weighted sample.

Source: own calculation

However, when we look at the distribution of log wages, the wage gap is evident only in the case of reservation wages, with the Kernel density plot for males shifted to the right (right-hand graph of Figure 2), reflecting higher male reservation wages. In the case of average salaries the shift is much more moderate.

for research. Among the assessment criteria are: number of publications and research projects undertaken, awards and distinctions received for excellence in research, and use of research results (licences, services provided, copyright) etc.

Figure 2. Distribution of wages and reservation wages by gender



Note: density estimations with Gaussian kernel function. Weighted sample.

Source: own calculation

3.3 Gender wage discrimination based on regression analysis

We estimate an earnings regression grounded on a traditional Mincer-type wage equation (Mincer and Polachek, 1974):

$$\ln w_i = \alpha + \sum_{j=1}^J \beta_j Ind_{j,i} + \sum_{k=1}^K \chi_k Job_{k,i} + \sum_{l=1}^L \delta_l HEI_{l,i} + e_i, \quad (1)$$

where: w_i is the gross monthly salary or reservation wage of an individual i , Ind represents the vector of individual characteristics (experience, experience squared, a dummy for gender, a dummy for additional income), Job is a vector of job characteristics (rank dummies for assistant, adjunct with habilitation, associate professor and full professor, number of teaching hours regulated in the employment contract, number of teaching hours actually realized, number of points from publication records, area of study dummies for agriculture, biology, humanities, medicine, science, social science, and technology), and HEI stands for the vector of institution characteristics (GDP per capita of the region where the HEI is located, type of HEI dummies for economics, pedagogical, technical university, agriculture and sport, and category dummies for the ministerial category of the institution).

Estimations are carried out separately for standardised monthly salary and reservation wage and the results are presented in Tables 1 and 2. First, we estimate a regression for a pooled sample with the gender dummy included (Male = 1, Female = 0). The basic specification (column (1) of Tables 1 and 2) includes only the experience variables

(experience and experience squared) and the gender dummy.¹⁰ The experience variable is statistically significant and positive for most of the specifications, but experience squared is statistically significant only for reservation wages. The baseline specification indicates a statistically significant gender salary gap of 7% for salary and 18% for reservation wage.¹¹ When we add rank specifications (column 2), in the case of monthly salary the gender dummy loses its statistical significance while in the case of reservation wages it remains significant but the magnitude of the parameter falls to 10%. All of the rank variables are highly significant. Being an assistant (the lowest rank) decreases both salary and reservation wage in relation to the reference category, which is adjunct, while the upper ranks increase them. The third specification (column (3)) takes into account all the variables listed in Table A1.¹² In the case of monthly salary, the statistically significant variables are experience, rank dummies, contracted teaching load (a negative impact on the level of salary), and economic, pedagogical and agricultural type of institution (on average the salary is higher at these HEIs than at general universities). For the reservation wage gap, apart from gender, experience variables and rank dummies, the statistically significant factors are: holding an additional job, number of contracted teaching hours, publication record, regional GDP per capita, medical and scientific field of study, and economic and technical type of university. All factors except teaching load are positively correlated with the level of the reservation wage. The notable difference between the estimations for salary and reservation wage is the statistically significant impact of additional income and publication record, which were not previously significant.

The regression analysis not only allows us to estimate the gender wage gap by including the gender dummy variable but also by running separate earnings regressions for males (M) and females (F), we can check whether any characteristics (covariates) determine the wages of males and females differently. Equation (1) is estimated separately for the subgroups of women and men:

¹⁰ We do not include the variables for age and experience in one regression due to possible collinearity problems. The coefficient of correlation between age and experience equals 0.97. We decided to use experience rather than the age variable because of possible later starters entering academia after working for a period of time in other professions.

¹¹ Mathematically, the percentage difference is calculated as $[\exp(\beta - \text{Var}(\beta)/2) - 1] \times 100$, where β is the gender dummy coefficient.

¹² In the case of category variables the reference point refers to the omitted category. The omitted rank is adjunct, the omitted area of study is Art, the omitted HEI category is category 1, the omitted type of HEI is university. The age variable and degree specification are not included due to potential collinearity problems with experience and rank respectively.

$$\ln w_{g,i} = \alpha + \sum_{j=1}^J \beta_{g,j} Ind_{j,i} + \sum_{k=1}^K \chi_{g,k} Job_{k,i} + \sum_{l=1}^L \delta_{g,l} HEI_{l,i} + e_{g,i} \quad \forall g = \{M, F\} \quad (2)$$

Columns (4) and (5) present the estimations for females and males. Additionally, column (6), headed *female=male*, reports a Wald test comparing the male and female coefficients, with the bracketed figure showing the level of significance. For monthly salary, the only significant difference between the coefficients for men and women ($p < 0.05$) arises with respect to the contracted teaching load, which in both cases is negatively correlated with the salary level but for males the magnitude is significantly greater in absolute terms (Column (6) of Table 1). For reservation wage the difference is for the agricultural type of HEI – the female reservation wage is negatively correlated with being employed at an agriculture university, whereas the male one is positively correlated.

