Cardiff Economics Working Papers

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June 2020

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The Gender Pay Gap: What can we learn from Northern Ireland?

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May 2020

Abstract

Northern Ireland forms an important outlier to the established international pattern of a pronounced gender pay gap in favour of men. Using contemporary data from the Quarterly Labour Force Survey we provide a comprehensive analysis of the gender pay gap in Northern Ireland and make comparisons to the rest of the UK. Despite the relatively common institutional and policy context, the gender pay gap in Northern Ireland is found to be far smaller than in the rest of the UK. This can largely be attributed to the superior productivity-related characteristics of women relative to men in Northern Ireland, which partially offset the influence of gender differences in the returns to these characteristics. Our analysis highlights the importance of occupation – both in terms of occupational allocation and the returns to occupations – in explaining the cross-country differential. This is reinforced by the impact of lower earnings inequality in Northern Ireland.

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1. Introduction

The well-developed international literature on the gender pay gap (hereinafter, GPG), whilst exhibiting variation across time and countries, documents a persistent, and typically sizeable, GPG (see Blau and Kahn, 2017 for a recent review). The majority of this evidence applies well-established decomposition methods in an attempt to understand the drivers of the raw gap and particularly to identify that part which is not explained by observable personal and employment-related characteristics. Comparisons across countries (Blau and Kahn, 1992; 1996) have proved insightful in highlighting the importance of the national wage structure, as well as cross-country gender differences in characteristics and the return to these characteristics, as determinants of the magnitude of the GPG. While narrowing trends have been identified across most developed countries (Kaya, 2014) a substantial raw gap typically remains, including in the UK where the contemporary GPG is about 17 per cent (ONS, 2019). Indeed, the persistence of the GPG has prompted significant policy attention, not least in the UK, where in 2015, the then Prime Minister David Cameron announced his aim to "end the gender pay gap in a generation" and introduced GPG transparency among large employers towards achieving this.

We make a novel contribution to this literature by considering an overlooked country outlier in this international pattern, often obscured by the aggregation of UK data (for example, Jones *et al*., 2018) or by omission as a consequence of data being collected specifically for Great Britain (for example, Mumford and Smith, 2008). Headline estimates suggest the GPG in Northern Ireland (hereinafter, NI) is much smaller than comparable measures for the UK and, using median gross hourly pay among full-time employees it is reversed, with women on average earning 2.8 per cent *more* than men in NI (ONS, 2019).[1] This contrasts starkly to the three other UK countries (which we collectively refer to as the rest of the UK, hereinafter, RUK) where the GPG indicates 6 to 10 per cent higher average earnings for men.[2] While documented in National Statistics and highlighted by the media, this pattern, to our knowledge, has not been recognised or explored within the academic literature.[3] Yet the distinctly narrower GPG in NI provides an opportunity to enhance our understanding of the drivers of the contemporary GPG of particular relevance to policy given renewed emphasis on narrowing the

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[1] As is typical within the literature our focus is on the mean GPG but the sensitivity of our estimates to using the median is explored.

[2] Using the same definition, the GPG is 10.0, 6.4 and 7.1 per cent in England, Wales and Scotland, respectively (ONS, 2019).

[3] See for example: https://www.bbc.co.uk/news/uk-northern-ireland-37166043.

GPG. Further, by exploring stark cross-country variation within the relatively common institutional, economic and policy context of the UK, this analysis provides a novel contribution to the international literature that is not plagued by the complexity and unobserved heterogeneity typically affecting cross-country comparisons, or issues relating to consistency of data collection.

Using directly comparable information from the largest UK Household Survey – the Quarterly Labour Force Survey (hereinafter, QLFS) – this paper applies established regression and decomposition methods to explore the determinants of the contemporary GPG in NI and how this compares to the RUK. First, by applying the Oaxaca-Blinder (hereinafter, OB) decomposition method (Oaxaca, 1973; Blinder, 1973) we separate the role of differences in personal and employment-related characteristics from that part of the GPG in NI that is unexplained and may reflect gender differences in the return to characteristics or pay inequality. We perform the same analysis for the RUK as a comparator. This enables us, for example, to understand whether the narrower GPG in NI reflects female advantage in terms of characteristics such as educational attainment and/or, greater pay equality. Second, we investigate why the GPG in NI differs so substantially from the RUK by undertaking a decomposition of the cross-country difference using a method by Juhn *et al.* (1991) (hereinafter, JMP), which has been widely applied in the international literature (see, for example, Blau and Kahn, 1992; 1996; Kaya, 2014). Here we separate the influence of observable characteristics, for example, cross-country gender differences in industrial and occupational segregation, and cross-country differences in returns to these characteristics, from unobserved factors, such as differences in the national wage structure, culture and/or local labour market conditions.[4]

Our results show that, regardless of the precise measure, the GPG in NI is far smaller than in the RUK. The relatively narrow (5.2 log per cent) full-time mean GPG in NI, can be largely attributed to the influence of superior productivity-related characteristics of women relative to men, which partially offset the effect of gender differences in the returns to characteristics that give rise to relative pay advantage for men. Indeed, that the contribution of the latter is more similar between NI and the RUK (at about 10 log per cent), reinforces the critical distinction between the concepts of the GPG and inequality, and suggests that, despite its narrow GPG, NI is not an exemplar in terms of gender pay equality. A decomposition of the sizeable 9.4 log

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[4] Although modest, there are also some relevant differences in government policy (see Section 2).

percentage point GPG difference between NI and RUK highlights the importance of occupation, in terms of both gender differences in occupational allocation and the returns to occupation, in determining the narrower GPG in NI. Lower earnings inequality within NI reinforces this effect. Therefore, despite the similar institutional and policy context, factors well-established to determine international variation in the GPG are also found to have an important role in generating considerable variation within the UK.

The remainder of this paper is structured as follows: Section 2 provides a brief overview of evidence from within and between country comparisons of the GPG and considers potential drivers of the relatively narrow GPG in NI. Section 3 provides an outline of the QLFS and the measures applied in this analysis. Descriptive evidence on the GPGs in NI and RUK is provided in Section 4. We outline the decomposition methods and present the results relating to the within country GPG decompositions and between country GPG comparison in Sections 5 and 6, respectively. Finally, Section 7 concludes.

2. Background

The core theme within the vast international GPG literature has been an attempt to estimate wage discrimination against women. The traditional approach, building on Becker's (1957) theory of labour market discrimination, entails applying versions of the OB decomposition methodology to comprehensive data in order to separate the GPG into an explained and unexplained component. The former arises due to gender differences in human capital and other productivity-related characteristics, whereas the latter is that part of the GPG arising from gender differences in the rewards to these characteristics, or what might be thought of the GPG that exists for otherwise comparable men and women. While the latter is widely recognised to be an imperfect measure of wage discrimination, this division is nonetheless insightful in understanding the drivers of the GPG, including in the UK (see, for example, Manning and Swaffield, 2008; Mumford and Smith, 2009; Chzhen and Mumford, 2011; Jones *et al*., 2018; Jewell *et al*., 2020).

