

The Public-Private Sector Pay Gap in Northern Ireland

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*NERI Working Paper Series No. 70
November 2020*

When citing this report, please use the following wording:

Mac Flynn, P. (2020) *The Public-Private Sector Pay Gap in Northern Ireland*, NERI Working Paper Series, NERI WP 2020/N0 70, Belfast: NERI.

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THE PUBLIC-PRIVATE SECTOR PAY GAP IN NORTHERN IRELAND

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Keywords: Wages; Wage Differentials; Public Sector Labor Markets

JEL Codes: E24; J31; J45;

ABSTRACT

The gap between mean earnings in the public and private sectors has been a near constant feature of economic policy debates in Northern Ireland for at least the last 20 years. However, much of this analysis is focused on estimates of the raw or unadjusted pay gap, that is a simple comparison of average wages. The goal of this paper is to take this analysis much further by exploring how the make-up of each sector affects what mean earnings are in each sector. This paper makes use of data from the UK Understanding Society survey in Northern Ireland to estimate an adjusted public private pay gap for Northern Ireland.

The scale and significance of the unadjusted public private pay gap is reduced by over 83% by accounting for observable differences in personal, job and workplace characteristics. Decomposing the unadjusted gap also shows that observable differences in these attributes account for the vast majority of this gap, while differing rates of return to characteristics play a significant but much smaller role. Overall observable differences in the workforce of both sectors can explain just under 80% of the raw gap in mean pay. These findings present a challenge to the persistent narrative that public sector wages in Northern Ireland are artificially high and that this is holding back the private sector.

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SECTION 1: INTRODUCTION

The gap between average earnings in the public and private sectors has been a near constant feature of economic policy debates in Northern Ireland since the introduction of devolved government in 1998. Any headline analysis of pay statistics in Northern Ireland will show a consistent gap between average earnings in the public sector compared to those in the private sector. In effect Northern Ireland has a positive public private pay gap or a public sector premium. However, much of this analysis is focused on estimates of the raw or unadjusted pay gap, that is a simple comparison of average wages.

Any public private pay gap is usually based on comparing the average wages in each sector but any such comparison can often be quite misleading, especially when it is based on comparisons of median wages. The mean wage is a simple average which is calculated by adding all of the employee wages of one sector and dividing that by the total number of employees in that sector. The median wage applies to an individual worker in the sample or population being analysed, with the worker in the middle of the distribution of earnings being the median. In such an analysis, the median worker in the public and the private sector bear no relation to each other, their positions only having been determined by the dynamics within their own sector. A raw, or unadjusted pay gap, analysis seeks to make direct comparisons between these workers without any consideration of other factors.

The goal of this paper is take this analysis further by exploring how the make-up of each sector influences what average earnings are in each sector. A raw or unadjusted pay comparison could be comparing the wages of a school principal to those of a retail worker, which is clearly not an appropriate comparison. Survey data allows for comparisons of average wages that adjust for many observable differences between workers in the public

and private sectors to arrive at a more like for like comparison. This data can give a much greater understanding of the public private pay gap by identifying what drives the gap in pay and how much of it we can explain.

Section 2 will set out the background of public private pay analysis in Northern Ireland to date and the policy environment which it has created. Section 3 will broaden this out by looking at the academic research on public private pay gaps to date and discuss the implications of those findings. Section 4 will set out the data that will be used in this analysis and how it describes the public and private sectors in Northern Ireland. Section 5 will set out the methodology that will be used to estimate and adjusted public private pay gap drawing from literature presented in Section 2. Section 6 will set out the results of that analysis and Section 7 will discuss the implications for policy.

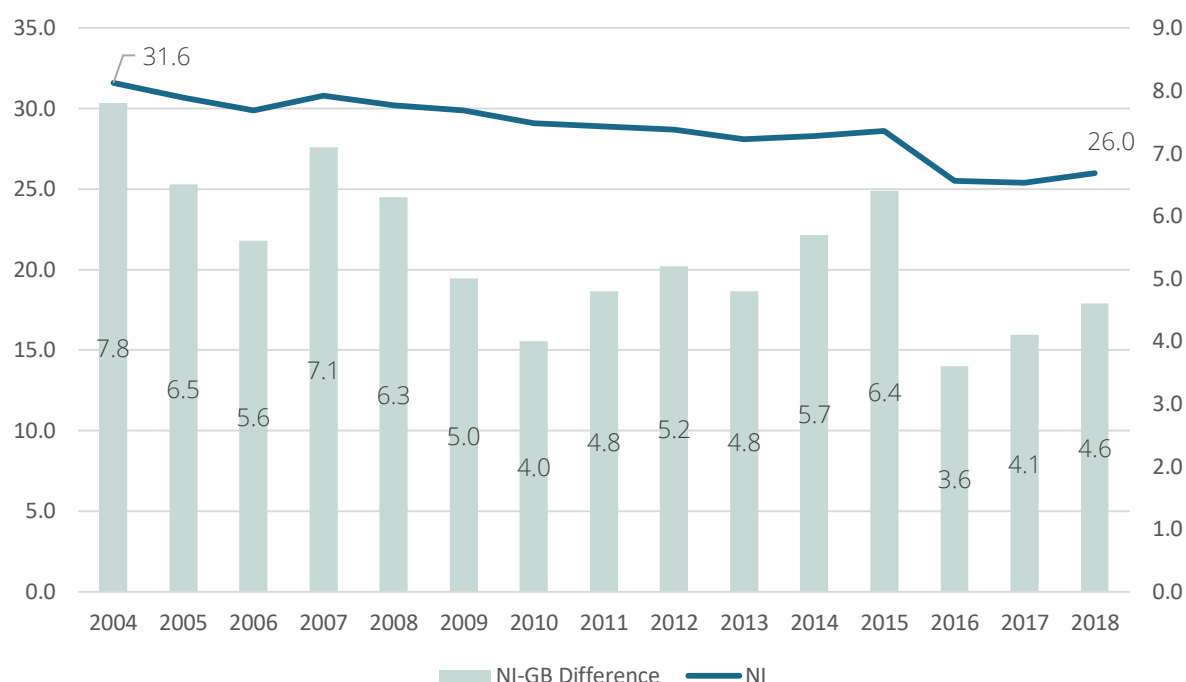
SECTION 2 BACKGROUND

The public private pay gap is one strand of a debate that focuses on the scale of public expenditure in Northern Ireland and its role in determining economic growth. For many, the role of public expenditure has been a constraint on Northern Ireland's economy throughout the period of conflict and beyond. For those who see public expenditure as detrimental to growth (Varney, 2008), the logic is that the role of public expenditure in Northern Ireland is outsized relative to comparator economies and therefore crowds out private sector activity which would ultimately yield greater productivity. The argument follows that if the same resources used by public expenditure were instead employed by the private sector, the resulting output would be greater.