Table 1. Estimation result – dependent variable standardised salary *ln(salary)*

	pooled	pooled	pooled	female	male	female=male
	(1)	(2)	(3)	(4)	(5)	(6)
Male	0.0716***	0.0157	-0.0186			
	[0.0241]	[0.0211]	[0.0245]			
Experience	0.0268***	0.0033	0.0080*	0.011	0.0111**	0.000
	[0.0043]	[0.0040]	[0.0043]	[0.0072]	[0.0046]	[0.993]
Experience ²	0.0001	0.0001	0.0001	-0.0001	-0.0001	0.06
	[0.0001]	[0.0001]	[0.0001]	[0.0002]	[0.0001]	[0.810]
Rank_assistant		-0.3537***	-0.3673***	-0.3641***	-0.2939***	0.54
		[0.0378]	[0.0506]	[0.0580]	[0.0460]	[0.464]
Rank_adjhab		0.2122***	0.1427***	0.1307	0.1214**	0.01
		[0.0396]	[0.0365]	[0.1022]	[0.0588]	[0.909]
Rank_assprof		0.5434***	0.4192***	0.4200***	0.3784***	0.21
		[0.0392]	[0.0445]	[0.0702]	[0.0429]	[0.645]
Rank_fullprof		0.7795***	0.6355***	0.5368***	0.6151***	0.30
		[0.0566]	[0.0627]	[0.1185]	[0.0560]	[0.582]
Income_add			0.0169	-0.0218	0.0565**	3.41
			[0.0222]	[0.0359]	[0.0245]	[0.064]
ln(teaching_load_cont)			-0.9920***	-0.3964**	-1.3543***	20.82
			[0.1278]	[0.1535]	[0.0996]	[0.000]
ln(teaching_load_real)			0.0347	0.0698	-0.005	1.30
			[0.0361]	[0.0573]	[0.0394]	[0.255]
ln(publication)			0.0134	0.0264	0.01	0.44

			[0.0118]	[0.0204]	[0.0124]	[0.505]
ln_region_pkbpc			0.0455	0.1728**	-0.017	2.87
			[0.0536]	[0.0834]	[0.0544]	[0.090]
area_studyAGR			-0.0374	0.2106	-0.055	2.88
			[0.1229]	[0.4271]	[0.1197]	[0.089]
area_studyBIO			-0.0427	0.1706	-0.0181	1.73
			[0.1165]	[0.4256]	[0.1134]	[1.88]
area_studyHUM			-0.105	0.1024	-0.0682	1.53
			[0.1144]	[0.4258]	[0.1127]	[0.216]
area_studyMEDi			-0.1005	0.3244	-0.1979	6.70
			[0.1416]	[0.4371]	[0.1420]	[0.010]
area_studySCI			-0.0187	0.1682	0.0129	1.23
			[0.1154]	[0.4305]	[0.1121]	[0.267]
area_studySOC			-0.045	0.2271	-0.0611	4.82
			[0.1141]	[0.4225]	[0.1117]	[0.028]
area_studyTEch			0.0379	0.2465	0.053	1.85
			[0.1168]	[0.4252]	[0.1130]	[0.174]
category2			0.0261	0.0076	0.036	0.21
			[0.0301]	[0.0483]	[0.0295]	[0.648]
category3			0.0305	-0.0229	0.0737**	1.85
			[0.0342]	[0.0578]	[0.0359]	[0.174]
category4			-0.1017	-0.1197	-0.0755	0.14
			[0.1643]	[0.1052]	[0.0626]	[0.71]
HEI_ekon			0.1268***	0.0667	0.1307**	0.61
			[0.0419]	[0.0804]	[0.0584]	[0.436]
HEI_pedag			0.1122*	0.087	0.1053	0.03
			[0.0587]	[0.0897]	[0.0674]	[0.870]
HEI_tech			0.0565	-0.0324	0.1065***	3.94
			[0.0345]	[0.0556]	[0.0349]	[0.05]
HEI_agri			0.1311*	0.0172	0.2398***	2.35
			[0.0774]	[0.0798]	[0.0560]	[0.126]
HEI_sport			0.0917	-0.0211	0.1088	0.43
			[0.0966]	[0.1581]	[0.1184]	[0.512]
Constant	7.6463***	7.9471***	12.5635***	7.5945***	15.2888***	18.44
	[0.0402]	[0.0371]	[0.9271]	[1.3785]	[0.7858]	[0.000]
r2	0.38	0.52	0.6	0.44	0.71	
N	1568	1568	1196	486	710	

Notes: Robust standard errors in parentheses. Statistically significant at ***1, ** 5, * 10 percent level. Weighted sample.

