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Analyzing the Public-Private Sector Wage Gap Using Difference-in-Differences

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Abstract

This paper estimates the differential between wages in the private and the public sectors using the difference-in-differences method. The method relies on estimating the wage changes of those that move from one sector to the other, that is, from the public sector to the private sector or from the private sector to the public sector. We find that the wages fall by 6-12% between years for those that move from the private sector to the public sector in either 2015 or 2016, while wages increase by 7-10% between years when moving from the public sector to the private sector in either 2015 or 2016.

Keywords: Private sector; public sector; wage differential.

Introduction

The wage differential between the private sector and public sector has been studied extensively over the years. In the Nordic countries, the wage differential generally has been found to be to the advantage of the private sector, while the opposite has been found for many European countries further south (Christofides & Michael 2013; Centeno & Portugal 2022; Rattsø & Stokke 2019; Sławińska 2021).

When estimating the wage differential between the public and private sectors, the methods generally applied are those comparable to the methods used to measure the gender wage gap. These include using OLS or GLS with a dummy variable signifying the public sector or the Oaxaca-Blinder decomposition method. One of the problems with using these methods is that they don't account for individuals self-selecting into either the private or the public sector.

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In this paper, we take this into account by applying the method of difference-in-differences (DiD) to estimate the wage differential between the private and the public sectors. DiD is a widely used method, especially to evaluate the effects of social programs. Rattsø and Stokke (2019) applied this methodology to estimate the wage differential between Norway's public and private sectors. They evaluated the wage effects of individuals that moved from the public sector to the private sector and compared the wage effects of switching sectors. The contribution of this paper is to estimate the public-private wage differential in Iceland using DiD, which has not been done before. The paper adds to the analysis made by Rattsø and Stokke (2019) by estimating not only the effects of moving from the public sector but also the effects of moving from the private sector to the public sector.

1. Theoretical background

In a comprehensive study that estimated the public-private sector wage differential in 27 countries, Christofides and Michael (2013) found that the public-private wage gap was beneficial for public sector employees in all Scandinavian countries, except in Norway, applying the Oaxaca-Blinder decomposition on EU-SILC data from 2008. The total wage differential for Iceland measured 16.5%, with an 8.1% unexplained private sector wage premium. Furthermore, the analysis showed that the wage differential in Finland was 13.7%, with a 12.2% unexplained private sector wage premium. The difference was smaller in Denmark and Sweden. It was 9.1% in Denmark, with 4.7% unexplained private sector wage premium, and 7.3% in Sweden, with 2.7% unexplained private sector wage premium. The wage differential measured negative in Norway, or -2.9%, with -6.7% unexplained private sector premium.

The wage differential between the private and public sectors in Iceland has been estimated from 2015 to 2017. Örnólfsdóttir (2020) performed random effects generalized least squares (GLS) regression on wage data from Statistics Iceland. They found a significant public-private wage gap in Iceland, where private sector employees received a wage premium ranging from 9.8% to 13.5%, depending on the specification of the regression. Ólafsson (2021) used the same data to estimate the wage differential while applying the Oaxaca-Blinder decomposition and propensity score matching. They found unexplained wage differential between 12% and 20% using the Oaxaca-Blinder decomposition, and between 10% and 16% wage differential using propensity score matching.

In a study using French, British, and Italian data, Lucifora and Meurs (2006) investigated the public-private wage gap using quantile regressions. They found that the wage gap varied considerably with both gender and skill. They also found that the public sector paid more to lower skilled workers than the private sector in all countries, while the reverse was true for higher-skilled workers.

Bargain et al. (2018) analysed the public-private wage gap in France over 25 years and found that wage rates were lower for public sector workers than private sector workers, and that the wage penalty was larger at the top of the wage distribution. Hospido and Moral-Benito (2014) analysed the public-private wage gap from 2005 to 2012, using the

Oaxaca-Blinder decomposition and counterfactual distributions, combined with fixed effects quantile regressions, thus accounting for endogenous selection. They found a positive public wage premium of 20% when controlling for various characteristics and 10% when taking endogenous selection into account. Similarly, Melly (2005) used the Oaxaca-Blinder decomposition and quantile regressions to evaluate differences in earnings distribution between the public and the private sectors in Germany from 1984 to 2001. They also found that the conditional distribution of wages is more compressed in the public sector than in the private sector. Furthermore, the results showed a negative wage differential for men but a positive one for women.