The 'crowding out' argument is by no means unique to Northern Ireland and is commonly used to challenge the role of public expenditure in many economies even some with comparatively low levels of public sector employment (Behar and Mok, 2013). 'Crowding out' focuses on the unitary nature of public expenditure and that when the state has an outsized economic role, private sector actors suffer. This can be in the form of investment whereby government use of physical capital resources by public expenditure could prevent more growth enhancing investment by the private sector. It can also be applied to the labour

market whereby the employment of human capital resources by public expenditure impedes their more efficient deployment in the private sector.

Chart 2.1: Public sector employment as a share of total employment in Northern Ireland and Great Britain 2018



Source: ONS (2019) Annual Population Survey

Chart 2.1 shows public sector employment as a percentage of total employment in Northern Ireland. It also shows the difference between Northern Ireland and the rest of the United Kingdom with regard to the same metric. What this shows is that Northern Ireland has had a consistently higher rate of public sector employment than the rest of the UK, but that this gap has narrowed in the most recent years. Table 2.1 shows that within the United Kingdom, Northern Ireland had the second highest proportion of public sector employment, coming just behind Wales and marginally ahead of the North East of England. However, in contrast to Wales and Scotland, Northern Ireland has a comparatively low total employment rate. In this sense, public sector employment represents a larger share of a smaller total employment figure.

Table 2.1: Public sector employment as a share of total employment and total employment rate by UK region 2018

Region	Public Sector Share %	Total Employment Rate %
Wales	26.6	73.1
Northern Ireland	26.0	70.0
Scotland	25.5	74.1
North East	24.6	71.1
North West	22.7	73.8
Yorkshire and The Humber	22.7	73.6
East Midlands	21.2	74.7
South West	21.2	78.7
West Midlands	21.0	73.3
South East	19.9	78.0
East	19.4	78.0
London	18.4	74.3

Source: ONS (2019) Annual Population Survey

Note: Employment Rate calculated as share of employment ages 16-64

In terms of identifying the crowding out of private sector employment, the gap in average earnings between the public and private sectors is the most common metric. The argument is that the public sector, by offering a higher wage, entices potential workers away from the private sector. Once again, the outsized role of public expenditure, is posited as an obstacle to competition for wages. The public sector is deemed to have a wage profile that is not linked to market conditions and therefore private sector actors are unable to compete with it. As Table 2.2 below shows, Northern Ireland has the largest gap in full-time median and mean earnings between the public and private sectors.

Table 2.2: Mean and Median full-time public and private sector hourly pay (ex overtime) by UK region 2018

Region	Sector	Median	Private/Public	Mean	Private/Public
UK	Public	16.51		18.33	
	Private	13.33	80.7	17.20	93.8
North East	Public	14.62		16.68	
	Private	12.02	82.2	14.54	87.2
North West	Public	15.86		17.89	
	Private	12.4	78.2	15.39	86.0
Yorkshire / Humber	Public	14.83		16.97	
	Private	12.04	81.2	14.94	88.0
East Midlands	Public	15.62		17.71	
	Private	11.94	76.4	14.62	82.6
West Midlands	Public	15.76		17.69	
	Private	12.46	79.1	15.86	89.7
East	Public	16.01		17.88	
	Private	13.15	82.1	16.30	91.2
London	Public	19.71		21.83	
	Private	18.03	91.5	24.17	110.7
South East	Public	16.35		17.85	
	Private	14.37	87.9	17.87	100.1
South West	Public	15.5		17.22	
	Private	12.68	81.8	15.54	90.2
Wales	Public	15.19		16.83	
	Private	11.5	75.7	13.79	81.9
Scotland	Public	16.89		18.44	
	Private	12.92	76.5	16.15	87.6
NI	Public	15.06		17.01	
	Private	9.84	65.3	13.00	76.4

Source: ONS (2018) ASHE

Note: The Private/Public column shows the mean (or median) private sector wage as a percentage of the mean (or median) public sector wage.

The regional breakdown in Table 2.1 is informative because, the regions that report the highest shares of public sector employment have consistently reported amongst the lowest overall average wages in the UK over the last number of years (ONS, 2020). However, the figures presented in Table 2.2 for 2019 do not represent a markedly different picture to those of the preceding years. That the public sector in Northern Ireland has a higher median wage than the private sector is not at issue, it is clearly the case. What is at issue is whether that

gap represents unfair competition. If the differences in wages can be explained by differences in the characteristics of the workforce, it cannot be argued that the public sector, through its wage setting process, is putting the private sector at a disadvantage.

Seeking to understand the nature of the gap in earnings between the public and private sector is the central motive of this paper. If the gap is not due to inappropriate wage setting in the public sector, then the policy implications of the figures presented in Table 2.1 are quite different. If there is limited or no 'crowding out' effect, then the role of public sector wages is in sustaining high paid employment in Northern Ireland. Public sector employment becomes the key driver of living standards and policy should instead focus on how private sector wages can be brought up to match. The next section will look at evidence from previous studies which have sought to answer this question.

SECTION 3 LITERATURE REVIEW

The data presented in Table 2.2 represents the raw gap between the mean and median private sector wage and the mean or median public sector wage. However, such a comparison is extremely blunt and can only give specific and limited insight to policy discussions. This is because the median worker in the private sector is likely to be quite different in many respects from the median worker in the public sector. In order to understand what any public private pay gap actually means, we first need to understand whether we are comparing like with like. The most common method is to measure the gap in mean pay but also to take account of differences in individual characteristics and circumstances beyond sector of employment which are likely to determine any gap in pay. A form of adjusted pay gap is central to all studies presented in this section in this area and in nearly all cases the adjustment results in a significant reduction in the overall public private pay gap.