Table 2. Estimation result – dependent variable standardised reservation wage
ln(wage_res_stand)

	pooled	pooled	pooled	female	male	female=male
	(1)	(2)	(3)	(4)	(5)	(6)
Male	0.1669***	0.1210***	0.1006***			
	[0.0235]	[0.0208]	[0.0241]			
Experience	0.0398***	0.0167***	0.0161***	0.0225***	0.0131**	0.95
	[0.0043]	[0.0042]	[0.0047]	[0.0067]	[0.0058]	[0.330]
Experience ²	-0.0004***	-0.0003***	-0.0003**	-0.0004**	-0.0002*	0.50
	[0.0001]	[0.0001]	[0.0001]	[0.0002]	[0.0001]	[0.480]
Rank_assistant		-0.3483***	-0.3448***	-0.4050***	-0.2732***	3.36
		[0.0315]	[0.0384]	[0.0536]	[0.0572]	[0.067]
Rank_adjhab		0.2487***	0.2251***	0.2053**	0.2540***	0.17
		[0.0530]	[0.0600]	[0.0945]	[0.0731]	[0.680]
Rank_assprof		0.4121***	0.3936***	0.3789***	0.3945***	0.03
		[0.0404]	[0.0487]	[0.0649]	[0.0534]	[0.870]
Rank_fullprof		0.5752***	0.4758***	0.5650***	0.4558***	0.50
		[0.0620]	[0.0731]	[0.1095]	[0.0697]	[0.477]
Income_add			0.1558***	0.1281***	0.1750***	1.02
			[0.0238]	[0.0331]	[0.0305]	[0.311]
ln(teaching_load_cont)			-0.3016***	-0.1611	-0.4289***	1.74
			[0.1026]	[0.1419]	[0.1239]	[0.188]
ln(teaching_load_real)			-0.0298	-0.1030*	-0.0014	1.97
			[0.0381]	[0.0530]	[0.0490]	[0.160]
ln(publication)			0.0413***	0.0155	0.0555***	2.43
			[0.0134]	[0.0188]	[0.0154]	[0.119]
ln_region_pkbpc			0.1167**	0.1795**	0.1068	0.49
			[0.0523]	[0.0771]	[0.0677]	[0.482]
area_studyAGR			0.1376	0.203	0.0479	0.66
			[0.1461]	[0.3949]	[0.1489]	[0.415]
area_studyBIO			0.1709	0.1076	0.1681	0.12
			[0.1372]	[0.3935]	[0.1411]	[0.725]
area_studyHUM			0.1501	0.0278	0.1617	0.66
			[0.1347]	[0.3937]	[0.1402]	[0.418]
area_studyMED			0.3208**	0.3954	0.1678	1.11
			[0.1542]	[0.4041]	[0.1768]	[0.292]
area_studySCI			0.2554*	0.1462	0.2711*	0.50
			[0.1383]	[0.3980]	[0.1395]	[0.478]
area_studySOC			0.1705	0.0721	0.2005	0.62
			[0.1362]	[0.3906]	[0.1390]	[0.432]
area_studyTEch			0.0927	0.0997	0.0658	0.04
			[0.1369]	[0.3931]	[0.1407]	[0.841]
category2			0.0253	0.1015**	-0.0126	3.65

			[0.0302]	[0.0446]	[0.0368]	[0.055]
category3			0.0091	0.0864	-0.0187	2.30
			[0.0353]	[0.0535]	[0.0446]	[0.129]
category4			0.112	0.1211	0.1499*	0.04
			[0.0867]	[0.0973]	[0.0779]	[0.842]
HEI_ekon			0.1716***	0.2439***	0.1149	1.88
			[0.0482]	[0.0743]	[0.0727]	[0.170]
HEI_pedag			0.0198	-0.019	0.0478	0.19
			[0.0778]	[0.0829]	[0.0838]	[0.661]
HEI_tech			0.1381***	0.0739	0.1877***	2.88
			[0.0360]	[0.0514]	[0.0434]	[0.089]
HEI_agri			0.0032	-0.1344*	0.1232*	5.59
			[0.0707]	[0.0738]	[0.0697]	[0.02]
HEI_sport			-0.0496	-0.1543	0.0681	1.56
			[0.0943]	[0.1462]	[0.1474]	[0.212]
Constant	7.9981***	8.2849***	8.3959***	7.4996***	9.0748***	0.97
	[0.0386]	[0.0393]	[0.7664]	[1.2745]	[0.9779]	[0.324]
r2	0.33	0.44	0.51	0.51	0.48	
N	1568	1568	1196	486	710	

Notes: Robust standard errors in parentheses. Statistically significant at ***1, ** 5, * 10 percent level. Weighted sample.

