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Minimum Wages and the Gender Gap in Pay: Evidence from the UK and Ireland

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Abstract

Since women are disproportionately in low paid work, they should benefit the most from the introduction of a minimum wage, disregarding any potential increase in the risk of losing their job. We exploit the introduction of a national minimum wage (MW) in Ireland (in 2000) and the UK (in 1999) to check this prediction. Using panel survey data, we implement difference-in-difference estimation of a distribution regression model. We separate out 'price' effects from 'composition' effects. A large reduction of the gap at low wages is found for Ireland, with small spill-over effects further up in the distribution. There is hardly any effect in Britain, largely because of apparent non-compliance with the minimum wage legislation.

Key Words: gender wage gap, minimum wages, distribution regression, UK, Ireland
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1 Introduction

Recent research into the gender wage gap has increasingly focused on more global methods than the evaluation of gender wage differences at the mean. Indeed gender gaps are often concentrated either at the bottom of the distribution ("sticky floors") or at the top ("glass ceilings"). In this way, this literature has benefited from the surge of methodologies extending Oaxaca-Blinder type of decompositions to the whole wage distribution (e.g. Juhn et al., 1993, DiNardo et al., 1996, Gosling et al., 2000, and the decomposition of unconditional quantiles in Melly, 2006, Machado and Mata, 2005, Firpo et al., 2009 and Chernozhukov et al., 2013, among others). These new methodologies have been widely applied in analyses of the gender gap along the wage distribution in Europe (Arulampalam et al., 2007, Beblo et al. 2003), Sweden (Albrecht et al., 2003), the UK (Blundell et al., 2007, Chzhen and Mumford, 2011), Spain (Gardeazabal and Ugidos, 2005, de la Rica et al., 2008), Ukraine (Terrell and Ganguli, 2009) and the US (Olivetti and Petrongolo, 2008, Weinberger and Kuhn, 2010). Most directly relevant for policy makers is the role of policies that have intended (or indirect) effect on gender inequality. These policies may affect workers at different positions of the wage distribution differently, so that distributional decomposition methods are of particular relevance.

In this paper, we focus on the effect of minimum wages (MW) on the gender gap in pay, especially on the gap at the bottom of the wage distribution. One of the consequences of MWs is, indeed, to compress the bottom of the wage distribution, where women are disproportionately represented. Although this is often not the direct or intended effect of the MW, a substantial reduction in the gender wage gap may take place. To address this question, some studies have used cross-country variation in wage distribution and MW setting (e.g., Blau and Kahn, 2003), checking for a possible negative correlation between the gender gap and the "bite" of MWs (the MW level as a proportion of the average wage). Other studies, closer to ours, have used micro data and time variation in MW legislation in the US (Blau and Kahn, 1997) and in Ukraine (Ganguli and Terrell, 2006, 2009) to check how gender gaps vary with MW levels. We suggest to examine an even more radical policy event, namely the introduction of a MW legislation. Precisely, we focus on the introduction of a national MW in the UK in 1999 and in Ireland in 2000. These countries set MWs with different "bites" within a year of each other, which allows interesting comparisons. Using the Living in Ireland survey (LII) and the British Household Panel Survey (BHPS), we employ a flexible model of wage distributions to construct counterfactual distributions of wages based on a fixed distribution of covariates for women in each country. We estimate the gender wage gap before and after the introduction of the MW, at every point in the wage distribution, separating out "explained", human capital effects, and residual "unexplained/discriminatory" differentials. We can thus deduce what effect (if any) the MW in each country had on the gender wage gap at the bottom of the distribution, as well as identify spillover effects further up in the

distribution.