Using data from the United Kingdom, Singleton (2019) used longitudinal linked employer-employee data from 2002 to 2016, controlling for both unobserved worker and unobserved firm heterogeneity. They found no significant public sector wage premium among men but a 4% public sector wage premium among women. Similarly, Borjas (2002) used longitudinal data from the US census from 1960 to 2000 and found no public-private wage differential for men, but a positive one for women. They found that since 1970 there has been a significant relative compression of the wage distribution in the public sector. As a result, the transition rate of employees moving out of the public sector is higher than the transition rate of those moving out of the private sector.

In a recent paper, Rattsø and Stokke (2019) proposed using a fixed effects difference-in-differences model to estimate the private-public sector wage differential. They used register data for high-educated workers from 1993 to 2010 to evaluate the public-private wage gap in Norway. They measured the change in wages for those individuals that shifted from the public sector to the private sector and found that public sector workers that shifted to the private sector received a 12.6% wage increase on average. They also found that individuals shifting from the public sector to the private sector were not identical, as they were generally younger than those staying in the public sector. To account for this difference, making use of the longitudinal nature of their data, they used individuals who shifted later in life from the public to the private sector as a control group and found a lower gain from shifting of 11.2%. The estimate for the effects for women was slightly lower, or 10.2%. They also found that the gain from shifting varied with the business cycle, i.e., it mattered at which point in time individuals moved from the public sector to the private sector.

2. Data and methodology

2.1 Data

The data used in this study was individual payroll data from employers, collected by Statistics Iceland for their calculation of the official Wage Index. The sample was a stratified sample of firms in the private sector, where the selection was made from firms with at least ten employees. The coverage of the public sector was nearly complete, with information on all central government employees, all employees of the largest municipalities, and a sample of the smaller ones. The data is annual and covers the years 2015-2017 and included about 70 thousand observations each year. In the data, an organization is

classified as public if its financing is at least 50% from public funds (OECD 2003). Each individual in the database has, on average, 2.3 observations. The number of observations and split between the public and private sectors are shown in Table 1.

Table 1. Number of observations by sector

	2015	2016	2017
Public sector	38,893	39,033	40,181
Private sector	30,187	30,746	31,794
Total	**69,080**	**69,779**	**71,975**

Of the 210,834 observations on 92,724 individuals in the data set, 1,589 shifted from the private sector to the public sector over the two years, while 1,594 shifted from the public sector to the private sector. The number of sector changes and the nature of those shifts are displayed in table 2.

Table 2. Movement between sectors, number of individuals

	2015-2016	2016-2017	Total
From private to public	1,042	547	1,589
From public to private	734	860	1,594
Total	**1,776**	**1,407**	**3,183**

With the coverage of data in the public sector almost complete, compared with a stratified sample in the private sector, the number of shifts to the public sector is in all likelihood overrepresented compared to shifts from the public to the private sector.

2.2 Method

The difference-in-differences (DiD) estimator is generally used to evaluate the impact of social programs by measuring the difference in the change before and after between participants and nonparticipants. The application of the DiD method for the analysis of data has the advantage of implying causality, given the parallel trends assumption which can be tested. In the context of this paper, we apply DiD to estimate the wage differential between those that move from the public sector to the private sector in the years 2016 and 2017, and vice versa. While not strictly a program outcome, the method can still be applied. DiD analysis is based on the assumptions that each individual *i* experienced no change in unobserved, relevant factors between time periods and that each individual *i* in the treatment group can be compared to each individual *j* in the control group (Fredriksson & Oliveira 2019; Rattsø & Stokke 2019).

The analysis is performed on two separate wage measures, base wages and total earnings, both hourly measures. The base wage is defined as the wage rate for regular work with the addition of various regular surcharges and bonus payments. Total earnings are the sum of all payments to the individual, the base wage, and all other types of wages,

including overtime payments. Hence, the base wage is the wage paid for a typical working day with a comparable number of work hours. Total earnings give a more accurate estimate of the take-home pay, while working hours can vary widely and are measured with less accuracy than the working hours of base wages. The wage distribution is different between the private and the public sector as shown in Figures 1 and 2.