GPG across countries

Despite its complexity, cross-country comparisons of the GPG have been central to enhancing our understanding of the sources of the GPG within countries, particularly in terms of institutions, policies, and gender differences in employment rates. For example, studies often use the JMP decomposition, an extension to the OB method proposed by Juhn *et al*. (1991), to separate the influence of cross-country differences in workforce composition by gender from

national wage structures to identify additional institutional drivers. In particular, the GPG is typically found to be wider in countries with greater earnings inequality such as the US (Blau and Kahn, 1992; 1996) and consistent with this, authors have suggested a role for centralised wage setting, such as through unions and collective bargaining, in narrowing the GPG (Blau and Kahn, 1996).[5]

Olivetti and Petrongolo (2008) demonstrate the critical role played by female labour force participation in explaining variation in the GPG between Anglo-Saxon countries and Southern Europe, with national GPGs being negatively correlated with gender employment gaps, consistent with the positive selection of females into work. However, in countries with relatively high female employment rates, including the UK, they find limited impact of selection on the GPG (see also Christofides *et al.*, 2013).

GPG in the UK

By international standards, the UK has a relatively large GPG, above the EU and OECD average, but similar to countries such as the US and Germany. Despite previous analysis using comprehensive data on personal and employment-related characteristics and, accounting for selection into work (Chzhen and Mumford, 2011), firm characteristics (Mumford and Smith, 2009) and firm fixed-effects (Jewell *et al.*, 2020), and attempting to adjust for typically unobservable characteristics such as personality (Manning and Swaffield, 2008), much of the UK GPG typically remains unexplained.

Unlike the majority of cross-country GPG comparisons including the UK, which are relative to the US (Blau and Kahn, 1992; 1996) or other EU countries (Christofides *et al.*, 2013; Kaya, 2014) there has been far less analysis within the UK, perhaps as a consequence of the four constituent countries sharing a largely common institutional and policy environment.[6] Indeed, to our knowledge there has been no previous study of the GPG in NI with the few labour market studies previously focused on NI tending to explore disparities by religion in light of the conflict (see, for example, Rowland *et al.*, 2018).[7]

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[5] The evidence in relation to the impact of family friendly policies is less clear. Blau and Kahn (1996) suggest they have ambiguous effects by raising the relative costs of hiring women and/or encouraging extended family leave. In Europe, however, with the exception of maternity leave, family friendly policies are found to be associated with a lower GPG (see, for example, Christofides *et al.*, 2013).

[6] Key labour market policies, such as in relation to the minimum wage and the tax credit system, apply universally. Although devolved and religiously segregated, the education system is broadly similar.

[7] The only exception is Mac Flynn (2014), who provides a descriptive picture of the GPG in NI and attributes the low GPG to public sector employment.

Given the complexity of cross-country comparisons, and difficulty in harmonising international data there is growing recognition of the potential insights from spatial comparisons of the GPG within countries (see Huertas *et al*., 2017 for Spain; Fuchs *et al*., 2019 for Germany). This theme within the literature is, however, much more limited. Consistent with the theoretical predictions of the spatial monopsony model, which suggest a lower unexplained GPG in more competitive regions (Hirsch *et al*., 2013) urban/rural differences have been considered in the UK (Phimister, 2005). In contrast, however, Stewart (2014) documents a wider GPG in London albeit, except within the top third of the earnings distribution, the difference is largely explained by gender differences in characteristics. The latter aligns to recent evidence on a disaggregate spatial scale in Germany, where Fuchs *et al*. (2019) find that the GPG is related to local area development, with greater sensitivity of male earnings serving to widen the GPG in more prosperous areas. Further, gender differences in observable characteristics are found to be more important when the GPG is larger, resulting in the unexplained GPG being relatively similar across areas. In contrast, however, although less pronounced than the variation in the raw GPG, the unexplained GPG is found to differ across Spanish regions even after accounting for firm fixed effects (Huertas *et al*., 2017).

NI Labour Market and Institutional Context

Before turning to our analysis, we provide a brief overview of key labour market characteristics of NI and compare these to the RUK in Table 1 in order to identify potential determinants of the cross-country GPG differential. Compared to the RUK, NI is characterised by relatively low employment rates but the gender differential is similar (at less than 10 per cent), and of considerably smaller magnitude than international variation highlighted by Olivetti and Petrongolo (2008).[8] The proportion of those in employment who are employees is similar across countries, although the gender differential is greater in NI, where a greater proportion of males are self-employed. The proportion of employees working full-time is also similar between NI and RUK and confirms the concentration of females in part-time work in each country. Consistent with a more pronounced decline in manufacturing in NI since the 1970s, there is a greater concentration of employees in the public sector relative to the RUK, and females are disproportionately employed in this sector, which is often associated with a lower GPG (Jones *et al*., 2018). Again, however, the gender differential in public sector employment is similar in NI and RUK. In contrast to what might be expected given their well-established

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[8] We nevertheless explore the sensitivity of our estimates to accounting for selection into employment (see Section 4).

influence on the GPG, NI has slightly greater gender occupational and industrial dissimilarity. The earnings distribution in NI is, however, more compressed, consistent with a narrowing influence on the GPG.[9] We return to these features of the labour market more formally in what follows, but before doing so, some distinct country features are worth noting.

Although there has been convergence in many aspects over time, NI has a unique historical setting stemming from religious conflict. The potential implications for gender equality have been explored by Ackah and Heaton (1996) and Heaton *et al*. (1997), who highlight a more traditional and conservative culture in NI, higher rates of fertility and relatively poor childcare provision as potential drivers of greater gender inequality in the labour market, but note the opposite influence of closer extended family ties in providing childcare and facilitating female participation. It should also be noted that some elements of policy, including employment law and equality, are devolved.[10] In practice, however, these differences are likely to have a limited effect since in both countries work of equal value is required to receive equal pay and discrimination on the basis of gender is illegal. Overall, therefore, it is difficult to identify distinct features of the NI labour market that might drive such a stark GPG differential with RUK.

[Table 1 here]

3. The QLFS

We use data from the QLFS (ONS, 2020), the largest nationally representative household survey in the UK, which contains comprehensive information on individual earnings, and personal and employment-related characteristics consistently across UK countries, which has been extensively used, including in previous analysis of the GPG (for example, Jones *et al*., 2018) and regional comparisons (for example, Blackaby *et al*., 2018).[11] We pool data on individuals in the first wave of the survey to create a contemporary cross sectional data set,

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[9] This might be a consequence of the higher bite of the minimum wage in NI. Further investigation, however, also suggests a higher rate of union membership in NI (and a higher rate among females in particular), something we explore in sensitivity analysis since information on union membership is only available in selected quarters of the QLFS (see Section 4).

[10] For example, NI did not adopt the 2010 Equality Act or 2017 GPG Reporting Regulations as per the RUK, but instead retains separate equality legislation for different protected characteristics, including the Equal Pay Act (NI) (1970) and the Sex Discrimination (NI) Order (1976). These are, however, broadly comparable to the UK Equal Pay Act 1970 and Sex Discrimination Act 1976.

[11] Whilst the QLFS is administered separately in NI, it is designed to be comparable to the RUK. UK labour market indicators are produced from the QLFS by ONS and submitted to Eurostat.

covering four complete years, 2016-2019.[12,13] Our main sample is restricted to full-time employees of working age (defined, given the changing state pension age over this period, as 16-59 and 16-64 for males and females respectively), and excludes full-time students.[14] Our key variable, hourly earnings, is derived from gross weekly pay in the respondent's main job on the basis of total usual hours worked (including overtime) and the standard ONS LFS filter is applied (which eliminates hourly pay above £100) to reduce measurement error. We define country in terms of location of work and separate employees in NI from those in the RUK.[15,16] After removing individuals with missing values on any of our variables of interest (see below) the sample for NI is 2,870 employees (about 4.5 per cent of the total sample), compared to 61,810 for the RUK.