3.4 Oaxaca-Blinder decomposition

The separate earnings regressions for males and females are the starting point for the Oaxaca-Blinder decomposition of mean wage differentials (Oaxaca, 1973; Blinder, 1973). The decomposition makes it possible to answer the question of how much of the gender wage gap can be explained by male-female differences in human capital (education), experience and other specific characteristics. The unexplained part is often interpreted as gender discrimination (residual wage), although other interpretations are possible (unobserved skills, missing covariances etc.) (Fortin et al. 2011). If we express equation (2) in general terms as

$$Y_{g,i} = \alpha_{g,0} + \sum_{n=1}^N \beta_{g,n} X_{i,n} + u_{g,i} \quad \forall g = \{M, F\}, \quad (3)$$

where X stands for all covariates (*Ind*, *Job*, *HEI*), then the estimated overall mean wage gap (unadjusted wage gap),

$$\hat{\Delta} = \bar{Y}_M - \bar{Y}_F, \quad (4)$$

can be decomposed as¹³

$$\hat{\Delta} = \underbrace{(\hat{\beta}_{M,0} - \hat{\beta}_{F,0}) + \sum_{k=1}^K (\hat{\beta}_{M,k} - \hat{\beta}_{F,k}) \bar{X}_{M,k}}_{\hat{\Delta}_{un}(unexplained)} + \underbrace{\sum_{k=1}^K \hat{\beta}_{F,k} (\bar{X}_{M,k} - \bar{X}_{F,k})}_{\hat{\Delta}_{ex}(explained)} \quad (5)$$

Table 3 reports the Oaxaca-Blinder decomposition for the three regressions formulated in the previous section (according to the set of explanatory variables). The part explained is computed as the difference between male and female means multiplied by the male coefficients reported in column (5) in Tables 1 and 2 respectively. The corresponding unexplained part of the wage differentials is computed as the difference between the male and female coefficients reported in columns (4) and (5).

Table 3. Oaxaca-Blinder decomposition of salary and reservation wage gap

	salary			wage reservation		
	(1)	(2)	(3)	(4)	(5)	(6)
TOTAL mean log wage gap	0.1869***	0.1869***	0.1709***	0.2557***	0.2557***	0.2500***
	[0.0266]	[0.0266]	[0.0302]	[0.0250]	[0.0251]	[0.0292]
Explained attributable to						
Experience	0.1227***	0.0316***	0.0234***	0.0865***	0.0137*	0.0101
	[0.0176]	[0.0077]	[0.0074]	[0.0137]	[0.0075]	[0.0078]
Ranks		0.1458***	0.1024***		0.1189***	0.0928***
		[0.0179]	[0.0163]		[0.0160]	[0.0167]
Income_add			0.0016			0.0049
			[0.0018]			[0.0052]
Teaching load			0.0358***			0.0113**
			[0.0121]			[0.0057]
ln(publication)			0.0027			0.0149***
			[0.0034]			[0.0054]
ln_region_pkbpcc			-0.0003			0.0017
			[0.0009]			[0.0019]
Area_study			0.0267***			-0.0092

¹³ To obtain the Oaxaca-Blinder decomposition, express the gap $\Delta = Y_M - Y_F$ as the difference between regression models: $\Delta = \bar{X}_M \beta_M - \bar{X}_F \beta_F$, add and subtract the average counterfactual wage that group M workers would have earned under the wage structure of F: $\bar{X}_M \beta_F$, which yields $\Delta = (\bar{X}_M \beta_M - \bar{X}_M \beta_F) + (\bar{X}_M \beta_F - \bar{X}_F \beta_F)$. The detailed steps to obtain the Oaxaca-Blinder decomposition together with the assumption of the wage setting mechanism can be found in Fortin et al. (2011).