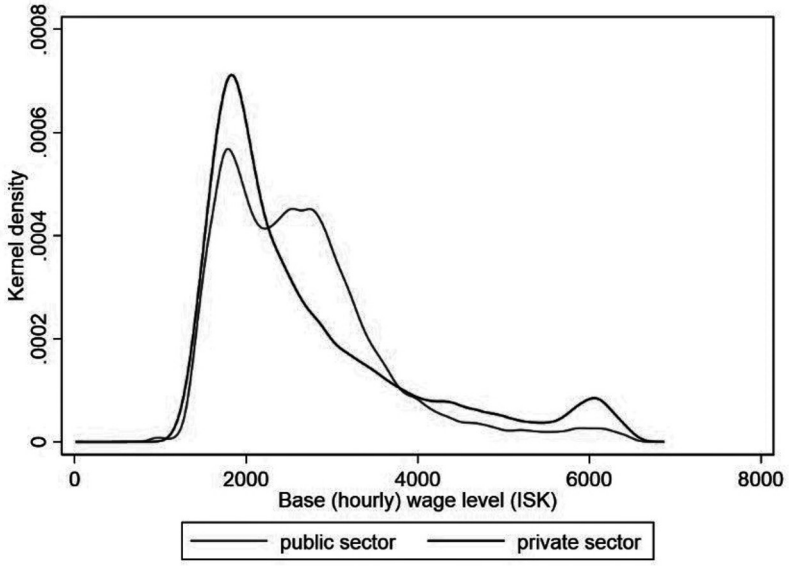

Figure 1. Density of base wages by sector

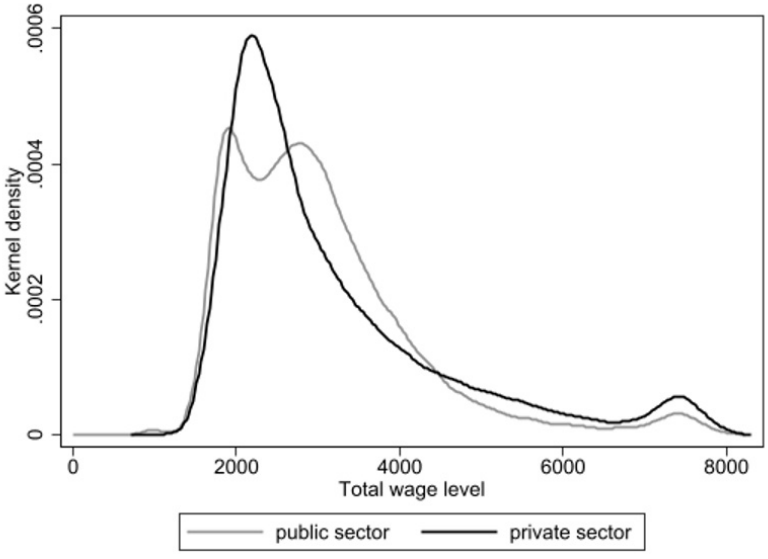

Figure 2. Density of total earnings by sector

The density of base wages is skewed to the left, with most individuals earning base wages around 2,000 ISK, as seen in Figure 1. At the lower end of the distribution, there is not much difference between the private and the public sectors. However, around the middle of the distribution there is a higher density of workers from the public sector than the private sector. At the highest point of the wage distribution there are more private sector workers than public sector workers. Hence, overall there is a greater wage distribution among private sector workers than public sector workers. Figure 2 shows the distribution of total earnings. There are no significant differences between the distribution of base wages and total earnings, as both show a similar difference between the private and the public sector.

Furthermore, the average wage level is higher in the private sector than in the public sector, with a higher standard deviation, as shown in Table 3.