Gaps in earnings between public and private workers at different points in the earnings distribution can be quite varied. There is a broad consensus within the literature examining public private pay dynamics within the earnings distribution that the gap tends to be positive at the lower end of the distribution and negative at the upper end (Lucifora and Meurs, 2004;

Depalo and Giordano, 2011; Giordano et al, 2015). This finding broadly reflects a situation where the earnings distribution in the public sector is substantially more compacted than in the private sector. Hyder and Reilly (2005) look at the extreme case of Pakistan where the pay gap between both sectors declines rapidly from 92% at the 10th percentile to only 20% at the 90th percentile. Understanding the relationship between the public private gap and the earnings distribution can have important implications for policy decisions. Hámori and Lovász (2011) examine an attempt by the government of Hungary to draw higher skilled employment from the private to the public sector with a blanket 50% wage increase. However, the gap in earnings with the private sector was only negative at the upper end of the distribution of earnings, making this an inefficient strategy.

Understanding the role of the earnings distribution can also provide clarity for differing pay gaps between groups. Lucifora and Meurs (2004) find that the difference in public private pay gaps along the earnings distribution is most pronounced for female workers. Depalo and Giordano (2011) find a similar trend in Italy while Giordano *et al* (2015) confirmed these findings in an analysis of public private pay gaps across Euro Area countries. Christofides and Michael (2013) note that while public private gaps tend to be higher for females at the low end of the distribution, in more than half of EU countries the size of the overall pay gap is still larger for males than it is for females. These studies can provide more accurate estimates of the adjusted public private pay gap because the workers being compared are more similar. Furthermore, the finding that the public sector tends to be more rewarding for those in lower pay brackets shows that the public sector appears to reduce overall pay inequality in the overall labour market. The finding that, for lower paid female workers, the effect is magnified also shows the benign impact of the public sector on the overall gender pay gap. That the gap can vary between groups is also an important insight particularly in economies where the lack of an overall gap in mean earnings can obscure substantial differences within the labour market.

In many cases simply correcting for differences in the composition of public and private sector workforces may not be enough. In order to garner a deeper understanding of differentials between pay in the public and private sectors it is necessary to understand the

structure of any gap. If, for instance, mean pay is higher in the public sector and this was solely due to a greater preponderance of university graduates, does it follow that equalising the number of graduates between both sectors would eliminate the gap? Not necessarily. This is why a substantial gap can remain even after adjustments are made for education and other characteristics. The question that arises in this case is, does the private sector value some workers less or does it value the attributes of some workers less?

This question leads to an investigation of how each sector rewards workers' characteristics and attributes, and whether the reward for characteristics is different between sectors. In particular, there is much focus in the literature on how education is rewarded differently in the public and private sectors both for the workforce as a whole and subgroups within it. Coppola and Calvo-Gonzales (2011) examine public and private sector compensation in Peru and one of their key findings is the critical role that post-secondary education plays in determining wages in both sectors. They found that education influences wages in both sectors, but the effect was stronger in the public sector where a post-secondary education served as a signal. The returns to a post-secondary education tended to be binary within the public sector, whereas the returns in the private sector were continuous. In this instance, while education has an impact on wages in both sectors, the scope of the impact is different.

Psacharopoulos (1983) found a similar impact in a number of countries where higher education was rewarded equally in both sectors, but lower levels of education were more generously rewarded in the public sector. Giordino (2010) examines the situation in Italy and finds that graduates in the public sector experienced a wage penalty up until the early 1990s, but after that it becomes a premium. Not only can the role of education vary between sectors, but the effect is also unlikely to be static. Bender and Elliot (1999) find a similar picture in the UK where the returns to education between the two sectors converged through the 1980s, but that this convergence was followed by a divergence driven by differing returns to occupational attributes.

While individual attributes such as education and occupation can tell us a lot about gaps in pay between the public and private sectors, in many cases it is not possible to account for all

of the gap by such means. Chatterji *et al* (2007) examining pay data for Great Britain find that while individual, workplace and other observable attributes can explain the gap in male earnings between the public and private sectors, almost four fifths of the gap in female earnings is unexplained. Heitmueller (2005) finds a similar picture in Scotland where observable characteristics explain a large proportion of a smaller male gap in earnings, but leave much of the gap in female earnings unaccounted for. Papapetrou (2006) looks at pay gaps within the earnings distribution in Greece and finds that observable characteristics can explain a large part of the gap at the upper end of the distribution, but explains barely half of the gap at the lower end.

If individual and workplace characteristics and the respective reward structure are accounted for, why would the public sector still reward its workers more than the private sector? This is where advocates of the 'crowding out' hypothesis would argue the public sector exercise its distortionary influence. However, the persistence of residual gaps in public and private pay does not automatically lead to this conclusion. Other studies have sought to emphasise the role of institutions and wider labour market structures in explaining that which cannot be explained through individual characteristics. Dell'Aringa *et al* (2005) look at how regional variation informs the public private pay gap in Italy. Given the well-known North-south economic divide in Italy, it is not surprising that they find significant variation the public private pay gaps by region. However, the residuals of these gaps are attributed to conditions in the private sector such as non-competitive practices and corruption which artificially constrain wages. At the more extreme end, Heitmueller and Mavromaras (2005) examine public private gaps in reunified Germany and find that while the public private gap in the west remained constant through the 1990s, the gap in the East increased threefold. Obviously, the scale of this gap represents a political choice in reunification which mandated a rapid convergence in public wages, but allowed market forces to drive a convergence in private sector wages which has yet to materialise.

The literature presented here show that raw differences in average earnings between the public and private sectors should not be the metric to inform policy. Controlling for individual characteristics creates a necessary balance in the comparison but may not be sufficient to

fully capture characteristic effects. Differential rewards to education and other attributes will also contribute to these gaps. It is also clear from the literature that residual unexplained gaps may persist, but that institutional factors in both the public and private sectors need to be considered in evaluating these.

SECTION 4: DATA

The data used in this paper is drawn from the Understanding Society Survey which is a longitudinal household survey carried out by the ESRC UK Longitudinal Studies Centre with the Institute for Social and Economic Research at the University of Essex. Known formerly as the British Household Panel Survey, Understanding Society was introduced in 2009 and has added samples for Scotland Wales and Northern Ireland, allowing for cross-country analysis. Along with Understanding Society, there are three other large UK surveys which gather earnings data and include sector of employment. They are the Labour Force Survey (LFS), the Annual Survey of Hours and Earnings (ASHE) and the Family Resources Survey (FRS).