			[0.0091]			[0.0114]
HEI_category			-0.0046			0.0001
			[0.0034]			[0.0039]
HEI_type			0.0072			0.0253***
			[0.0070]			[0.0082]
Total explained by model	0.1227***	0.1774***	0.1949***	0.0865***	0.1326***	0.1519***
	[0.0176]	[0.0201]	[0.0252]	[0.0137]	[0.0162]	[0.0225]
Unexplained attributable to						
Constant	-0.0827	-0.077	7.6944***	0.2266***	0.2503***	1.5752
	[0.0643]	[0.0718]	[1.5867]	[0.0624]	[0.0723]	[1.6064]
Experience	0.1468**	0.0685	0.0192	-0.0574	-0.1306**	-0.0886
	[0.0594]	[0.0651]	[0.0731]	[0.0575]	[0.0656]	[0.0763]
Ranks		0.018	0.0094		0.0033	0.0217
		[0.0170]	[0.0182]		[0.0170]	[0.0190]
Income_add			0.0440*			0.0263
			[0.0245]			[0.0253]
Teaching load			-5.593***			-0.8808
			[0.9130]			[0.9455]
ln(publication)			-0.0623			0.1517
			[0.0904]			[0.0923]
ln_region_pkbpc			-1.9906*			-0.7629
			[1.0446]			[1.0765]
Area_study			-0.2399			0.0674
			[0.4355]			[0.4127]
HEI_category			0.0371			-0.0606*
			[0.0324]			[0.0330]
HEI_type			0.0579**			0.0487*
			[0.0239]			[0.0249]
Total unexplained	0.0642***	0.0094	-0.024	0.1692***	0.1230***	0.0981***
	[0.0225]	[0.0201]	[0.0236]	[0.0217]	[0.0202]	[0.0247]
N	1568	1568	1196	1568	1568	1196

Notes: * p<0.10, ** p<0.05, *** p<0.01. Reference group: males, calculation using male coefficients from column (5) of Tables 1 and 2. Standard errors in parenthesis. Groups of variables: Experience (Experience, Experience²), Ranks (Rank_assistant, Rank_adjhab, Rank_assprof, Rank_fullprof), Teaching load (log of teaching_load_cont, log of teaching_load_real), Area of study (area_studyAGR, area_studyBIO, area_studyHUM, area_studyMED, area_studySCI, area_studySOC, area_studyTEch), HEI_category (category2, category3, category4), HEI_type (HEI_ekon, HEI_pedag, HEI_tech, HEI_agri, HEI_sport).

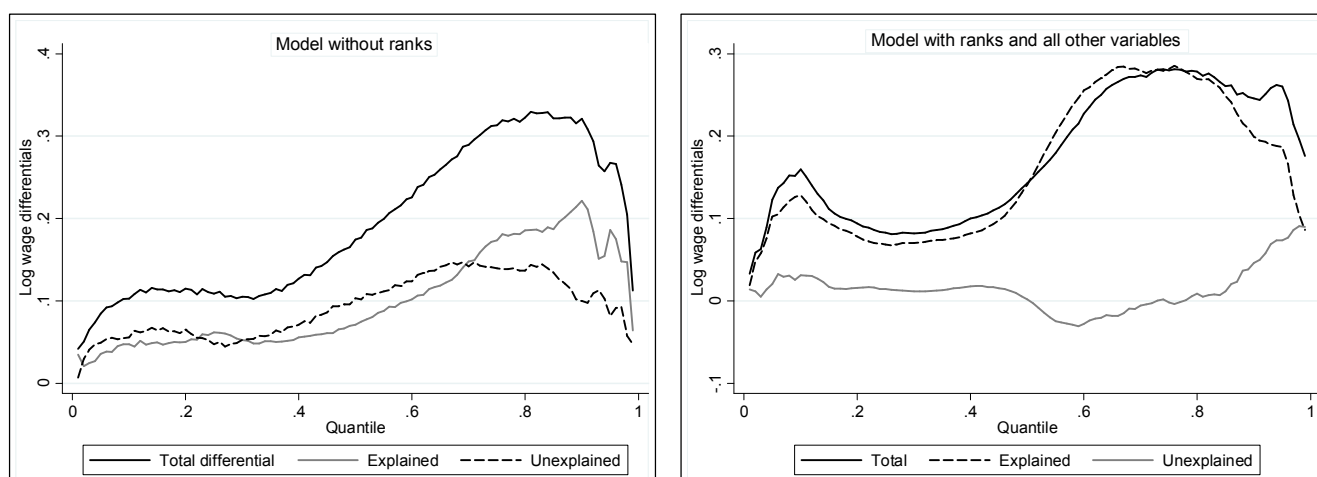
Source: Own calculation with the use of *Oaxaca* procedure in Stata.