The QLFS also contains detailed information on personal and employment-related characteristics found to determine the GPG and widely used in cross-country comparisons. In our analyses, we control for the following personal characteristics: years of potential experience (and experience squared); marital status; highest qualification; disability and ethnicity.[17] Employment-related characteristics include months tenure with current employer (and tenure squared); temporary employment contract; workplace size; occupation (Standard Occupational Classification (SOC 2010) major occupations), industry (Standard Industry Classification (SIC 2007) industry sectors) and public/private sector.[18] Further details of all

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[12] The QLFS has a rotational panel design such that, in every quarter, 20 per cent of individuals are in their first wave and 20 per cent are in their fifth and final wave. We pool observations across time to enhance the NI sample size. Although the Annual Population Survey has a larger RUK sample, it does not include an enhanced NI sample.

[13] Trends in the QLFS from 1997 suggest the cross-country GPG differential is not a feature of the period selected.

[14] Self-employed workers are excluded since they do not provide information on earnings.

[15] In practice since 98 per cent of employees who live in NI also work in NI the results are not sensitive. We exclude individuals who work outside the UK (less than 0.5 per cent of employees). Of course, country of work is potentially endogenous to the extent that individuals are able to migrate in response to labour market differences. Further, this might differ by gender. While this is not unique to NI we explore the robustness of our findings using comparisons with the North RUK, where there are likely to be similar incentives to migrate to a high wage region (see Sections 5 and 6) and on the basis of a sample of 'stayers' where country of work and birth coincide (see Section 5) (see Hirsch *et al*., 2013 for a similar strategy).

[16] Some more detailed analysis is undertaken distinguishing between region of work (see Section 4) but since the findings are robust, our main results refer to RUK.

[17] Religion is collected separately in NI and RUK (see Appendix Table A.1). In an additional specification we include religion given its importance in NI and because there might be differential impacts by gender (Fuchs *et al*., 2019).

[18] We merge SIC codes for 'A-Agriculture, forestry and fishing' with 'B,D,E-Energy and water' given the small sample sizes in the former in some specifications. We explore the robustness of our findings in relation to model specification in Section 5. This includes the inclusion of more detailed controls for occupation and industry, and the exclusion of controls for occupation, industry and sector given decisions in relation to these variables might be the outcome of discrimination (or anticipated discrimination) within the labour market, which affects the interpretation of the unexplained component. Our purpose is not, however, to provide an accurate measure of discrimination but to explore the potential drivers of the GPG in NI and its difference with RUK. Since union membership is only available within a single quarter each year it is excluded from the main specification, but we similarly examine the robustness of our findings to its inclusion.

explanatory variables and their means by gender and country are included in Appendix Table A.1. The descriptive statistics indicate largely common patterns across countries and confirm some well-established differences by gender within each country. However, they also highlight some important features and cross-country differences. Consistent with international improvements in female productivity-enhancing characteristics (Blau and Kahn, 2017), females are more highly qualified than males in both NI and RUK and are considerably more likely to work in professional occupations than men, particularly in NI. In terms of employment-related characteristics, while females have shorter average job tenure than males in RUK, the reverse is true in NI. Consistent with their concentration in public sector employment, females are more likely than males to work in industries such as public administration, education, and health in both countries, while there is no evidence of cross-country gender differences in temporary employment or workplace size.

4. Preliminary Evidence on the GPGs

We first provide a descriptive pattern of differences in the raw GPG between NI and RUK on the basis of estimates from a simple earnings equation which pools individuals across gender and country. More formally, the Ordinary Least Squares (hereinafter, OLS) earnings equation takes the form:

$$lnE_{ij} = \alpha + \mu F_{ij} + \gamma C_{ij} + \delta F_{ij} C_{ij} + \varepsilon_{ij} \tag{1}$$

where the natural logarithm of gross hourly earnings of individual i in country j ($\ln E_{ij}$) is regressed on a (female) gender indicator (F_{ij}), a (RUK) country indicator (C_{ij}) and their interaction, and ε_{ij} is the random error term.[19] The GPG in NI is given by μ, the cross-country difference in male hourly earnings is given by γ and δ measures the difference in the GPG between NI and the RUK.

These figures are presented in Table 2 for full-time and all (full-time and part-time) employees, respectively. The upper panel (A) provides a comparison between NI and RUK. Consistent with the evidence of relatively low Gross Value Added in NI (ONS, 2018), male hourly earnings are on average 0.167 log points (or 16.7 log per cent) lower in NI compared to the RUK. Confirming the headline ONS findings, the GPG for full-time employees is considerably lower in NI than the RUK at 5.2 log per cent and 14.7 log per cent respectively, with a statistically significant difference of 9.5 log percentage points. Although the raw GPG is wider

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[19] We omit the time subscript throughout and pool individuals across 2016 to 2019, but control for year, quarter, and their interaction throughout.

for all employees, at 9.4 log per cent in NI, the pronounced cross-country differential is also evident. Indeed, the 19.0 log per cent raw GPG among all employees in the RUK is consistent with existing evidence. The corresponding regional comparisons (which separate the RUK into 11 standard regions) are provided in the lower panel (B) of Table 2, predominately to rule out the potential influence of London and the South East and, that the GPG in NI is similar to other more deprived regions in the 'North' of the RUK. These results confirm that the pattern in NI is also significantly different from any other standard region within the RUK, including those that are more similar in terms of prosperity and industrial structure. While, consistent with Stewart (2014), the GPG tends to be larger in London and the South East. The difference between NI and Wales and other parts of Northern England, which might be anticipated to have a narrower GPG on the basis of area prosperity (Fuchs *et al*., 2019), is at least 5 log percentage points (or double the GPG in NI). The descriptive pattern therefore confirms NI as an outlier in the UK, including relative to the other two devolved nations, Wales and Scotland.

[Table 2 here]

Next we extend our analysis of the pooled regression model in equation (1) to explore how the inclusion of control variables affects GPG, and how the residual or adjusted GPG varies across countries. Although we perform sensitivity analysis relating to all employees in Sections 5 and 6, in our benchmark estimates, we focus on the full-time GPG in order to make comparisons between males and females with a more similar labour market commitment (Blau and Kahn, 2017). For this purpose, we modify the earnings equation as follows:

$$lnE_{ij} = \mu F_{ij} + \gamma C_{ij} + \delta F_{ij} C_{ij} + \boldsymbol{x_{ij}} \boldsymbol{\beta_j} + \varepsilon_{ij} \qquad (2)$$

where $\boldsymbol{x_{ij}}$ is the vector of personal and employment-related characteristics described above including a constant term. We successively add additional control variables across specifications (1) to (6) in Table 3 to explore the role of personal and employment-related characteristics separately. Column (1) provides the raw GPG and cross-country differential discussed above for ease of comparison. The inclusion of personal characteristics (column (2)) widens the GPG in NI substantially, from 5.2 to 10.6 log per cent, suggesting gender differences in personal characteristics act to narrow the GPG in NI. In contrast, the cross-country differential narrows once personal characteristics are controlled for. The inclusion of other employment-related characteristics (excluding occupation, industry, and sector) (column (3)) have a limited influence. While the inclusion of controls for occupation narrow the GPG in NI slightly (column (4)), industry appears to have a more important narrowing role (column

(5)). The subsequent inclusion of sector (column (6)) has a minimal influence, in contrast to the suggestion of Mac Flynn (2014).[20] In the most comprehensive specification, the adjusted GPG in NI at 6.3 log per cent remains slightly larger than the raw GPG. While the cross-country differential narrows substantially to 5.0 log per cent, consistent with an important role for cross-country gender differences in characteristics, it remains large in magnitude and is statistically significant; NI has both a narrower adjusted, as well as raw, GPG compared to RUK.