ASHE has the largest sample, a good measurement of earnings in Northern Ireland and also a reliable indicator of public or private sector status. However, ASHE is an employer survey and only has workplace-based information on employees and does not include critical characteristics such as education. Furthermore, ASHE tends to under sample lower paid workers. The LFS also has a large sample size for Northern Ireland but suffers from a considerably lower level of response to questions about earnings. The Office for National Statistics estimates that only around 10% of respondents provide earnings information and that brings the sample within Northern Ireland to a critically low level. The FRS provides both reliable earnings and sector of employment variables, but has a much smaller sample size than Understanding Society. The Workplace and Employment Relations Survey (WERS) and Skills and Employment Survey (SES) also gather earnings and workplace data but sample sizes for Northern Ireland are too small.

Within the existing literature, and depending on the choice of data, there have been different approaches to identifying public sector workers. Some studies (Lucifora and Meurs, 2004; Christofides and Michael, 2013; Depalo and Giordano 2011) are unable to draw a binary

distinction between public and private sector workers from the datasets employed. They resort to identifying workers by industries which tend to have a large majority of public sector workers. These industries are Public administration, Health and Education and while they tend to have a majority of public sector workers, there is still a significant private sector share of employment.

The Understanding Society data contains a specific variable which asks workers to specify whether they work for the public or private sector, *“Do you work for a private firm or business or other limited company or do you work for some other type of organisation”*. There is then a further question relating to the nature of the non-private entity for whom the respondent works. Those that indicated they worked for a non-private entity are given a choice of institutions ranging from local government to universities and state-owned companies. Charities and public limited companies are included in the list of non-private organisations and while they are ‘non-private’, they could not be deemed as public sector organisations from the point of view of this paper. Therefore, the public sector dummy variable created for this analysis will treat those working for charities and PLCs as private sector workers. The sample is also restricted to employees to give greatest comparability between the public and private sectors.

Table 4.1 sets out the mean and median wages in the public and private sectors in Northern Ireland as reported by the Understanding Society survey. As much of the literature presented in section 3 highlighted, the distribution of earnings in the public sector tends to be wider in the private sector and consequently, the gap between the mean and median wages in the public sector is less than that in the private sector. The figures reported by Understanding Society are lower than those reported in the ASHE. The gap between median wages is, however, broadly similar. ASHE data imply a median private sector wage which amounts to 65% of the median public sector wage and a mean private sector wage which amounts to 76% of the public sector wage.

Table 4.1: Mean and Median wages by public/private sector in Understanding Society 2016-18

Measure	Private Sector Wage	Public Sector Wage
Mean	10.92	14.86
Median	8.75	13.55

Source: Understanding Society Wave 8

Looking at the breakdown between public and private sector among employees, Table 4.1 shows that 64% of employees are in the private sector compared to 36% public sector. This is slightly higher than the proportions reported in ASHE for the same period which have the private sector at 66% and the public sector at 34%. Looking at gender and age, the Understanding Society data shows a fairly even split between the public and private sectors for females and a large majority (72%) of male employees in the private sector. These proportions closely follow those presented in ASHE. In terms of age, the private sector has a large majority of employees at the upper and lower ends of the age categories, while there is a more even split toward the middle.

Table 4.2: Descriptive statistics of demographic Profile of Public and Private sector workers in Understanding Society 2016-18

	Private %	Public %
Overall	62	38
Gender		
Female	53	47
Male	72	28
Age		
18-34	75	25
35-49	58	42
50-64	50	50
65+	79	21

Source: Understanding Society Wave 8

Table 4.2 shows that collective bargaining agreements are weighted toward the public sector, with almost two thirds of workers in collectively bargained workplaces being in the public sector. Of those in workplaces without collective bargaining, 88% are in the private sector.

Among industries, Public Administration, Health and Education obviously have a large majorities of public sector workers, although this is much lower in the Health sector than commonly thought. Other sectors with substantial shares of public sector employment are Transport, Other Services and to a lesser extent Administration.

Table 4.3: Descriptive statistics of Sectoral and Industrial Profile of Public and Private sector workers in Understanding Society 2016-18

Sector	Private %	Public %
No Collective Bargaining	88	12
Collective Bargaining	37	63
Industry	Private	Public
Agriculture and Utilities	90	10
Manufacturing	99	1
Construction	93	8
Wholesale and Retail	98	2
Transport	66	34
Accommodation and Food	89	11
Information and Communication	98	2
Professional Services	89	11
Administration	78	22
Public Administration	0	100
Education	5	95
Health and Social Services	49	51
Other Services	65	35

Source: Understanding Society Wave 8

Looking at job characteristics, 72% of those who are employed as managers are within the private sector. It should be noted, however, that while managers in small workplaces are majority in the private sector, managers in large workplaces are evenly split between both sectors. Other occupations which are majority public sector are professional, intermediate non-manual and personal services. As Table 4.2 also shows, equal shares of part-time and full-time workers are employed in the public sector.

Looking at the size of workplaces by number of employees, Table 4.4 shows that a large majority (72%) of workers employed in small firms are in the private sector. Among those employed in larger firms there is a majority within the public sector, however, this is not of

the scale that other studies particularly those related to the Republic of Ireland, would suggest (Kelly *et al*, 2006). In terms of broader composition, it should be noted that looking at the composition of the public and private sector by workplace size, 16% of all public sector employees are in firms with greater than 1000 employees compared to 8% of private sector employees. Finally, Table 4.4 shows that of those with degrees or other higher qualifications, a majority are within the public sector, while those with GCSE or lower education qualifications are more heavily weighted toward the private sector.

Table 4.4: Descriptive statistics of Occupational and Workplace Profile of Public and Private sector workers in Understanding Society 2016-18

Occupation	Private %	Public %
Manager	72	28
Professional	23	77
Intermediate Non-manual	37	63
Junior Non-Manual	70	30
Personal Services	38	62
Manual Foreman	84	16
Manual Skilled	87	13
Manual Semi-Skilled	81	19
Manual Un-skilled	80	20
Agricultural Workers	92	8
Working time	Private	Public
Part-time	62	38
Full-time	62	38
Size of Workplace by Employment	Private	Public
1-9	72	28
10-24	64	36
25 - 49	60	40
50 - 99	58	42
100 - 199	67	33
200 - 499	62	38
500 - 999	51	49
1000 or	41	59
Highest Qualification	Private	Public
Degree	42	58
Other higher qualification	46	54
A-level	70	30
GCSE etc	78	22
Other qualifications	84	16
No qualifications	76	24

Source: Understanding Society Wave 8

SECTION 4: METHODOLOGY

The standard approach to estimating an adjusted gap in mean pay between the public and private sector is a 'single equation model' with an appropriate dummy variable indicating whether the worker is public sector or not. This is in the form of a standard log wage equation of the form

$$\ln \omega_i = \alpha + \beta'X_i + \gamma pub_i + e_i \quad [1]$$

where for each individual i , $\ln \omega_i$ is the log of hourly earnings, X_i is a vector of observable individual, job and workplace characteristics, pub_i is a dummy variable with a value of 1 if the employee works in a public sector institution or 0 in all other settings and e_i is an error term uncorrelated with the set of observable characteristics. The above equation is estimated by Ordinary Least Squares (OLS) with $\hat{\gamma}$ giving an estimate of the effect of the public sector on mean pay.