Table 3 reports the decomposition of mean wage differentials and the contribution of independent variables to the explained (upper panel) and unexplained wage gap (lower panel). To clarify the presentation, some of the variables are grouped, e.g. all rank dummies are grouped into the category *Ranks*. Columns (1) to (3) give the decomposition of monthly salary; columns (4) to (6) show the reservation wages corresponding to the models in Tables 1 and 2. When the simplest regression with just experience variables is considered (experience and experience squared), the unexplained part of the mean salary accounts for 0.06 log points out of the 0.187; see column (1). However, when rank and other variables are included then the unexplained part is not significant for monthly salaries. For the reservation wage the situation is different. The discriminating part constitutes from 66% to 39% of the overall wage gap. For the explained part, rank is the factor with the most explanatory power for both salaries and reservation wages (0.1024 out of 0.1949 – 53% – for salaries and 0.0928 out of 0.1519 – 60% – for reservation wages).

3.5 Quantile regression

It is well documented that decomposition of mean wages can hide differences in discrimination at the bottom or top of the distribution (e.g. Fortin et al. (2011)). To obtain as detailed a picture as possible of the gender wage gap, the final part of this paper is dedicated to a decomposition of the differences in distribution using a quantile regression. We follow the procedure of Melly (2006) to calculate the decomposition of quantile regression uniformly distributed between 0 and 1 for two different models of salaries and reservation wages depending on the set of covariates included in the regression. Figure 3 plots the decomposition as a function of quantiles for salary and Figure 4 for reservation wages, with the baseline model without rank in the left-hand graph and the specification with rank and all the other covariates in the one on the right.

Fig 3. Decomposition of the gender salary gap using quantile regression

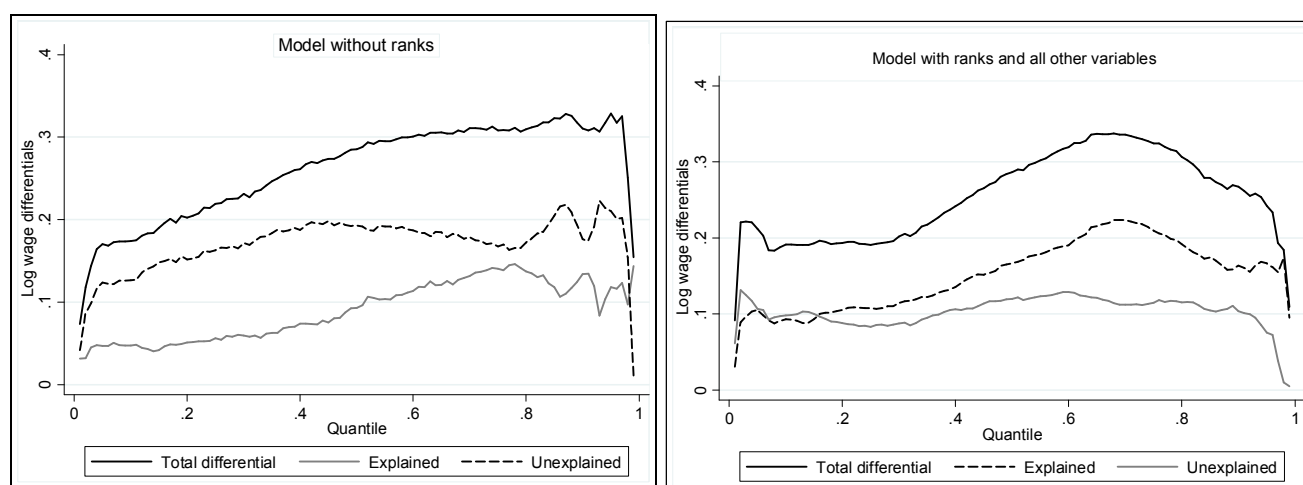


Notes: Model without ranks (left-hand graph) corresponding to the specification (1) in Table 3. Model with ranks and all other covariates as in specification (3) in Table (3).

Source: own compilation with the use of the *rqdeco* procedure in Stata.

The estimated total differentials shows that the gender salary and reservation wage gaps are higher at the top end of the distribution than at the lower end (the curves are S-shaped). This could be interpreted as an indicator of a glass ceiling phenomenon. In fact, for monthly salary, after controlling for the effects of all the other characteristics (right-hand graph), the unexplained part of the differentials is first decreasing (a negative value indicates discrimination against males) but after the 80th percentile it is increasing by up to 0.1 log points. A different situation is observed for the reservation wage. The total and explained differentials are increasing while the unexplained part is relatively stable, only decreasing at the very end of the distribution.

Fig. 4 Decomposition of the gender reservation wage gap using quantile regression



Notes: Model without ranks (left graph) corresponding to specification (4) in Table 3. Model with ranks and all other covariates as in specification (6) in Table (3).

Source: own compilation with the use of the *rqdeco* procedure in Stata.