[Table 3 here]

5. Decomposing the GPG within NI

To explore the drivers of the GPG *within* NI and the RUK we estimate a version of equation (2):

$$lnE_{g,j} = x_{g,j}\boldsymbol{\beta}_{g,j} + \varepsilon_{g,j} \tag{3}$$

where the vector of returns to characteristics $\boldsymbol{\beta}_{g,j}$ is estimated separately by gender g (male (M) and female (F)) and for each country j (NI and RUK).[21] The explanatory variables included in $x_{g,j}$ are the same across specifications and relate to the most comprehensive specification (6) in the pooled model above, with personal and employment-related characteristics.

This approach, which allows the return to characteristics to vary by gender and country, facilitates an OB decomposition of the raw GPG in country j into its explained and unexplained components as follows:

$$\overline{\ln E}_{M,j} - \overline{\ln E}_{F,j} = \underbrace{(\overline{x}_{M,j} - \overline{x}_{F,j})\widehat{\boldsymbol{\beta}}_{M,j}}_{\text{explained}} + \underbrace{\overline{x}_{F,j}(\widehat{\boldsymbol{\beta}}_{M,j} - \widehat{\boldsymbol{\beta}}_{F,j})}_{\text{unexplained}} \tag{4}$$

where the bar above a variable denotes the mean value and $\widehat{\boldsymbol{\beta}}_{g,j}$ is the OLS estimate of $\boldsymbol{\beta}_{g,j}$. In equation (4), the explained component measures that part of the GPG due to gender differences in the observable characteristics while the unexplained component reflects that part due to gender differences in the return to those attributes. The latter is typically interpreted as a measure of wage discrimination, albeit the limitations of this are well-established (see, for example, Neumark, 2018), particularly in the presence of unobservable personal and employment-related characteristics.[22]

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[20] Sector also has a modest influence when included prior to industry (results available upon request).

[21] We suppress subscript i for notational simplicity.

[22] Equation (4) uses as the counterfactual the earnings of an average woman at the male returns ($\overline{x}_{F,j}\widehat{\boldsymbol{\beta}}_{M,j}$), which assumes the latter represent competitive prices. We nevertheless explore the sensitivity of the findings to this assumption by weighting the difference in characteristics by the female returns (see Appendix Table A.2).

These results are presented in Table 4 for the full-time GPG for NI and RUK respectively.[23] Within the upper panel, the raw GPG within each country is separated into its explained and unexplained components. In contrast with previous UK evidence, but consistent with the findings from the pooled model, the explained component of the GPG is negative in NI, suggesting that women in NI have more productivity-enhancing personal and employment-related characteristics than men, such as higher educational attainment.[24] At -4.4 log per cent the explained gap is of similar absolute magnitude to the raw GPG (5.2 log per cent) leaving an unexplained GPG of 9.6 log per cent, nearly double the raw GPG.[25] The narrow raw GPG in NI is thus a misleading indicator of gender pay inequality. Corresponding figures for the RUK conform to more established patterns, with a positive explained component that contributes a modest proportion (less than one third) of the overall GPG. The unexplained GPG in the RUK is therefore smaller than the raw GPG, but interestingly is of similar in magnitude to that in NI. When interpreted cautiously as a measure of gender pay inequality, the comparison suggests that the narrower GPG in NI is predominately not a reflection of greater pay equality relative to the RUK.

The lower panel of Table 4 presents the detailed decomposition of the explained gap, where that part attributed to different groups of personal and employment-related characteristics is identified. This suggests that gender differences in education and occupation make the largest (negative) contributions to the explained GPG in NI, consistent with women having higher qualifications and a highly rewarded occupational allocation compared to men. Gender differences in industry and experience, however, partly offset these effects and serve to widen the GPG in NI. Comparisons between the decompositions within NI and RUK highlight occupation as a source of the differential explained gap, with occupation having a minimal role in explaining the GPG in the RUK.

[Table 4 here]

We explore the sensitivity of our main decomposition results in Table A.2 using alternative samples, specifications or versions of the OB decomposition methodology to: (1) extend the

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[23] A full set of coefficient estimates from each earnings equation is available on request but conforms to expected patterns.

[24] Christofides *et al.* (2013) provides similar evidence for EU countries with relatively low GPGs such as Belgium, Poland, Portugal and Italy.

[25] This is consistent with evidence from Caraballo-Cueto and Segarra-Almestica (2019), who find a positive unexplained GPG despite a negative raw GPG in Puerto Rico, and Fuchs *et al.* (2019), who find a relatively similar unexplained GPG across local areas within Germany despite considerable variation in the raw GPG.

sample to all employees; (2) consider the median GPG; (3) estimate the decomposition at the female coefficients; include additional controls such as (4) union membership, (5) religion and more detailed controls for (6) industry and (7) occupation; (8) exclude occupation, industry and sector; explore differences in the definition of country such as by (9) residence and (10) birth; (11) undertake comparisons with the 'North' of the RUK (given greater similarity in industrial structure and economic prosperity to NI); estimate decompositions separately for the (12) public and (13) private sector; and (14) account for non-random selection into work. In the latter, the selection adjusted GPG is estimated using a Heckman selection model (Heckman, 1979) where the first stage, selection into our sample (relative to non-employment), is modelled using a probit model separately by gender and country with the following personal characteristics: age band; highest qualification; disability, ethnicity and, marital status and the number of dependent children under 4 and their interaction.[26] The key findings are robust, with a small and typically negative explained GPG in NI and greater similarity in the unexplained relative to raw GPG between NI and the RUK.[27] Further, as in previous studies (Olivetti and Petrongolo, 2008; Christofides *et al.*, 2013), selection is found to have a limited role on the GPG, particularly for the RUK.

6. Decomposing the GPG between NI and the RUK

Using the JMP decomposition, applied widely in cross-country comparisons of the GPG, this section explores the difference in the raw GPG *between* NI and the RUK.

For this purpose, suppose that we rewrite equation (3) as follows:

$$lnE_{g,j} = \boldsymbol{x_{g,j}}\boldsymbol{\beta_{g,j}} + \sigma_{g,j}\theta_{g,j} \tag{5}$$

where the component of log hourly earnings accounted by unobservable characteristics is expressed in terms of the residual standard deviation $\sigma_{g,j}$ and the standardised residual $\theta_{g,j}$ (i.e. $\theta_{g,j} = \varepsilon_{g,j}/\sigma_{g,j}$). Using OLS estimates of equation (5) for the male return to observable characteristics $\boldsymbol{\widehat{\beta}_{M,j}}$, and the male residual standard deviation $\hat{\sigma}_{M,j}$, the GPG in country j then can be expressed as:

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[26] Dependent children and their interaction with marital status are excluded from the earnings equation to provide identification. The results are not sensitive to additionally controlling for housing tenure as a proxy for household income in the selection equation.