Table 3. Average base wages and total earnings by sector, standard deviation in parenthesis

	2015	2016	2017
Public sector			
Base wages	2,385 (871)	2,669 (936)	2,827 (966)
Total earnings	2,811 (1,097)	3,023 (1,146)	3,216 (1,187)
Private sector			
Base wages	2,524 (1,197)	2,742 (1,227)	2,849 (1,253)
Total earnings	2,944 (1,343)	3,191 (1,392)	3,308 (1,415)

When estimating the wage change from moving from one sector to the other, we control for various factors. The control variables in the analysis were labor market experience (in years), seniority in the current workplace (in years), education; a set of dummy variables indicating the highest level of educational attainment, full-time work; a dummy variable which takes on the value 1 if the individual is working full-time, total hours worked over the year, capital area; a dummy variable which takes on the value 1 if the individual lives in the capital area, and a set of occupation dummy variables indicating the first number of the ISCO-88 standard. The variables labor market experience and workplace seniority were also included in squared form to better grasp the nonlinearity of wage progression with regards to time. Table 4 shows the mean, median, and standard deviation for the main explanatory variables. The last six variables are dummy variables. Their mean value therefore denotes the share of the sample for which their value is positive.

Table 4. Descriptive statistics

	Mean	Median	Standard deviation
Labor market experience	17.93	21	9.30
Workplace seniority	8.10	7	7.48
Total annual work hours	1,489	1,702	789.4
Elementary education	0.2285		
High school education	0.3660		
Undergraduate education	0.2351		
Graduate education	0.1705		
Full-time work	0.5780		
Capital area	0.6655		

Based on the explanatory variables discussed above, we use the following specifications to analyze the data.

$$(1)\ \Delta \ln w_{Bit} = \alpha_0 + \alpha_1 Sectorchange_i + \alpha_2 After_t + \delta SectorChange_i \times After_t + \eta \mathbb{X}_{it} + \varepsilon_{it}.$$

$$(2)\ \Delta \ln w_{Tit} = \alpha_0 + \alpha_1 Sectorchange_i + \alpha_2 After_t + \delta SectorChange_i \times After_t + \eta \mathbb{X}_{it} + \varepsilon_{it}.$$

The dependent variable w_{Bit} denotes the hourly base wage of individual *i*, w_{Tit} denotes the total hourly earnings of individual *i*. The coefficient δ represents the estimated wage effect of switching between sectors, while $\mathbb{X}_{it}$ denotes a vector of control variables. We analyzed the movement to and from each sector in the periods 2015-2016 and 2016-2017. The research question is whether the wage development between those that move from one sector to another (shifters) differs from those that stay in the same sector (stayers). Furthermore, whether the movement of the wage development is in line with the measured wage differential between the private and the public sectors, i.e. whether wages fall when shifting from the private sector to the public sector and rise when shifting from the public sector to the private sector.

3. Results

There is a difference between those individuals that move between sectors (shifters) and those that stay (stayers) as shown in Table 5. Job shifters were more likely to have shorter tenure at the current firm, or have been in the labor market for a shorter period of time. They were also more likely to work part-time and have less education than job stayers.

Table 5. Descriptive statistics for shifters and stayers

	Shifters		Stayers	
	2015-2016	2016-2017	2015-2016	2016-2017
Labor market experience	12.9	10.4	18.0	18.2
Firm seniority	4.9	3.3	8.2	8.2
Full-time work	39.4%	29.6%	58.0%	59.0%
High school education	44.5%	44.9%	36.6%	36.3%
Undergraduate education	20.8%	18.8%	23.8%	23.5%
Graduate education	10.0%	7.7%	17.2%	17.4%
Capital area	70.6%	62.2%	66.7%	66.5%

Looking at the change in wages for those that shifted from the public sector to the private sector, controlling for various individual characteristics, we found that their base wages increased by 10.1% (0.0965 log points) for those that moved between 2015 and 2016 and by 7.2% (0.0698 log points) for those that moved between 2016 and 2017 as shown in Table 6. The opposite holds for those that move from the private sector to the public sector, as their base wages base wages fell by 5.7% (-0.0585 log points) for those that moved between 2015 to 2016 and by 7.9% (-0.0827 log points) between 2016 and 2017. In all cases, we controlled for labor market experience, workplace seniority, educational attainment, a dummy variable indicating whether the individual is working full-time, total hours worked, whether the individual lives in the capital area; and a set of occupational dummy variables indicating the first number of the ISCO-88 standard.