Within the existing literature, there have also been concerns raised regarding possible selection effects for workers in the public and private sectors. Simply put, if selection effects are present, then there are factors influencing the estimated wage that are not contained as variables within the regression, therefore the error term will be correlated with the outcome variable. Selection effects are a common concern for public private wage analysis but also for similar analysis regarding the impact of collective bargaining (Mac Flynn, 2020). There have been a number of strategies used to control for possible selection effects.

The most common among these is the Heckman correction where the observable variables are used to estimate the likelihood of a worker being in one sector or the other. This is probit estimation where the predicted value of the observables is used to calculate an inverse Mills ratio which is then included in the full regression to correct for selection. There are a number of problems associated with the Heckman correction summarised in Bushway *et al* (2007). These mostly relate to exclusion restrictions which entail dropping controls from the main regression in order to prevent correlation between the selection term and the set of controls. Exclusion restrictions are fraught with subjective judgements that can have significant impacts on the final result.

The second strategy employed is instrumental variables (IV). This is less common in public sector premium analysis than it is in union wage analysis. IV avoids the correlation difficulties encountered with Heckman by using variables that determine sector choice but that do not determine wages, but such variables are notoriously elusive. The most common of these is to use a parent's sector of employment as an instrument for sector choice. Depalo and Giordano (2011) attempt this, but there have been concerns about whether a parent's sector of employment is actually unrelated to a child's subsequent wages. Hoogerheide et al (2012) claim that there is no significant violation of the properties of an IV in the parental sector variable, but Gong (2018) highlights networking effects which can influence wages. Irrespective of these arguments, such data is not available in Understanding Society for the Northern Ireland sample and so this strategy cannot be employed. Bellante and Linke (1981) attempted to use car insurance as an indicator of risk aversion which in turn is a proxy for public sector preference. Even the authors admit though that there are much more significant factors than risk aversion which influence the purchase of insurance and therefore the association with public sector choice is weak.

The third strategy relates to panel data and the use of a fixed effects estimator to root out any unobserved individual heterogeneity. This is the most promising of the three strategies, but even within this there are pitfalls. For a FE analysis to prove fruitful, a certain number of panel members have to move between sector over the time period of the data. The concerns mostly centre around the contention that the unobserved factors that influence sector choice are time invariant, a key assumption for any fixed effects analysis. This is a hard assumption to make with regard to sector choice. Disney and Gosling (2003) overcame this by using a large dataset which allowed for analysis of workers who changed sector but did not change jobs. This was possible because the data included workers in public sector firms that were privatised. Even with such a rich dataset, concerns remained regarding the random nature of those workers that remained in their jobs over the period of privatisation and those who left. Obviously such a rich dataset is not available for Northern Ireland, but the panel element of Understanding Society could allow a FE analysis. This will be considered in a future paper.

Given the issues outlined with regard to the Heckman correction, the lack of any suitable instrumental variables an OLS estimation would seem to be the most consistent and practical approach for this paper. Some selection effects may persist but given data constraints and the pitfalls inherent in many of the strategies that seek to correct for selection, this paper will proceed without any explicit selection adjustment.

Specifically, the OLS regression will seek to estimate the impact of public sector employment on mean pay among employees after controlling for a number of individual, job and workplace characteristics. The dependent variable is the natural log of hourly wages excluding overtime. The individual characteristics include gender, age, level of education. The job characteristics include occupation, whether the job is full-time or part-time and whether the jobs is permanent or temporary. The workplace characteristics include, size of the firm, whether there is a collective agreement determining pay at the firm and its broad industrial sector. Kelly *et al* (2006) raised issues about the inclusion of firm size given that nearly all public sector workers in the Republic of Ireland work in large organisations. As the descriptive section shows, this is not the case in Northern Ireland. They raise collinearity issues about the inclusion of union membership and/or collective agreements. However, collinearity test between these variables were not significant. Furthermore, as Mac Flynn (2020) shows, while there is significant correlation between collective bargaining and the public sector, the former has more explanatory power in a wage regression.

There have been questions raised about the use of log wages in this type of regression and the problem with log re-transformation, particularly when estimated with robust standard errors to account for the possibility of heteroskedasticity in the error term. Blackburn (2007) specifically highlights the issue of heteroskedasticity associated with binary status variables in a log-wage regression and recommends the use of quasi maximum-likelihood methods that are consistent under weaker assumptions about the dependence between the error term and the regressors. The assumptions of homoskedasticity, normality, and independence required for OLS regression are not strictly required when estimating with complex sample design, like Understanding Society. The estimator used bases its inference

on the sample design (stratification and variation between primary sampling units) and is robust to violations of those assumptions. The sample size in Understanding Society would also give confidence that the results are robust to violations of these assumptions. However, as Blackburn (2007) points out, robust standard errors are not sufficient to tackle the problem of heteroskedasticity in log wage regression equations. Therefore, in addition to OLS, a generalized linear model estimation is also presented to deal with concerns arising from the distribution of variances.

The OLS specification represents the foundation of any estimation of public private pay gaps across the literature. Naturally there have been extensions to this analysis and corrections which seek to create a firmer causal base for analysis. Lausev (2014) provides a concise overview of the various approaches that have been taken beyond OLS. As noted in the review of existing literature, the difference in the distribution of earnings in the public and private sector lead many studies to look beyond a standard linear regression in order to get a clearer picture of any gap. Quantile regression techniques are used to supplement OLS estimates and have been utilised in much of the recent literature (Lucifora and Meurs, 2004; Christofides and Michael, 2013; Bargain and Melly, 2008; Papapetrou, 2006; Disney and Gosling, 1998). As set out in the previous section, the data available for Northern Ireland are limited and do not allow sufficient sample size to estimate a quantile for a single year. A combination of multiple years of data is possible and could allow a quantile regression analysis. This will be considered in a future paper.