4 Conclusions

This paper has made several contributions to understanding of the gender wage gap in the specific higher education sector labour market. To the best of our knowledge it is the first paper to provide empirical evidence on this topic in Polish academia, which is currently undergoing a substantial reform. The analysis has been based on unique web survey data since information about salaries in Poland is confidential, which in itself can be viewed as an impediment to a transparent labour market.

A detailed examination has been conducted passing from descriptive statistics, through regression analysis, to decomposition methods. The study not only takes into account monthly salaries but also information about the reservation wage gap obtained from a questionnaire (in response to a question asking academics the lowest acceptable salary above which they would not take on additional work). In the regression analysis it was shown that the variable related to productivity (publication record) is not among the important determinants of salary, but it was shown to be positively correlated with reservation wages. This lack of relationship between research productivity and individual academics' salaries questions the way research is assessed, and can be considered demotivating in terms of careers in Polish academia. Additionally, it was found that the gender salary gap disappears when rank dummies are included as additional covariates. This finding is suggestive of the importance of rank in explaining the gender salary differential.

Decomposition techniques made it possible to directly assess the factors that are quantitatively important for the gender wage gap. An Oaxaca-Blinder decomposition indicates that differences in rank account for the greatest proportion of the salary and reservation wage gender gaps – which suggests that how men and women are promoted should be explored in more detail. A further important development in this study has been the use of a quantile regression tool. Going beyond the mean shows that both the differences in raw salary and reservation wages between females and males are more pronounced at the top of the distribution. The increasing unexplained part of differentials at the high end of the distribution could be a sign of a glass ceiling in Polish academia; for reservation wages the discriminating part was more stable.

Our analysis has straightforward policy implications. The results indicate that the rigid pay scales in force seem to be a successful tool in eliminating a gender salary gap. Additionally, analysis of the reservation wage gap could be useful for establishing salaries at

each level in order to guarantee that members of academic staff in Poland hold only one contract at a time. Finally, the lack of correlation between productivity and salary level should be thoroughly analysed in future studies, and, if confirmed, adequate policy initiatives should be introduced to relate the efficiency of individuals to their remuneration.

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Appendix

Table A1. Summary statistics

	FEMALE (n=653)			MALE (n=928)		
	mean	median	Std.	mean	median	Std.
SALARY AND INCOME (in PLN)						
Salary	4438.11	3520	2828.93	5180.81	4000	2924.66
Salary_add_homeuniv	478.18	280.5	1618.45	532.68	333.333 3	895.38
Salary_overhours	303.72	166.666 7	448.54	422.26	250	747.97
Salary_grants	583.78	83.3333 4	2027.66	718.72	250	1600.68
Salary_other	260.15	0	930.24	349.78	58.3333 3	833.24
Income_add	0.56	1	0.50	0.60	1	0.49
Income_add_fulltime	1788.71	1250	2263.48	2664.40	1000	5798.12
Income_add_parttime	1172.68	500	2206.97	1346.02	833.333 3	1708.03
Income_add_ownent	1018.03	0	2322.23	1460.39	0	3499.33
Income_add_research	361.81	0	736.80	397.23	0	751.15
Income_add_other	710.83	166.666 7	1162.14	954.73	250	1654.79
Income_add_total	1373.35	208.333 3	2654.10	2202.51	416.666 7	4487.36
Wage_reservation	5771.14	5000	2704.00	7217.21	6000	3258.48
Salary_stand	3669.97	2863.63 6	2512.92	4494.57	3214.28 6	3013.79
Wage_res_stand	5409.82	4500	3150.72	6988.52	6000	3806.82
INCOME_TOTAL	6263.68	4566.66 7	5309.76	8336.15	6471.97	6480.78
Personal characteristics						
Age	40.53	38	9.75	44.50	41	11.65
Experience	15.18	12	10.30	19.44	16	12.53
Degree						
Master	0.14	0	0.34	0.08	0	0.27
Doctor	0.67	1	0.47	0.54	1	0.50
Habilitation	0.14	0	0.34	0.23	0	0.42
Professorship	0.06	0	0.23	0.16	0	0.36
Job characteristic						
Teaching_load_contract	223.69	230	31.49	219.30	225	32.95
Teaching_load_realised	278.66	250	94.43	291.27	260	110.28
Publications	70.97	50	80.82	97.46	56	134.23
Rank						
Assistant	0.18	0	0.38	0.11	0	0.31
Adjunct	0.63	1	0.48	0.51	1	0.50
Adjunct_hab	0.03	0	0.17	0.05	0	0.22