Table 6. Estimated effects on base wages of moving between sectors

	2015-2016		2016-2017	
	Public to private	Private topublic	Public to private	Private to public
Constant	7.7382 (0.0057)***	7.904 (0.0056)***	7.8396 (0.0054)***	7.9659 (0.0053)***
Sector change	0.00006 (0.0077)	-0.0962 (0.0070)***	0.0168 (0.0088)*	-0.0427 (0.0075)***
After	0.1028 (0.0015)***	0.0889 (0.0018)***	0.0568 (0.0015)***	0.0510 (0.0017)***
δ (DiD)	0.0965 (0.0109)***	-0.0585 (0.0099)***	0.0698 (0.0124)***	-0.0827 (0.0105)***
High school education	0.07100 (0.0025)***	0.066 (0.0022)***	0.0735 (0.0024)***	0.0616 (0.0021)***
Undergraduate	0.1226 (0.0030)***	0.1040 (0.0031)***	0.1263 (0.0029)***	0.0916 (0.0030)***
Graduate	0.2615 (0.0033)***	0.2079 (0.0042)***	0.2571 (0.0031)***	0.1849 (0.0040)***
Full-time work	-0.0081 (0.0023)	0.0723 (0.0027)***	-0.0082 (0.0022)***	0.0670 (0.0026)***
Total work hours	0.00008 (1.54*10-6)***	0.000018 (1.76*10-6)***	0.00008 (1.48*10-6)***	0.000017 (1.67*10-6)***
Capital area	-0.0183 (0.0017)***	0.0411 (0.0019)***	-0.0138 (0.0016)***	0.0399 (0.0019)***
Workplace seniority	0.0059 (0.0003)***	0.0064 (0.0003)***	0.0058 (0.0003)***	0.0065 (0.0003)***
Workplace seniority, squared	-0.00016 (9.42*10-6)***	-0.000105 (8.37*10-6)***	-0.000143 (9.04*10-6)***	-0.00011 (8.10*10-6)***
Labor market experience	-0.0046 (0.0005)***	0.0091 (0.0005)***	-0.0054 (0.0005)***	0.0099 (0.0004)***
Labor market experience, squared	0.00034 (0.00002)***	0.00003 (0.000016)***	0.00034 (0.000014)***	-8.96*10-6 (0.000014)
ISCO-dummies	Yes	Yes	Yes	Yes
R2	0.6086	0.6965	0.5958	0.6948
Adj. R2	0.6085	0.6964	0.5957	0.6947

*** = p< 0.001; ** = p< 0.01; * = p< 0.05.

As base wages do not give the complete picture and may not be fully comparable between the two sectors, we also estimated the wage effects on total earnings, which included all extra payments.

Table 7. Estimated effects on total earnings of moving between sectors

	2015-2016		2016-2017	
	Public to private	Private to public	Public to private	Private to public
Constant	7.8695 (0.0068)***	8.1040 (0.0059)***	7.9248 (0.0063)***	8.1617 (0.0057)***
Sector change	0.0117 (0.0092)	-0.0863 (0.0074)***	0.0274 (0.0103)***	-0.0427 (0.0080)***
After	0.0628 (0.0018)***	0.0844 (0.0019)***	0.0618 (0.0017)***	0.0476 (0.0019)***
δ (DiD)	0.0928 (0.0129)***	-0.1021 (0.0104)***	0.0738 (0.0145)***	-0.1283 (0.0113)***
High school education	0.0793 (0.0030)***	0.0663 (0.0023)***	0.0884 (0.0028)***	0.0654 (0.0022)***
Undergraduate	0.1216 (0.0035)***	0.0979 (0.0033)***	0.1350 (0.0033)***	0.0938 (0.0032)***
Graduate	0.2811 (0.0039)***	0.2109 (0.0044)***	0.2800 (0.0037)***	0.1962 (0.0043)***
Full time work	-0.0254 (0.0027)***	0.0262 (0.0029)***	-0.0229 (0.0025)***	0.0303 (0.0027)***
Total work hours	0.000096 (1.83*10-6)***	0.000017 (1.86*10-6)***	0.000096 (1.74*10-6)***	0.000015 (1.79*10-6)***
Capital area	-0.0178 (0.0020)***	0.0287 (0.0021)***	-0.0124 (0.0019)***	0.0295 (0.0020)***
Workplace seniority	0.0074 (0.0003)***	0.0091 (0.0003)***	0.0075 (0.0003)***	0.0093 (0.0003)***
Workplace seniority, squared	-0.00022 (0.000011)***	-0.000171 (8.85*10-6)***	-0.0002 (0.00001)***	-0.00018 (8.67*10-6)***
Labor market experience	-0.0052 (0.0006)***	0.0058 (0.0005)***	-0.0053 (0.0003)***	0.0059 (0.0005)***
Labor market experience, squared	0.00034 (0.00002)***	0.000094 (0.000017)	0.0003 (0.000016)***	0.000076 (0.000015)***
ISCO-dummies	Yes	Yes	Yes	Yes
R2	0.4992	0.6266	0.5112	0.6205
Adj. R2	0.4991	0.6265	0.5111	0.6204