The next most common extension beyond single equation OLS is a 'double equation' method (Lausev, 2014) whereby earnings in both the public and private sector are modelled separately. This allows for the returns to characteristics to vary between both sectors whereas they are held constant in the single equation model. This is the first step to performing a decomposition of wages in the public and private sector. The most common method of decomposition is the Oaxaca-Blinder (Oaxaca, 1973; Blinder 1973) method. If the double equation is the first stage of decomposition the second stage involves separating out how much of the overall pay gap is attributable to differences in observable characteristics and that which remains unexplained.

If wages in the public and private sector are estimated as follows

$$\ln \omega_i^{pub} = \alpha^{pub} + \beta'^{pub} X_i + e_i^{pub} \quad [2]$$

$$\ln \omega_i^{pri} = \alpha^{pri} + \beta'^{pri} X_i + e_i^{pri} \quad [3]$$

where *pub* and *pri* denote public and private workers. Then the decomposition is completed with the equation below (Lausev, 2014; Oaxaca and Ransom, 1994)

$$\ln \omega^{pub} - \ln \omega^{pri} = [(\bar{X}^{pub} - \bar{X}^{pri})\hat{\beta}^*] + [\bar{X}^{pub}(\hat{\beta}^{pub} - \hat{\beta}^*) + \bar{X}^{pri}(\hat{\beta}^* - \hat{\beta}^{pri})] \quad [4]$$

The first set of brackets shows what impact the difference in observable traits like education and gender will have on the notional wage β^* that an individual would get in the overall economy. The second term estimates the returns to workers in each sector beyond that attributable observables. The two parts of the second bracketed term represent respectively the notional public sector ‘premium’ (penalty) and the private ‘penalty’ (premium) that remains.

The decomposition gives an important insight into the nature of any pay gaps between the public and private sector and how much of it can be explained by factors that are known and unknown. In the following section estimates for the decomposition will be analysed alongside the results of the OLS regression in order to understand the scale of the gap in pay and the scale of our understanding of that gap.

SECTION 5: RESULTS

Table A.1 in the accompanying appendix sets out the results of the regression outlined in the methodology section. Specifically, columns 1 through 4 outline the OLS estimations as individual, occupational and workplace characteristics are added to the model. Column 5 shows the results of the model in column 4 carried out by with Generalized Linear Models estimation in place of Ordinary Least Squares. The estimates of mean wages are for the population from which the sample was drawn, adjusting for the complex survey design when comparing mean differences.

Column 1 shows the raw wage gap between workers in private and public sector is 33 log points or 40% (the antilog of .339) and the result is statistically significant at the 1% level. This implies that mean wages in the private sector are 72% of the mean of the public sector. This is a larger gap than that reported in ASHE which implies a raw gap of 33% where private sector wages are 75%¹ of mean public sector wages. Column 2 then begins by controlling for individual characteristics, namely gender, age, qualifications and whether work is full-time and/or permanent. The effect of introducing these variables in to the regression is to reduce the gap between mean earnings in the public and private sectors by half. Within this, qualifications have the single largest impact and all qualification variables are significant at the 1% level. As the reported coefficients show, having only GCSE qualifications can reduce mean pay by 42% compared with a higher level degree. Qualifications are commonly found to be amongst the greatest predictors of wages and have the effect of reducing large gaps in wages between groups of workers whether by gender or bargaining coverage (Mac Flynn, 2020).

Age is estimated to have a positive and significant impact on mean wages up until the point age of 65, where the impact is of a similar scale but of no significance. Being a part-time worker tends to have a negative effect on wages, but the effect is not significant. However, whether the contract of employment is permanent or not was significant and was associated with mean wages of up to 25% higher. Introducing controls for education and working arrangements increases the r-squared from 0.11 to 0.36 and the public sector still has a significant association with wages at the 1% level.

Column 3 then adds control variables for occupation and the size of the firm which again decreases the impact of the public sector to 0.17 from 0.12 while r-squared for the regression increases to 0.45. With Managers as the base occupation, Table A.1 shows that all other occupations are negatively associated with log wages, with the exception of professional and agricultural workers. This is to say, being in occupations other than

¹ The ASHE data presented in table 2.2 applies to median full-time earnings whereas this calculation is based on mean differences for all employees.

management is, on average, likely to reduce pay, by up to 40% as is the case for semi-skilled manual workers. The variable for professional occupations is not significant, indicating that the difference in earnings between management and professional occupations is not significant once the other factors listed in the regression are accounted for. Firm size has a positive relationship with wages which is significant for firms in both the 200-499 and the 500-999 size bracket.

Column 4 introduces controls for whether the workplace has trade union based collective bargaining and a very broad control for industry differentiating between production (including construction), services and public services. Collective bargaining has a positive and significant effect on mean wages whilst, services and public services are both negatively associated with wages compared to the production/construction sector. The effect of the collective bargaining variable is to reduce the coefficient on the public sector from 0.12 to 0.05. The public sector is also no longer significantly associated with a change in mean pay.

As set out in the methodology section, the log linear specification of OLS can be upwardly biased in estimating the public sector premium. Therefore, a Generalized Linear Models estimation is presented in column 5. The GLM estimator reduces the estimated effect of the public sector on pay from 5% to less than 1% and the public sector variable is not statistically significant. The results indicate that the raw public private pay gap in Northern Ireland is reduced by almost 85% when characteristics related to individuals, jobs and workplaces are taken into account. The level of education has the most significant impact on the public private pay gap, reducing it by almost 50%, an effect that would not be picked up by workplace-based surveys which do not account for education.

In order to gain a deeper understanding of the nature of the gap in pay between the public and private sector, Table A.2 shows the results of the Oaxaca-Blinder decomposition. As mentioned in the methodology section, the first step involves separate regressions for both the public and private sectors in order to estimate sector specific effects of characteristics such as education or occupation. These results are then used to calculate how much of the gap is attributable to differences in characteristics, how much is attributable to different

returns to those characteristics and how much is attributable to the simultaneous interaction between both of these differences. This is the threefold decomposition. Subsequently, we can estimate an explained and unexplained component of the same gap which is referred to as the twofold decomposition.