[27] In several specifications, such as at the median, the GPG in NI is not significantly different from zero. The absence of a median GPG in NI is in complete contrast to most developed countries, and therefore provides an additional motivation for the analysis. However, it is not unique internationally (see, Caraballo-Cueto and Segarra-Almestica, 2019 for evidence on Puerto Rico).

$$\Delta \overline{lnE}_j = \overline{lnE}_{M,j} - \overline{lnE}_{F,j} = \underbrace{\Delta \overline{x}_j \widehat{\boldsymbol{\beta}}_{\boldsymbol{M,j}}}_{\text{predicted gap}} + \underbrace{\widehat{\sigma}_{M,j} \Delta \overline{\theta}_j}_{\text{residual gap}} \qquad (6)$$

where the symbol $\boldsymbol{\Delta}$ represents the gender difference in the mean of the variable directly following. The predicted gap in equation (6) is equivalent to the explained gap in the OB decomposition (equation (4)). The analogy between the residual gap and unexplained gap in equations (4) and (6) is also worth noting. In the OB decomposition, the unexplained component represents the difference between the earnings an average woman would have received at the male returns and her actual earnings. In JMP, this is interpreted in terms of (minus) the mean value of the (hypothetical) female residuals, that are derived by taking the difference between the actual female earnings and the earnings each female would receive if rewarded according to the male earnings equation $(-\widehat{\sigma}_{M,j} \overline{\theta}_{F,j})$. In equation (6), this term is written as $\widehat{\sigma}_{M,j} \Delta \overline{\theta}_j$ as when OLS is applied, the mean standardised residuals for males is zero.[28]

Finally using equation (6), the difference in the GPG between NI and RUK can be decomposed into the following four components:

$$\underbrace{\Delta \overline{lnE}_{NI} - \Delta \overline{lnE}_{RUK}}_{\text{difference in observed GPGs}} = \underbrace{(\Delta \overline{x}_{NI} - \Delta \overline{x}_{RUK})\widehat{\beta}_{M,RUK}}_{\text{observed characteristics effect}} + \underbrace{\Delta \overline{x}_{NI}(\widehat{\beta}_{M,NI} - \widehat{\beta}_{M,RUK})}_{\text{observed prices effect}} \qquad (7)$$

$$+ \underbrace{(\Delta \overline{\theta}_{NI} - \Delta \overline{\theta}_{RUK})\widehat{\sigma}_{M,RUK}}_{\text{gap effect}} + \underbrace{\Delta \overline{\theta}_{NI}(\widehat{\sigma}_{M,NI} - \widehat{\sigma}_{M,RUK})}_{\text{unobserved prices effect}}.$$

The first term in equation (7) is the 'observed characteristics effect' and measures the impact of cross-country differences in the gender gap in productivity-related characteristics. The second term, 'observed prices effect', captures the effect of cross-country differences in male returns to these characteristics. The sum of these two effects is typically referred to as that part of the cross-country differential which can be explained by observable characteristics and prices. The third term, the 'gap effect' is the cross-country differences in the percentile ranking of men and women in the male residual earnings distribution after controlling for productivity-related characteristics and holding residual male earnings inequality constant. In other words, it captures the impact of cross-country differences in unobserved characteristics. The final term, the 'unobserved prices effect', measures the impact of the cross-country difference in male residual inequality, assuming that females maintain the same percentile ranking in the residual earnings distribution of men. It can be interpreted as the influence of differences in

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[28] The decomposition only requires estimation of the male earnings equation under the assumption that this is equivalent to competitive prices (as per OB above). While not free of criticism (see Yun, 2009) this is a standard approach (see Blau and Kahn, 1996). Nevertheless, we explore the sensitivity of the findings to this assumption by using the female coefficients (see Appendix Table A.3 panel D).

returns to unobservable characteristics across countries. The cross-country difference in the unexplained GPG is the sum of the 'gap' and 'unobserved prices' effects.

To perform the decomposition analysis, we use the estimates from equation (5), based on the most comprehensive specification introduced above, and predict the earnings of each woman if she were paid according to the male earnings equation. The first two components, the 'observed characteristics effect' and the 'observed prices effect' can then be calculated using the estimated coefficients and sample means by gender. To estimate the unexplained terms, we follow a non-parametric approach proposed by Juhn *et al.* (1991) that uses the entire distribution of male and female residuals from the male equation for each country. In particular, the second term of the 'gap effect' ($\Delta \bar{\theta}_{RUK} \hat{\sigma}_{M,RUK}$) is obtained by assigning each woman in RUK a percentile corresponding to her position in the male residual distribution of RUK, then using these relative ranks to derive the residuals from the RUK residual distribution. Analogously, the first term of the 'unobserved prices effect' ($\Delta \bar{\theta}_{NI} \hat{\sigma}_{M,NI}$) can be calculated using the NI distribution. The remaining term in the 'gap' and 'unobserved prices' effects ($\Delta \bar{\theta}_{NI} \hat{\sigma}_{M,RUK}$) is estimated by assigning each individual in NI a percentile corresponding to its position in the residual distribution of NI, then using these relative ranks to derive hypothetical residuals given the RUK residual distribution, and finally taking the mean difference in these hypothetical residuals between men and women.[29]

The upper panel of Table 5 provides the four components of the JMP decomposition and further details of the observed characteristics and observed prices effects are provided in the panels below. The cross-country difference in the raw GPG between NI and RUK is -9.4 log percentage points, nearly double the absolute GPG in NI. Of this, 'observed characteristics', or cross-country differences in the gender difference in characteristics account for nearly half. This is consistent with the female characteristic advantage in NI identified above also being a driver of the cross-country differential. Indeed, the cross-country gap would narrow to 5.2 log percentage points in the absence of gender differences in characteristics between countries. However, 'observed prices' account for a similar proportion of the differential, suggesting differences in characteristics are reinforced by a relatively advantageous (male) return to these characteristics in NI compared to the RUK. Consistent with the OB decomposition, the explained cross-country gap (that is, in terms of observed prices and quantities) thus accounts

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[29] The decomposition of the residual differential has been subject to criticism arising from the potential dependence between the standard deviation of the earnings residual and the percentile ranking (see Suen, 1997), albeit this is not always evident empirically (Kaya, 2014). Our results, however, confirm the importance of the explained component of the country differential and it is this on which we focus.

for the vast majority of the raw cross-country differential. However, the fairly modest total unexplained cross-country GPG conceals two important but largely offsetting effects. Unobserved prices, typically interpreted as the influence of residual earnings inequality, further account for about a third of the cross-country differential and more than offset a 'gap' effect which acts to widen the GPG in NI relative to the RUK. The narrowing influence of residual earnings inequality on the cross-country GPG differential is consistent with the compressed earnings distribution in NI disproportionately benefitting women relative to men and aligns to international evidence of the importance of national wage structure for the GPG. This is interesting since NI and the RUK share a largely common policy and institutional environment, including for example, the National Living Wage, suggesting international drivers of the GPG may also be important drivers of spatial variation in the GPG within countries.[30]

Further separation of the observed components serves to identify the influence of individual personal and employment-related characteristics to the cross-country differential. In terms of characteristics, occupation, education, and tenure make an important contribution, with the occupational allocation narrowing the GPG in NI relative to RUK as suggested by the OB decomposition above. Interestingly, cross-country differences in (male) returns to occupations also reinforce this and serve to further explain the country differential.[31] In other words, the (male) returns to occupations in NI also contribute to narrowing the GPG in NI relative to RUK. Indeed, the combined influence of occupational allocation and returns accounts for nearly half of the cross-country GPG differential. Cross-country differences in the returns to industry and sector play a further, although more minor, role.