*** = p< 0.001; ** = p< 0.01; * = p< 0.05.

A slightly different picture emerges when looking at total earnings as the total earnings of shifters from the private to the public sector fall more than base wages while the increase in total earnings for the shifters between the public to the private sector are similar for base wages and total earnings. Employees that moved from the public to the private sector between 2015 and 2016 enjoyed an increase of 9.7% (0.0928 log points) on average in total earnings, while the earnings rose by 7.7% (0.0738 log points) between

2016 and 2017. Those individuals that moved from the private sector to the public sector experienced a fall in total wages of 9.7% (-0.1021 log points) between 2015 and 2016, and 12.0% (-0.1283 log points) between 2016 and 2017.

To validate the DiD we look at the wage development of shifters versus stayers. A graphical analysis of shifter versus stayer wage progression over time supports the parallel trends assumption in the case of those who shift from or stay in the private sector (Figures 3 & 4) while the same analysis rejects the assumption in case of those who shift from or stay in the public sector (Figures 5 & 6).

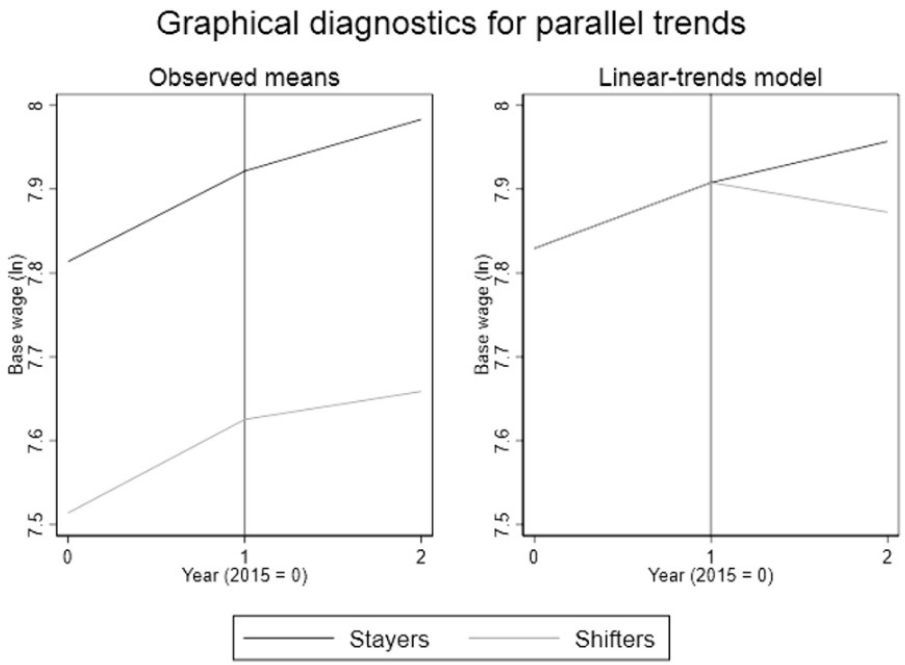

Figure 3. Parallel trends of private sector base wages

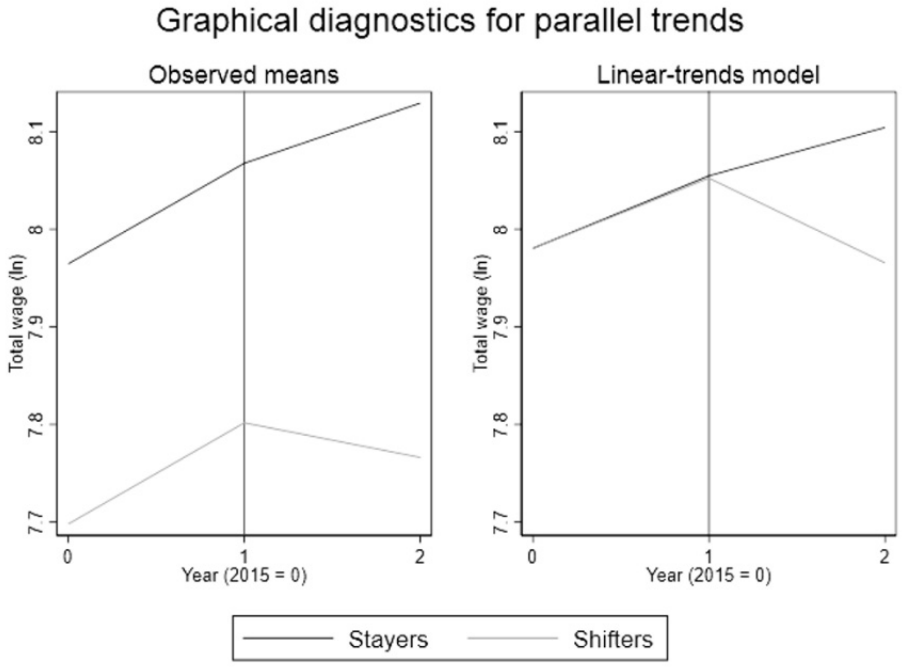

Figure 4. Parallel trends of private sector total earnings

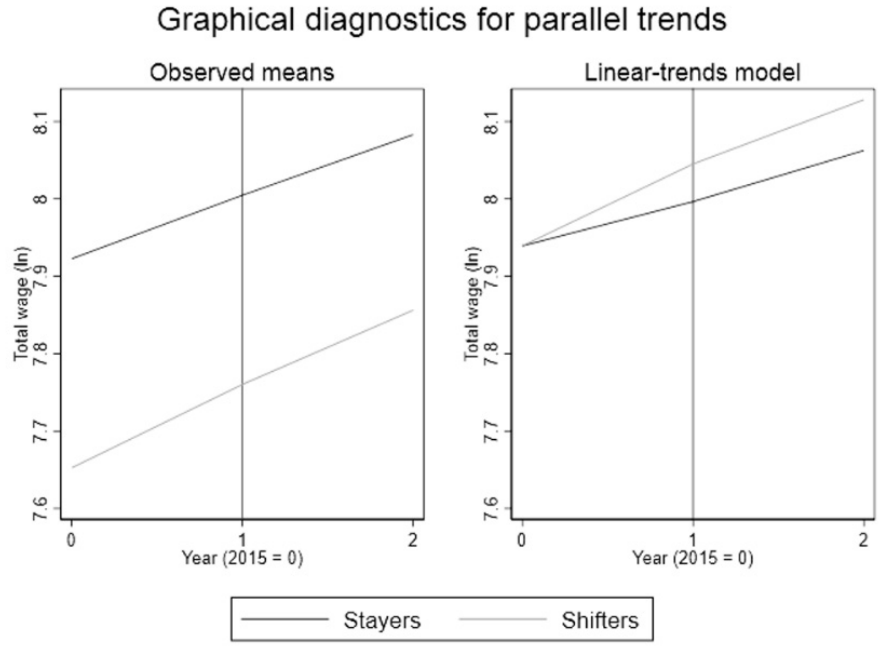

Figure 5. Parallel trends of public sector base wages

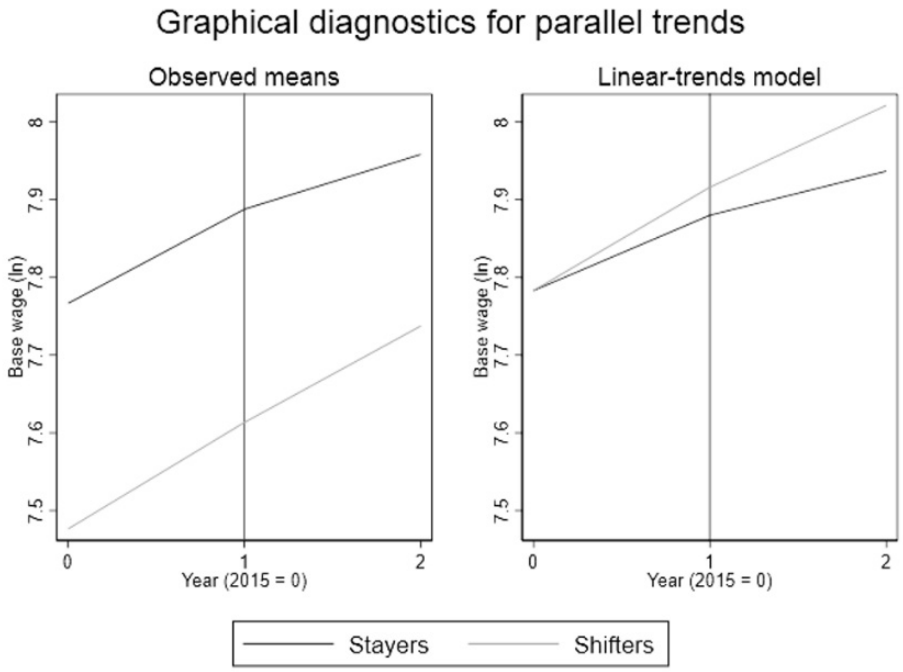

Figure 6. Parallel trends of public sector total earnings