The first panel of Table A.2 shows the results of the threefold of the public private sector pay gap. The first results are simply the estimated mean log wage in both the public and private sector and the gap between them. The estimated mean log wage in the private sector is 2.26 and 2.59 in the public sector resulting in a gap of 0.33. The first result in panel 1 deals with the raw differences in characteristics between the public and private sectors and is known as the endowment effect. In this case the endowment effect -0.294 or 90% of the total gap. What this means is that, if holding all else equal, differences in characteristics between both sectors would account for 90% of the gap. The second effect estimates the impact of differences in returns to those characteristics and is known as the coefficient effect. In this case the coefficient effect is -0.094 or 28% of the total gap. This means that holding all else equal (including the characteristics of both sectors), differences in the returns to characteristics would account for 28% of the public private pay gap. The main result of this first decomposition is that observable characteristics play a far more important role than differential returns to those characteristics.

The final term presented in the first panel is the interaction effect which estimates the interaction of the preceding effects. The interaction term in this case is positive, 0.06 or 18% of the total gap. What this means is that the effect of differences in endowments and returns to those endowments conflict when applied simultaneously, thus the interaction effect reduces the pay gap that would apply if observable characteristics and their returns were applied between sectors. In essence, based on observable characteristics and the returns to them in the both sectors, the public private pay gap is predicted to be larger than it actually is. This finding motivates the estimation presented in the second panel of table A.2

Looking next the second panel of table A.2 we can see the results of the twofold decomposition of wages in the public and private sector. Differences in observable

characteristics and their returns are estimated to account for 0.26 of the 0.33 gap while 0.07 of that gap remains unexplained. In short, just under 80% of the existing public private pay gap can be explained by observable differences in characteristics of the employees of the public and private sectors.

The results presented in this section show that there is a large unadjusted gap in mean pay between the public and private sectors in Northern Ireland. This is not contested. The OLS regression shows, however, that the scale and significance of this gap is dramatically reduced by accounting for observable differences in personal, working and workplace characteristics. Decomposing the raw gap shows that observable differences in these characteristics account for the vast majority of this gap, while differing rates of return to characteristics play a significant but much smaller role in determining the gap. Finally, the decomposition shows that observable characteristics can explain just under 80% of the raw gap in mean pay between the public and private sectors, with just over 20% unaccounted for. These results do have some implications for policies aimed at boosting earnings in the Northern Ireland economy.

SECTION 6: POLICY IMPLICATIONS

The results presented in this paper indicate that while there is a large gap between mean earnings in the public and private sector, the bulk of this gap can be explained by observable differences in the workforces of both sectors. Section 2 outlined a 'crowding out' hypothesis that was based on the assumption that pay in the public sector was artificially higher than in the private sector. The results of this analysis would seem to undermine that hypothesis. While arguments could still be made that the relative size of the public sector poses a problem for private sector growth, much of the research to date does not back this up. Henley & Thomas (2008) found that public sector employment growth in Britain was actually positively, if weakly, associated with private sector employment growth. This effect was found to be strongest in regions with high levels of unemployment, implying that a tight local labour market is more likely to be a constraint on employment growth. Similarly, Faggio and Overman (2012) find no identifiable effect of public sector employment on overall private

sector employment in England and only weak effects on the composition of employment in the private sector.

The focus of policy needs to shift from an excessive fixation with the effects of the public sector pay on the private sector and the unfounded belief that there is a strong causal relationship. What is clear is that the public private pay gap that currently exists arises from structural differences between public and private sector workforces. Some of these structural differences are inherent to each sector, but many of them are not. If anything, the results of this paper illustrate how the private sector can close the gap in pay with the public sector by seeking a structural change in its workforce. There are many avenues for government to support these aims through policy. For instance, there is no reason why the private sector in Northern Ireland cannot increase the number of graduates in employment. Similarly, there is significant scope to increase the size of firms in the private sector, particularly in the highest employment bracket.

The issue of skills has been a near constant feature of economic debate in Northern Ireland and while much of the policy focus to date has been on the supply of skills, the demand for skills is an equally large problem. Mac Flynn (2017) analyses the dynamics of this situation and identifies chronically low demand for skills within Northern Ireland's private sector. In this sense, it is not that the public sector attracts a disproportionately large number of graduates, it is more likely the case that the private sector does not attract enough. In order to build capacity for skills in the private sector, it is necessary to build the appetite for skills. Policy can proactively encourage innovation and expansion but there is a connection here too with another of the significant structural difference between the two sectors, firm size.

Northern Ireland has the lowest share of large firms (more than 250 employees) of any UK region, 25% fewer than the UK. Large firms aren't a prerequisite for graduate employment but small firms are significantly less likely to seek or attract graduates (Hart and Barratt, 2009). In many instances small firms lack human resources infrastructure or links with third level institutions necessary to take advantage of talent. Small firms are also least likely to engage in training or upskilling (Stone, 2012). Government policy needs to be focused not only on

encouraging expansion and innovation within small firms, it needs to be focused on sustaining that support long enough in order to produce a structural change in the private sector.

One of the other significant structural differences between the public and private sectors is the prevalence of collective bargaining. As the results presented here showed, collective bargaining holds much greater explanatory power for wages than the public sector. Collective bargaining itself has been shown to be a significant determinant of wages in Northern Ireland (Mac Flynn, 2020). The fact that the vast majority of workers (63%) covered by collective bargaining agreements are in the public sector has a significant impact on the public private pay gap. Building collective bargaining within the private sector is a clear route to closing that gap. The prevalence of collective bargaining in the private sector has declined in the UK along with many other western economies and policies that seek to widen access to collective bargaining are likely to bring significant wage advances for impacted workers.

In summary, these findings present a challenge to the persistent narrative that public sector wages in Northern Ireland are artificially high and that this is holding back the private sector. In fact, the roots of comparatively low pay in the private sector are within that sector and there is little evidence of a causal relationship between the two, much less a negative one. In the event that closing the gap in earnings becomes a government priority, policy should be focused on achieving structural change within the private sector in order to bring gains that are achievable.