Two particularly interesting features of this study should be highlighted. First, while a few studies have also used the implementation of the British MW as a 'natural experiment' (see Robinson, 2002, 2005 and Dickens et al, 2011), we provide a comparative setting across two neighbouring countries with different wage distributions and MW "bites" in order to generalize policy conclusions linking MW levels and the gender gap in pay at low wages. Second, we suggest an original application of the distribution regression (DR) approach, a methodology recently used by Chernozhukov et al. (2013) to analyze wage inequality in the US. This approach allows us to model entire counterfactual distributions of wages in order to pinpoint the gender wage gap before and after the introduction of the MW at every point in the wage distribution. DR is better suited to our study than the more commonly used quantile regression (QR) methodology. The main reason is that there is a considerable amount of rounding at the level of the MW, which makes wage variables highly discrete. Moreover, there is nonlinearity in the conditional quantile function, so that a linear model may not provide a good approximation for this function. The DR approach does not suffer from these problems and provides a direct way to identify changes in the gender wage gap at specific wage levels in each country observed in our data.

Our results are as follows: A large correction of the gap at the bottom is found for Ireland, with spillover effects further up in the distribution, while there is hardly any effect in Britain. We find that, while the MW may correct the gender wage gap by up to 100% at the bottom of the wage distribution, its effect on the mean gender wage gap is small or negligible, illustrating the importance of a distributional approach to this question. We perform several robustness checks that include fixing the population using panel data, detrending the effects and checking the sensitivity of our results to the inclusion of occupation and industry variables. We also suggest an extrapolation exercise which examines the counterfactual effect of introducing the same MW bite in the UK as in Ireland. We find that the absence of an effect in Britain is due to the high degree of non-compliance to the MW.

2 Background and Institutions

2.1 The Gender Wage Gap

Figure 1 shows the evolution of the raw gender wage gap in the UK, Ireland and in the EU-27 during the period studied. Between 1997 and 2001, the gap was similar and relatively stable in both countries, with men earning, on average, 20-24% more than women. This was, however, higher than the EU average of 16%. At the beginning of the noughties when the MW was introduced and the Celtic Tiger took off in Ireland, the Irish gender wage gap decreased relative

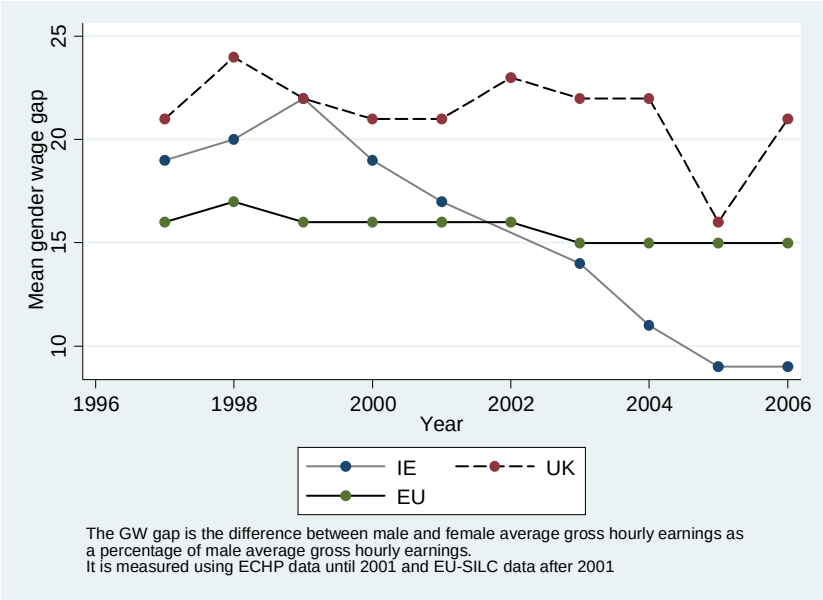


Figure 1: The Evolution of the Gender Wage Gap in the UK and Ireland

to the UK one with the 2006 gap standing at 21% and 9% in the UK and Ireland respectively.

Results from Arulampalam et al (2007) indicate that this gap was not uniform across the wage distribution. Using pooled data from 1996-2001, they estimate the average raw wage gap to be 25% and 20% for the UK and Ireland respectively. However, they estimate the gender wage gap in the first decile of earning to be 24% in the UK and 25% in Ireland. Although Ireland and the UK are not classed as having "sticky floors", defined as the 10th percentile wage gap being 2 ppt higher than the 25th percentile wage gap, their first decile gender wage gaps are still among the highest in the sample of eleven European countries studied by Arulampalam et al (2007). In the top decile of earnings, the corresponding gender wage gaps are estimated to be 25% and 13%. These are unadjusted gaps, i.e. not corrected for different human capital and job characteristics between men and women but the adjusted (unexplained) wage gap exhibit similar patterns, indicating that both countries display high gender inequality at the bottom of the wage distribution while Ireland may have less of a "glass ceiling" problem than the UK at the top of the distribution.