[Table 5 here]

In Appendix Table A.3, we show that extending the sample to all employees (panel A); undertaking comparisons with the 'North' of the RUK (panel B); or using NI as the benchmark coefficients (panel C) makes no difference to our results. The 'gap' effect is eliminated, and the magnitude of the observed price effect is reduced when using the female reference coefficients (panel D), although the vast majority of the cross-country differential remains explained in line with our benchmark estimates.

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[30] As noted previously, the 'bite' of the minimum wage is likely to be higher in NI and union membership is also higher in NI relative to RUK.
[31] This is in contrast to US evidence exploring the narrowing GPG where improvements in the occupational distribution have been offset by changes in the returns to occupation (Blau and Kahn, 2017), but is consistent with Kaya (2014) who finds that changing returns to occupational skills contributed to narrowing the UK GPG (1994-2009).

7. Conclusion

The surprisingly narrow GPG in NI, especially in comparison to the RUK given the relatively homogenous policy and institutional context, provides an interesting case study from which to explore the drivers of the contemporary GPG. Using data from the largest household survey in the UK which contains comprehensive and directly comparable information across constituent countries, we explore the role of personal and employment-related characteristics in determining the GPG in NI, and its difference relative to the RUK. Our analysis is performed in two stages. We seek to understand and compare the drivers of the GPG within each country, and then we explore the cross-country differential. The findings contribute to the international literature on understanding cross-country variation in the GPG and integrate this to emerging analysis of spatial variation in GPGs within countries, with NI providing particular insights for contemporary policy aimed at narrowing the GPG.

Regardless of the precise measure of the GPG we find that the GPG in NI is far narrower than in the RUK and all other UK standard regions, including other devolved nations. Within country decompositions indicate that the relatively low mean full-time GPG in NI is a consequence of women having superior productivity-related characteristics relative to men, particularly in terms of education and occupation. The unexplained GPG in NI is larger than the raw GPG, and of a comparable magnitude to the RUK. NI is not therefore an exemplar of gender pay equality and instead serves to illustrate the important distinction between the GPG and pay inequality. In this respect this cross-country comparison shares similarities with UK evidence exploring the narrowing GPG over time, which finds a relatively stable unexplained GPG (Jones *et al*., 2018). Indeed, as in international evidence exploring trends in the GPG (Kaya, 2014), local variation (Fuchs *et al*., 2019) and exceptions to the international pattern of male pay advantage (Caraballo-Cueto and Segarra-Almestica, 2019), NI highlights the critical role of gender differences in productivity-related characteristics. This is particularly important in the UK policy context where, unlike in some countries (for example, Switzerland) the current legislation requires firms only to report their raw GPG. If there are positive lessons for policy from NI, they are in terms of highlighting the potential of productivity-related characteristics for women as a determinant of pay. However, in focusing on relative measures, the risk is that what appears to be female advantage might simply reflect male disadvantage, particularly in less prosperous areas (see Fuchs *et al*., 2019).

Our comparison between NI and RUK confirms the importance of gender differences in occupational allocation as a driver of the substantial cross-country GPG differential. This is

reinforced by cross-country differences in the (male) returns to occupations, which benefit women in NI relative to the RUK. Together these influences narrow the cross-country differential by nearly half. This is perhaps surprising in the context of the relatively homogenous contemporary policy, education and institutional environment and, in the absence of a clear explanation, deserves further attention. It may, for example, suggest further scrutiny of the historical context as a driver of cultural norms, potentially affecting both individual occupational preferences and employer attitudes, is warranted. Consistent with previous international evidence, however, we also find an important role for non-gender specific factors, with lower earnings inequality in NI narrowing the GPG and accounting for a further third of the cross-country differential. Again, this is perhaps less anticipated within this context, and would seem to suggest that earnings inequality deserves future attention as a determinant of within country variation in the GPG, particularly in countries where wage bargaining is decentralised.

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Table 1: Key Labour Market Indicators by Country and Gender

	NI				RUK			
	All	Male	Female	Gender gap (%)	All	Male	Female	Gender gap (%)
Employment (%)	75.7	78.3	73.0	6.8	80.4	83.7	77.0	8.0
Employee (%)	84.3	78.2	90.9	-16.2	85.1	81.0	89.6	-10.6
Full-time employment (%)	77.3	92.3	63.6	31.1	77.9	92.0	63.8	30.7
Public sector employment (%)	32.3	21.4	42.2	-97.2	25.6	17.0	34.3	-101.8
Occupational dissimilarity index			0.36				0.30	
Industrial dissimilarity index			0.34				0.30	
Earnings inequality								
Standard deviation	0.46	0.47	0.46	2.90	0.55	0.56	0.52	7.47
Ratio 90-10 percentile	1.53	1.54	1.54	0.29	1.66	1.67	1.62	3.33
Ratio 90-50 percentile	1.24	1.27	1.22	3.25	1.29	1.29	1.27	1.60
Ratio 50-10 percentile	1.23	1.22	1.26	-3.06	1.29	1.29	1.27	1.76

Notes: Authors calculations based on the QLFS 2016-2019. (i) All figures are based on the working-age population and exclude full-time students. (ii) Employees are measured as a percentage of those in employment. (iii) Full-time and public sector employment are measured as a percentage of employees. (iv) Occupational and industrial dissimilarity are based on the Duncan and Duncan (1955) index and SOC 2010 major occupations and SIC 1997 sectors, respectively. (v) Earnings inequality measures use the log of hourly earnings and relate to the main full-time pay sample. (vi) The within country gender gap is measured as a percentage of the relevant male figure in each case.

Table 2: Comparisons of the Raw GPG by Country and Region

	Full-time	All employees
Panel A (Country)		
Female	-0.052**	-0.094***
	(0.017)	(0.016)
RUK	0.167***	0.158***
	(0.012)	(0.012)
Female × RUK	-0.095***	-0.096***
	(0.018)	(0.016)
Adjusted-R^2	0.02	0.04
Panel B (Region)		
Female	-0.052**	-0.094***
	(0.017)	(0.016)
Female × North East	-0.077**	-0.070**
	(0.025)	(0.022)
Female × North West	-0.077***	-0.069***
	(0.021)	(0.019)
Female × Yorkshire and Humberside	-0.072***	-0.062***
	(0.022)	(0.019)
Female × East Midlands	-0.088***	-0.086***
	(0.023)	(0.020)
Female × West Midlands	-0.053**	-0.060**
	(0.023)	(0.020)
Female × East of England	-0.107***	-0.107***
	(0.023)	(0.020)
Female × London	-0.129***	-0.114***
	(0.022)	(0.020)
Female × South East	-0.121***	-0.132***
	(0.021)	(0.019)
Female × South West	-0.148***	-0.131***
	(0.022)	(0.020)
Female × Wales	-0.054*	-0.047*
	(0.026)	(0.023)
Female × Scotland	-0.060**	-0.062**
	(0.022)	(0.020)
Adjusted-R^2	0.07	0.08

Notes: (i) Estimates are obtained from a pooled OLS earnings equation. (ii) Males and NI are the reference categories. (iii) Robust standard errors in parentheses. (iv) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. (v) All models include a constant term, year, quarter and year-quarter interactions. In Panel B models also include region dummy variables. (vi) The number of observations is 64,680 (of which 2,870 are from NI) across full-time specifications. The equivalent sample sizes for all employees (full-time and part-time) are 83,481 (3,736).