Associate professor	0.13	0	0.33	0.21	0	0.41
Full professor	0.03	0	0.18	0.12	0	0.32
Area of academic study						
Humanities	0.21	0	0.41	0.11	0	0.32
Social Studies	0.37	0	0.48	0.26	0	0.44
Science	0.04	0	0.21	0.16	0	0.37
Biological sciences	0.15	0	0.36	0.10	0	0.30
Technological sciences	0.10	0	0.30	0.26	0	0.44
Agricultural, forestry and veterinary sciences	0.07	0	0.25	0.06	0	0.24
Medical, health and sport sciences	0.04	0	0.21	0.03	0	0.17
The arts	0.01	0	0.12	0.02	0	0.13
HEI characteristic						
Location						
region_GDPpc	37418.43	35597	10352.66	37836.23	35597	9745.15
region_POLav	100.86	96	27.91	101.99	96	26.27
Type of HEI						
HEI_ekon	0.05	0	0.23	0.04	0	0.20
HEI_pedag	0.07	0	0.26	0.04	0	0.21
HEI_tech	0.19	0	0.39	0.35	0	0.48
HEI_agri	0.09	0	0.28	0.08	0	0.27
HEI_univ	0.56	1	0.50	0.45	0	0.50
HEI_sport	0.02	0	0.15	0.02	0	0.14
HEI_other	0.01	0	0.10	0.01	0	0.11
Category						
1	0.38	0	0.49	0.47	0	0.50
2	0.31	0	0.46	0.28	0	0.45
3	0.26	0	0.44	0.21	0	0.41
4	0.04	0	0.21	0.04	0	0.20

Notes: observation weight according to the representation of the given category in population.

Source: own compilation.

Questionnaire*

1. Imagine that higher education institutions are introducing a new contract for academics with the following conditions:
- teaching activity;
 - research activity;
 - administrative work;
 - **doing any additional work outside the home higher education institution, even unpaid, is prohibited;**

What should the annual quota of teaching hours be for such a contract?

_____ teaching hours per academic year

2. What is the minimum **net monthly** salary for which you would accept such a contract (with the conditions described in question 1)?

_____ PLN per month

3. What is your **basic monthly gross salary** (before taxes, social security and health payments) from your home university?

_____ PLN per month

4. How much is your **extra annual gross pay** for work at your home university such as awards, bonuses and the so-called 13th month?

_____ PLN per year

5. How much is your **annual gross overtime pay** for working extra teaching hours at your home university?

_____ PLN per year

6. How much do you receive in the form of **research grants (annual gross value)** for work at your home university?

_____ PLN per year

7. What **other annual gross income** do you receive from your home university?

_____ PLN per year

8. Do you have an additional income other than remuneration for work at your home university?

1. YES

2. NO

If you answer is NO then go to question 13

9. What are your additional earnings from full-time work besides your salary from your home university? Give the annual gross amount.

_____ PLN per year

10. What are your additional earnings from part-time work besides your salary from your home university? Give the annual gross amount.

_____ PLN per year

11. What are your additional earnings from self-employed activities? Give the annual gross amount.

_____ PLN per year

12. What are your additional earnings from external research grants (not connected to your home institution). Give the annual gross amount. _____ PLN per year
13. What is the annual gross amount of any additional income (besides those stated in your answers to questions 9 to 12) obtained outside your home institution? _____ PLN per year
14. Your current age
15. Gender
1. Male
 2. Female
16. How many years of experience have you had? _____ years
17. Annual quota of teaching hours required by your current employment contract _____ teaching hours per year
18. What is your actual teaching load? How many hours do you actually teach annually? _____ teaching hours per year
19. What is the highest degree you currently hold?
1. Master
 2. Doctorate
 3. Habilitation
 4. Professorship
 5. Other, please, specify: _____
20. What is your current rank at your university?
1. Assistant
 2. Adjunct
 3. Adjunct with habilitation
 4. Associate professor
 5. Full professor
 6. Other, specify: _____
21. Please provide the name of the higher education institution (HEI) where you currently work. If you work for more than one HEI please give the name of your main employer – the institution you are affiliated with.
22. In which department are you working? E.g. Department of Economics, Department of Law etc.
23. In which area of academic study are you specialized?
1. Humanities
 2. Social studies
 3. Science
 4. Biological sciences
 5. Technological sciences
 6. Agricultural, forestry or veterinary sciences
 7. Medical, health or sport sciences

8. The arts

9. Other, please, specify: _____

24. How many points have you received for your publications (articles, books etc.) in the last three years according to the scale provided by the Polish Ministry of Science and Higher Education (MSHE)?

_____ points

25. Do you have any remarks/comments?

*This is the English translation of the original questionnaire in Polish

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