Gender gaps have been studied in the context of different career development patterns between men and women. The role of child-related career interruption (Meurs et al., 2011), and specific discrimination that prevents women from achieving high wages and top positions are particularly important in explaining glass ceilings. The study of these requires accounting for firm-specific heterogeneity and the use of matched worker-firm data (Meng and Meurs, 2004; Nordman and

Wolff, 2011). To explain sticky floors, the literature has also focused on factors that may affect wage inequality at the start of the career, including signaling and statistical discrimination (Belley et al. 2012). Long-lasting effects of gender wage inequality at an early career stage (Weinberger and Kuhn, 2010) are also important, and so are labor market regulation affecting low-skill workers.[1] We are mainly interested in the latter type of factor and the (intended or unintended) role of labor market policies.

Wage inequality in the population as a whole has been shown to be strongly positively correlated with the gender wage gap (Gupta et al, 2006). Studies of the impact of MW on the wage distribution usually find that such regulation compresses the bottom of the distribution, reducing the sticky floor effect. Closer to our study, Ganguli and Terrell (2006, 2009) find that the doubling of the MW between 1997 and 2003 contributed to the closing of the gender wage gap in Ukraine. Blau and Kahn (1997) also emphasize that the sharp decine in the MW between 1979 and 1988 in the US is one of the important institutional factors explaining the widening gender gap during this period.[2] Finally, Robinson (2002), using QR, finds no evidence that the MW in the UK affected the gender wage gap in the lower part of the wage distribution. In a later study, Robinson (2005) uses regional variation in the bite of the MW in the UK combined with a difference-in-difference approach and finds some evidence of a narrowing of the gender pay gap by $1-2$ percentage points in regions where women comprise a relatively large share of the low paid, and where the regional bite is larger (like Scotland).

Departing from the standard decomposition method of Blinder (1973) and Oaxaca (1973), a number of decomposition methods for wage distributions have been proposed (such as Juhn et al., 1993, DiNardo et al., 1996, Gosling et al., 2000, Melly, 2006, Machado and Mata, 2005). However, the decomposition results of distributional measures obtained by these methods are not comparable to those of the standard Blinder-Oaxaca decomposition of the mean wage differential. In fact, none of these methods produces consistent results when changes in the gender wage gap over time are being studied, while the results of a Blinder-Oaxaca decomposition of changes in the gender wage gap between two points in time are consistent with those of a decomposition of

[1] Blau and Kahn (1996), using the Juhn et al (1993) decomposition, show that eight European countries have a lower gender gap than the US and attribute this to higher female wages in Europe for low earners. Countries with higher unionization rates tend to have lower wage dispersion (Blau and Kahn, 1992, 1996)), possibly lowering the wage gap. Trade unions may be less likely to represent the interests of their female electorate because they may be perceived as having less attachment to the labour market (Booth and Francesconi, 2003). They may also be less sensitive to the interests of members at the low end of the wage distribution - see also Arulampalam et al. (2007).

[2] Many other studies address the role of the MW on wage inequality. The popular decomposition of DiNardo et al (1996) provides evidence that the decline in the real value of the MW explains a substantial proportion of rising wage inequality in the US between 1979 and 1988, particularly for women. This result is reinforced in the empirical application of Chernozhukov et al. (2013).