Table 3: Comparisons of the Adjusted Full-time GPG by Country

	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.052**	- 0.106***	- 0.113***	- 0.098***	- 0.064***	-0.063***
	(0.017)	(0.014)	(0.014)	(0.013)	(0.013)	(0.013)
RUK	0.167***	0.164***	0.161***	0.128***	0.119***	0.118***
	(0.012)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
Female × RUK	- 0.095***	- 0.065***	- 0.055***	- 0.048***	- 0.049***	-0.050***
	(0.018)	(0.015)	(0.014)	(0.013)	(0.013)	(0.014)
Personal characteristics	No	Yes	Yes	Yes	Yes	Yes
Employment-related characteristics	No	No	Yes	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes	Yes
Industry	No	No	No	No	Yes	Yes
Sector	No	No	No	No	No	Yes
Adjusted-R^2	0.02	0.29	0.33	0.43	0.45	0.45

Notes: (i) Estimates are based on a pooled OLS earnings equation. (ii) Males and NI are the reference categories. (iii) Robust standard errors in parentheses. (iv) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. (v) All models include a constant term, year, quarter and year-quarter interactions. (vi) The number of observations is 64,680 across all specifications.

Table 4: Decomposition of the Full-time GPG within NI and RUK

	NI		RUK	
Raw GPG	0.052**	[100%]	0.146***	[100%]
Explained	-0.044**	[-85%]	0.042***	[29%]
Unexplained	0.096***	[185%]	0.104***	[71%]
N	2,870		61,810	
Explained	-0.044**	[-85%]	0.042***	[29%]
Year/quarter	-0.000	[0%]	-0.001	[-1%]
Experience	0.015***	[29%]	0.012***	[8%]
Disabled	0.002	[4%]	0.003***	[2%]
Married	0.004*	[8%]	0.009***	[6%]
Qualifications	-0.043***	[-83%]	-0.030***	[-21%]
Ethnicity	-0.000	[0%]	-0.000**	[0%]
Temporary contract	0.001	[2%]	0.001***	[1%]
Occupation	-0.042***	[-81%]	0.002	[1%]
Tenure	-0.003	[-6%]	0.005***	[3%]
Industry	0.024*	[46%]	0.032***	[22%]
Sector	-0.001	[-2%]	0.010***	[7%]
Workplace size	-0.001	[-2%]	-0.002*	[-1%]

Notes: (i) OB method is used to decompose the mean GPG using relevant male coefficients as the baseline. (ii) Specification includes personal and employment-related characteristics (including occupation, industry and sector). (iii) Figures in [ ] are proportions of the raw GPG. (iv) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 5: Decomposition of the Full-time GPG between NI and RUK

Difference in raw GPG (NI-RUK)	-0.094	
GPG in RUK	0.146	
GPG in NI	0.052	
	Decomposition of the difference in raw GPG	
(1) Observed characteristics	-0.042	[45%]
(2) Observed prices	-0.044	[47%]
(3) Gap effect	0.022	[-23%]
(4) Unobserved prices	-0.030	[32%]
(1) Observed characteristics	-0.042	[45%]
Year/quarter	0.001	[-1%]
Experience	0.001	[-1%]
Qualifications	-0.014	[15%]
Occupation	-0.021	[22%]
Tenure	-0.009	[10%]
Industry	0.001	[-1%]
Workplace size	-0.000	[0%]
Disabled	-0.002	[2%]
Married	-0.001	[1%]
Ethnicity	-0.000	[0%]
Temporary contract	0.000	[0%]
Sector	0.003	[-3%]
(2) Observed prices	-0.044	[47%]
Year/quarter	-0.000	[0%]
Experience	0.002	[-2%]
Qualifications	0.001	[-1%]
Occupation	-0.023	[24%]
Tenure	0.001	[-1%]
Industry	-0.010	[11%]
Workplace size	0.001	[-1%]
Disabled	0.000	[0%]
Married	-0.003	[3%]
Ethnicity	0.000	[0%]
Temporary contract	0.000	[0%]
Sector	-0.014	[15%]

Notes: (i) JMP method is used to decompose the cross-country GPG differential using the male coefficients as reference and RUK as benchmark. (ii) Specification includes personal and employment-related characteristics (including occupation, industry and sector). (iii) Figures in [ ] are proportions of the difference in the raw GPG between NI and RUK. (iv) The number of observations is 64,680 (of which 2,870 are from NI).

Appendix

Table A.1: Summary Statistics for all Variables, by Gender and Country

	NI			RUK		
	All	Male	Female	All	Male	Female
Log (hourly earnings)	2.50	2.52	2.47	2.62	2.68	2.53
Personal characteristics						
Experience (years)	21.15	22.00	20.06	22.09	23.01	20.80
Disabled	0.09	0.09	0.10	0.13	0.12	0.15
Married	0.60	0.63	0.55	0.52	0.57	0.46
Highest qualification						
Degree or equivalent	0.38	0.32	0.46	0.38	0.34	0.44
Other higher education	0.12	0.11	0.12	0.10	0.09	0.10
A level or equivalent	0.21	0.24	0.17	0.22	0.24	0.20
GCSE A-C or equivalent	0.17	0.18	0.16	0.19	0.19	0.19
Other qualifications	0.06	0.06	0.04	0.07	0.08	0.05
No qualifications	0.06	0.08	0.04	0.04	0.05	0.03
White ethnicity	0.98	0.98	0.98	0.90	0.90	0.89
Employment-related characteristics						
Tenure (months)	121.23	117.73	125.67	102.29	107.58	95.01
Temporary contract	0.03	0.03	0.04	0.03	0.02	0.03
Public sector	0.34	0.24	0.48	0.26	0.18	0.37
Occupation (SOC 2010)						
Managers and senior officials	0.09	0.11	0.07	0.13	0.14	0.10
Professional occupations	0.24	0.20	0.31	0.25	0.23	0.28
Associate professional and technical	0.14	0.15	0.13	0.17	0.17	0.16
Administrative and secretarial	0.14	0.08	0.21	0.10	0.05	0.16
Skilled trades occupations	0.10	0.16	0.02	0.09	0.14	0.02
Personal service occupations	0.76	0.03	0.14	0.08	0.03	0.14
Sales and customer service occupation	0.06	0.06	0.07	0.05	0.04	0.07
Process, plant and machine operatives	0.08	0.14	0.02	0.07	0.11	0.02
Elementary occupations	0.07	0.09	0.05	0.07	0.09	0.05
Industry (SIC 2007)						
Agriculture, forestry and fishing *and* Energy and water	0.03	0.04	0.01	0.03	0.04	0.01
Manufacturing	0.13	0.19	0.07	0.13	0.17	0.07
Construction	0.06	0.09	0.02	0.06	0.09	0.02
Distribution, hotels and restaurants	0.15	0.16	0.13	0.15	0.16	0.14
Transport and communication	0.06	0.09	0.03	0.10	0.14	0.06
Banking and finance	0.15	0.16	0.14	0.17	0.17	0.17
Public admin, education and health	0.37	0.22	0.56	0.33	0.20	0.50
Other services	0.05	0.05	0.04	0.04	0.04	0.04
Workplace size (workers)						
< 25	0.33	0.34	0.33	0.29	0.30	0.28
25-49	0.14	0.14	0.15	0.13	0.12	0.15
50-249	0.26	0.26	0.25	0.27	0.27	0.26
250-499	0.08	0.09	0.07	0.08	0.08	0.08