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APPENDIX

Table A.1 Regression Results

Log Hourly Wages	(1)	(2)	(3)	(4)	(5)
Sector (Base Private Sector)					
Public Sector	0.3399*** (0.0469)	0.1733*** (0.0477)	0.1194*** (0.0451)	0.0548 (0.0522)	0.0034 (0.0643)
Gender (Base Female)					
Male		0.0855 (0.0325)	0.0465 (0.0360)	0.0505 (0.0356)	0.0621 (0.0423)
Age (Base 18-35)					
35-49		0.2181*** (0.0497)	0.1809*** (0.0459)	0.1538*** (0.0461)	0.1558 (0.0576)
50-64		0.2683*** (0.0492)	0.2004*** (0.0530)	0.2023*** (0.0472)	0.1943*** (0.0539)
65+		0.2558** (0.1319)	0.1286 (0.1088)	0.1368 (0.1068)	0.1314 (0.1345)
Qualifications (Base Degree)					
Other higher qualification		-0.1600*** (0.0629)	-0.1617*** (0.0625)	-0.1472** (0.0634)	-0.1103 (0.0776)
A-level		-0.3781*** (0.0531)	-0.2728*** (0.0564)	-0.2578*** (0.0581)	-0.2257*** (0.0800)
GCSE etc		-0.4515*** (0.0527)	-0.3484*** (0.0471)	-0.3220*** (0.0473)	-0.3422*** (0.0551)
Other qualifications		-0.6589*** (0.0885)	-0.4780*** (0.0881)	-0.4436*** (0.0836)	-0.4282*** (0.0984)
No qualifications		-0.5553*** (0.0689)	-0.3910*** (0.06851)	-0.3699*** (0.0656)	-0.4014*** (0.0749)
Working Hours (Base Part-time)					
Full-time		0.0913** (0.0391)	-0.0143 (0.0387)	-0.0004 (0.0431)	0.0066 (0.0421)
Contract Type (Base Temporary)					
Permanent		0.2485** (0.1069)	0.2265** (0.1056)	0.2093** (0.1038)	0.1737 (0.1283)

Log Hourly Wages	(1)	(2)	(3)	(4)	(5)
Occupation (Base Managerial)					
Professional		-0.1586 (0.1408)	-0.1357 (0.1357)	-0.0389 (0.1550)	
Intermediate Non-manual		-0.1724*** (0.0605)	-0.1834*** (0.0626)	-0.1772*** (0.0630)	
Junior Non-Manual		-0.3794*** (0.0667)	-0.3732*** (0.0671)	-0.3775*** (0.0732)	
Personal Services		-0.3664** (0.1226)	-0.3877*** (0.1174)	-0.3502*** (0.1643)	
Manual Foreman		-0.2311*** (0.0763)	-0.2710*** (0.0765)	-0.2966*** (0.0870)	
Manual Skilled		-0.1938** (0.0857)	-0.2227*** (0.0863)	-0.2177*** (0.0989)	
Manual Semi-Skilled		-0.5233*** (0.0747)	-0.5520*** (0.0755)	-0.5731*** (0.0816)	
Manual Un-skilled		-0.4117*** (0.0845)	-0.4540*** (0.0841)	-0.4769*** (0.0880)	
Agricultural Worker		-0.0809 (0.1581)	-0.1242 (0.1500)	-0.1602*** (0.1451)	
Firm Size (Base 1-9 Employees)					
10-24 Employees		-0.0340 (0.0585)	0.0218 (0.0588)	-0.0347 (0.0682)	
25-49 Employees		0.1599** (0.0710)	0.1365 (0.0676)	0.1241 (0.0806)	
50-99 Employees		0.1100* (0.0634)	0.0872 (0.0614)	0.0380 (0.0707)	
100-199 Employees		0.1241* (0.0661)	0.0881 (0.0659)	0.0370 (0.0757)	
200-499 Employees		0.1792*** (0.0679)	0.1318** (0.0675)	0.0564 (0.0783)	
500-999 Employees		0.2424*** (0.0733)	0.1760** (0.0761)	0.1386 (0.0870)	
1000+ Employees		0.1612** (0.0861)	0.0935 (0.0844)	0.0087 (0.0988)	

Log Hourly Wages	(1)	(2)	(3)	(4)	(5)
Union Coverage (Base Not Covered)					
Covered				0.0876** (0.0455)	0.1143** (0.0585)
Industry (Base Manufacturing and Construction)					
Services				-0.1492 (0.0578)	-0.1583*** (0.0638)
Public Services				-0.0678 (0.0663)	0.0785 (0.1479)
R-Squared	0.1063	0.3569	0.4416	0.4548	

Note: Column 1 presents the raw public private pay gap. Column 2 controls for individual worker characteristics. Column 3 firm characteristics. Column 4 further controls for industry characteristics. Column 5 performs the same regression in column 4 with a GLM estimator. A GLM estimator does not report an r-squared.

Table A.2 Decomposition Results

	Log Wages
Predicted Private wage	2.2630 (0.0289)
Predicted Public Wage	2.5917 (0.0310)
Public Private Gap	-0.3287 (0.0422)
Threefold Decomposition	
Endowments	-0.2940 (0.0662)
Coefficients	-0.0941 (0.0512)
Interaction	0.0593 (0.0712)
Twofold Decomposition	
Explained	-0.2585 (0.0403)
Unexplained	-0.0703 (0.0429)

Table A.3 Variable Definitions

Variable label	Variable definition	Variable name in dataset	Categories
Worker characteristics			
Gender	Gender of respondent	h_sex	Male Female
Age	Age of respondent	h_dvage	18-25 35-49 50-64 65+
Education	Highest educational qualification attained	h_qfhigh_dv	Degree Other higher qualification A-level GCSE etc Other qualifications No qualifications
Sector of employment	Public/private sector		Public Private
Employment type	Current job: permanent or temporary	h_jbterm1	Permanent Temporary
Working arrangements	Full-time or part-time	h_jbft_dv	Full-time Part-time

Firm characteristics			
Number employed at workplace	Number at workplace (employees)	h_jbsize	1-9 10-24 25-49 50-99 100-199 200-499 500-999 1000+
Occupation	Current occupation (SOC 2000 classification)		Managerial, Directors, Senior Officials Professional Junior Non-Manual Personal Services Manual Foreman Manual Skilled Manual Semi-Skilled Manual Un-skilled Agricultural Worker

Industry characteristics			
Industry	Current industrial sector		Production (including Agriculture, Forestry, Fishing, Electricity, Water Manufacturing Construction) Services (including Wholesale, Retail & Transportation Accommodation & Food Information, Communication, Financial, Insurance & Real Estate Professional, Technical, Scientific, Administration, Other services, Arts, Entertainment) Public service (including Public admin, Health, Education)

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