gender differences in wage growth over this period (given the use of a common reference vector as defined by Oaxaca and Ransom, 1994). Because of these potential biases which preclude one from distinguishing between discrimination and wage structure, it makes sense to identify particular country institutions, and directly test their effect on the gender wage gap. Blau and Kahn (2003) do this by exploring the role of a particular wage setting scheme: collective bargaining. They use micro-data from the International Social Survey Programme (ISSP) for 22 countries over the 1985–94 period and find that countries with a more compressed male wage structure (a narrower male earnings distribution) are associated with a lower gender pay gap. Also, they find that greater collective bargaining coverage is negatively related to the gender pay gap which stands to reason because collective bargaining tends to set high wage floors, thereby equalizing earnings. But collective bargaining is just one institutional feature which can affect the gender wage gap. Polachek and Xiang (2009) also look at labor market institutions related to female lifetime work that affect the gender wage gap across countries. In particular, they confirm that collective bargaining and MWs are negatively associated with the gender pay gap.

2.2 The Minimum Wage in Ireland and the UK

We study the almost simultaneous implementation of MW policies in two neighbouring countries with a common past history and a highly centralized system of collective wage bargaining that could facilitate the introduction of equal pay. Nonetheless, at the turn of the 2000s when MWs were introduced, Ireland and the UK present very different wage distributions – a fact that is exploited in our analysis.

On one side, Ireland is a country with a strong history of gender inequality on the labour market due to a combination of cultural and religious ideals, a traditionally unequal gender division of labour and a relatively weak economy until the Celtic Tiger years in the 1990's. Despite the rapid catching up of female labour market participation in the 1990s, the Irish gender wage gap remained substantial in the face of extensive equality legislation, such as the Anti-Discrimination (Pay) Act 1974 and the Employment Equality Act 1998. Despite a narrowing of the gap in the 1990s, it remained one of the highest in Europe at the time the MW was introduced (see Arulampalam et al., 2007). By contrast, attention was given relatively early to the issue of equal pay in the UK as, during WWI, women took up typically male jobs and began to strike when they realised that they were being paid less for equal work. The issue came to the fore once again during WWII, culminating the Equal Pay Act of 1970, which legislated for equal pay and conditions for men and women. However, the modification of job titles often allowed employers to continue discriminatory practices and, over four decades later, there still exists an unexplained gender wage gap in the UK.

The British industry-based Wages Council system that regulated pay in many sectors was abol-

ished in 1993 by John Major's government, who argued that the wages councils reduced employment, although there was little evidence that the system had cost jobs (Machin and Manning, 1994). Following its election in 1997, Tony Blair's Labour Government introduced a MW of £3.60 per hour in April 1999 for those aged 22 or older, with a lower youth rate of £3 per hour for those aged 18–21 inclusive (those aged less than 18 were not covered). The initial rate was purposely set at a modest rate, as it was deemed best to start low rather than setting it too high and provoking adverse employment effects. One of the stated aims of this legislation was actually to tackle the gender pay gap. About 6 percent of workers' wages were raised up to the minimum (Dickens and Manning, 2003). Metcalf (1999) notes the increased importance of the MW for part-time female workers (around 55% of the workers directly affected by the introduction of the MW). According to Metcalf (2008), who surveys the literature relating to the employment effect of the British MW, there is little or no evidence of any employment effect. Dolton et al (2010) corroborate this in a study of employment and inequality in the UK over the decade since its introduction. They find that the average employment effect over the entire period is neutral, although there are small but significant positive MW effects from 2003 onwards.

In 1999, a Commission was set up to oversee the introduction of a MW in Ireland. This Minimum Wage Commission recommended that the initial rate be set at around two thirds of median earnings, representing around IE£4.40 per hour (O'Neill et al, 2006). Prior to this, MWs in Ireland were set by Joint Labour Committees. However the wages specified in these agreements were often low and covered less than a quarter of the workforce. Furthermore the level of enforcement was weak. Official figures suggest that the MW directly benefited approximately 163,000 workers, or 13.5 percent of the total workforce. Figures from the Economic and Social Research Institute (ESRI) indicate that 17 percent of female workers and 11 percent of male workers earned less than the IE£4.40 rate at the time of its introduction. There is little evidence in the literature either relating to the effectiveness of the Irish MW in tackling the gender wage gap or to any employment effects it may have had. McGuinness et al (2008), using an employer-employee matched dataset find that the Irish MW improved the relative position of part-time females only. They discover that the wage penalty for being employed in a company with a large proportion of MW earners was less for part-time women than for part-time men, while there was no difference for full-time workers. O'Neill et al (2006) find that the MW may have had a statistically significantly negative effect on employment for the small number of firms most severely affected by the new legislation i.e. with a high proportion of expenses devoted to low wage workers but the size of these effects is modest.