500+	0.19	0.18	0.20	0.23	0.23	0.23
Number of children under 4[a]	0.22	0.18	0.26	0.21	0.19	0.23
Union member[b]	0.37	0.27	0.48	0.26	0.23	0.30
Religion (NI)						
Catholic	0.43	0.40	0.46			
Other Christian	0.40	0.40	0.39			
Other	0.04	0.04	0.04			
No religion	0.14	0.16	0.12			
Religion (GB)						
Christian				0.47	0.44	0.51
Buddhist				0.01	0.00	0.00
Hindu				0.02	0.02	0.02
Jewish				0.00	0.00	0.00
Muslim				0.02	0.03	0.02
Sikh				0.01	0.01	0.01
Other				0.01	0.02	0.02
No religion				0.46	0.49	0.43
N	2,870	1,605	1,265	61,810	35,798	26,012

Notes: Authors calculations based on the QLFS 2016-2019. (i) All variables are binary (unless otherwise stated). (ii) Industry sector 'Agriculture, forestry and fishing' is merged with 'Energy and water' to enhance the sample size. (iii) Variable means are constructed on the basis of the estimation sample and are rounded to two decimal places. (iv) [a]Mean is based on the sample used in the Heckman selection model employment equation. (v) [b]Union membership is only available in October-December quarters and the mean is therefore based on a restricted sample.

Table A.2: Decomposition of the GPG within NI and the RUK, Sensitivity Analysis

	(1) All employees		(2) Median		(3) Female coefficients		(4) With union		(5) With religion		(6) Detailed industry		(7) Detailed occupation	
	NI	RUK	NI	RUK	NI	RUK	NI	RUK	NI	RUK	NI	RUK	NI	RUK
Raw GPG (log points)	0.094***	0.190***	0.026	0.137***	0.052**	0.146***	0.015	0.140***	0.052**	0.146***	0.052**	0.146***	0.052**	0.146***
Explained	0.001	0.096***	-0.060***	0.034***	-0.052**	0.015***	-0.071*	0.042***	-0.046**	0.043***	-0.020	0.052***	-0.029	0.059***
	[1%]	[51%]	[-231%]	[25%]	[-100%]	[11%]	[-480%]	[30%]	[-89%]	[30%]	[-68%]	[32%]	[-39%]	[36%]
Unexplained	0.094***	0.093***	0.086***	0.103***	0.104***	0.131***	0.086**	0.098***	0.099***	0.103***	0.072***	0.094***	0.080***	0.087***
	[99%]	[50%]	[331%]	[75%]	[200%]	[90%]	[580%]	[70%]	[189%]	[70%]	[139%]	[65%]	[155%]	[59%]
N	3,736	79,745	2,870	61,810	2,870	61,810	806	15,491	2,853	61,754	2,870	61,810	2,870	61,810

	(8) Excluding occupation, industry and sector		(9) Country of residence		(10) Country of work and birth		(11) North RUK		(12) Public		(13) Private		(14) Selection	
	NI	RUK	NI	RUK	NI	RUK	NI	RUK	NI	RUK	NI	RUK	NI	RUK
Raw GPG (log points)	0.052**	0.146***	0.054**	0.146***	0.040*	0.147***	0.052**	0.121***	0.036	0.156***	0.137***	0.177***	0.005	0.138***
Explained	-0.059***	-0.016***	-0.042**	0.043***	-0.054**	0.046***	-0.044**	0.022***	-0.058*	0.040***	0.035	0.077***	-0.044**	0.042***
	[-114%]	[-11%]	[-78%]	[29%]	[-134%]	[31%]	[-85%]	[18%]	[-160%]	[26%]	[26%]	[43%]	[-931%]	[30%]
Unexplained	0.111***	0.163***	0.096***	0.103***	0.094***	0.101***	0.096***	0.099***	0.094***	0.115***	0.102***	0.101***	0.049	0.096***
	[214%]	[111%]	[178%]	[71%]	[234%]	[69%]	[185%]	[82%]	[260%]	[74%]	[74%]	[57%]	[1031%]	[70%]
N	2,870	61,810	2,885	61,795	2,373	51,224	2,870	43,164	979	16,050	1,891	45,760	2,870	61,810

Notes: Authors calculations based on the QLFS 2016-2019. (i) OB and Machado and Mata (2005) methods are used to decompose the GPG at the mean and median respectively using relevant male coefficients as the baseline (unless otherwise stated). (ii) Figures in [ ] are proportions of the raw GPG. (iii) * p < 0.05, ** p < 0.01, *** p < 0.001. (iv) Standard errors for the Machado and Mata (2005) decomposition are bootstrapped with 500 replications. (v) Specification includes personal and employment-related characteristics (including occupation, industry and sector) (unless otherwise stated). (vi) Sample is full-time employees (unless otherwise stated). (vii) The specification for all employees includes a control for part-time employment. (viii) Union membership is only available in the October-December quarter. (ix) Religion is defined differently in NI and RUK (see Appendix Table A.1). (x) Detailed controls for occupation and industry are defined using 3-digit SOC 2010 and SIC 1997 codes, respectively. (xi) North RUK is defined to include Wales, Scotland, North East, North West, Yorkshire and Humberside, West Midlands and East Midlands. (xii) The selection adjusted GPG is decomposed in panel (14). First stage estimates from the Heckman selection model are available on request. The selection term is only significant for females in RUK.

Table A.3: Decomposition of the GPG between NI and RUK, Sensitivity Analysis

Panel A	All employees	
Difference in raw GPG (NI-RUK)	-0.095	
GPG in RUK	0.190	
GPG in NI	0.094	
	Decomposition of the difference in raw GPG	
(1) Observed characteristics	-0.035	[37%]
(2) Observed prices	-0.061	[64%]
(3) Gap effect	0.028	[-29%]
(4) Unobserved prices	-0.028	[29%]
Panel B	North RUK	
Difference in raw GPG (NI-North RUK)	-0.069	
GPG in North-RUK	0.121	
GPG in NI	0.052	
	Decomposition of the difference in raw GPG	
(1) Observed characteristics	-0.028	[41%]
(2) Observed prices	-0.037	[54%]
(3) Gap effect	0.019	[-28%]
(4) Unobserved prices	-0.023	[33%]
Panel C	NI benchmark	
Difference in raw GPG (NI-RUK)	-0.094	
GPG in RUK	0.146	
GPG in NI	0.052	
	Decomposition of the difference in raw GPG	
(1) Observed characteristics	-0.046	[49%]
(2) Observed prices	-0.040	[43%]
(3) Gap effect	0.015	[-16%]
(4) Unobserved prices	-0.023	[25%]
Panel D	Female coefficients	
Difference in raw GPG (NI- RUK)	-0.094	
GPG in RUK	0.146	
GPG in NI	0.052	
	Decomposition of the difference in raw GPG	
(1) Observed characteristics	-0.050	[53%]
(2) Observed prices	-0.018	[19%]
(3) Gap effect	-0.005	[5%]
(4) Unobserved prices	-0.022	[23%]

Notes: (i) JMP method is used to decompose the cross-country GPG differential using the male coefficients as reference and RUK (North RUK) as benchmark (unless otherwise stated). (ii) Specification includes personal and employment-related characteristics (including occupation, industry and sector). The specification for all employees includes a control for part-time employment. (iii) Figures in [ ] are proportions of the cross-country difference in GPG. (iv) North RUK is defined to include Wales, Scotland, North East, North West, Yorkshire and Humberside, West Midlands and East Midlands. (v) For all employees the number of observations is 83,481 (of which 3,736 are from NI). For North RUK the number of observations is 46,034 (of which 2,870 are from NI).