There are limitations to the analysis applied here as the graphical analysis of the relevance of the parallel trends assumption requires at least three time periods. Hence, the assumption can only be tested on those who shift between sectors in the year 2016. Furthermore, plotting of the parallel trends assumption requires that individuals are in the sample for all three periods. Therefore, the parallel trends assumption could only be tested on a subsample of the observations.

4. Discussion and conclusion

Previous research on the wage differential in Iceland showed that wages were lower in the public sector than the private sector, while controlling for individual characteristics. The results from the DiD analysis that were presented in this paper are consistent with these results. We found that wages of those moving from the public sector to the private sector increase due to the change, while the wages of those moving from the private sector to the public sector fall due to the change. The results are significant, consistent and with the expected sign. As we can assume that the productive characteristics of those moving between the two sectors are unchanged by the move, the estimated wage differential can be interpreted to mean that there is a difference in wage setting between the two sectors. The parallel trends assumption is supported in the case of those who shift from or stay in the private sector while we did not find support for the assumption in the case of those who shift from or stay in the public sector.

These results, in comparison to Örnólfsdóttir (2020) and Ólafsson (2021), show a lower wage differential or between 6% and 12%, compared to their estimates of 10-20% wage differential between sectors, while all three studies use the same data set. A possible explanation is that those that shift from one sector to the other are generally younger with less human capital investment and less work experience than those that stay.

The results presented here are in line with those of Rattsø and Stokke (2019) in that wages of those moving from the public sector to the private sector fall. This paper adds to their analysis as we also analyzed the effects of moving from the private to the public sector, showing a fall in wages. Rattsø and Stokke (2019) found a correlation between the wage change and economic growth. Our results show indications in that direction, while the time series it too short to draw any definite conclusions. While economic growth measured 6.3% in 2016, and 4.2% in 2017, we found that the estimated wage increases were higher between 2015 and 2016 than between 2016 and 2017, while the opposite held for wage decreases.

The next step in the analysis is to explore whether these differences remain consistent and robust over time, i.e., whether shifters from the public to the private sector generally receive higher wages and shifters from the private to the public sector generally receive lower wages. Rattsø and Stokke (2019) also explored longer term effects of shifting, which due to the short time series data available for this study was not possible to explore. Last, but not least, it would be interesting to examine whether this shift in wages is related to the gender wage differential, as we know a higher share of women than men work in the public sector.

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