Table 1 shows the level and "bite"of the MW in each country where the "bite"is a measure of the MW compared to the average wage. The bite of the Irish MW was around 10% higher than that of the British MW. Table 2 shows the employment rate and proportion of workers earning

less that the MW in each country in the year before $(t-1)$ and after $(t+1)$ its introduction. Employment rates for men are similar in the two countries $(80-85\%$ over the time period examined) although employment rates for women are much lower (though rising) in Ireland than in Britain. There were more people earning less than the MW in Ireland (12%) than in Britain (9%) in $t-1$ and the vast majority of these are women in both countries. This is in line with the official statistics, giving us confidence in the chosen datasets. However, although there was a large drop in the number of women earning less than the MW in $t+1$ in Ireland, the corresponding proportional drop was much lower in Britain. In theory, there should be no one earning below the MW after its introduction, except for those still classed as apprentices of some sort. However, as the wages in the data used are self-reported, measurement error, the black market and ineffective enforcement may also account for some of the observations. We discuss this in more detail in Section 6.

Table 1: The "Bite" of the MW in the UK and Ireland

	Ireland 2000	UK 1999
	stg£	stg£
National Minimum Wage	3.40	3.60
Median wage in (t-1)	5.95	6.99
Mean wage in (t-1)	7.05	8.55
Bite of the NMW		
NMW / median wage (t-1)	0.57	0.52
NMW / mean wage (t-1)	0.48	0.42

Figures from own calculations using the population of 22-65 year olds from the Living in Ireland Survey and British Household Panel Survey.

Monetary values are expressed in pounds sterling for the year in question.

2.3 Other Policies

In any policy analysis such as this, it is important to ensure that the effect picked up is due to the policy in question and not due to other policies implemented at the same time. The period 1997 - 2000 was one of large growth, declining unemployment and generous budgets in Ireland. For example, between 1998 and 2000, successive budgets increased the level of the Family Income Supplement,[3] the Lone Parent Allowance and Child Benefit, decreased the income tax rate of both the higher and lower tax brackets and increased tax free allowances for all household types. In the UK, the "New Deals" for lone parents, young people and over-25s were introduced in 1998

[3]The Family Income Supplement is a tax credit for families at work on low pay.

Table 2: Employment rate and Proportion of Workers Earning less than the MW

	Ireland		UK	
	t-1	t+1	t-1	t+1
Employment rate	66%	70%	76%	76%
Male	81%	83%	84%	85%
Female	52%	57%	69%	68%
Workers below NMW	12%	6%	9%	5%
Male	7%	4%	3%	2%
Female	18%	8%	13%	8%
Full-time	10%	5%	6%	4%
Part-time	26%	14%	25%	15%

Figures from own calculations using the population of 22-65 year olds from the Living in Ireland Survey and British Household Panel Survey.

Time period t is 1999 in the U.K. and 2000 in Ireland

[4] and the Working Families Tax Credit was introduced to replace the Family Credit in October 1999. These policies could affect our results via two channels. If, singly or together, they induce a change in labour supply, this will probably be reflected in the change in the gender wage gap between the pre-and post-MW period. For example, the WFTC reform in 1999 incited adults in previously workless families to move into work and adults in previously two-worker families to move out of work (Brewer and Browne, 2006). We will therefore distinguish between pure price effects and employment or "composition" effects in our analysis. The other channel through which other policies could affect our results is if they affect gross income directly. As most of the policy changes described affect net income, and not gross income, they should not have any effect on our estimation of the effect of the MW on the gender wage gap. One exception may be the introduction of the WFTC in the UK which has been accused of inciting firms to lower wages for low-earners who receive this top-up. For this reason, our estimates of the effect of the MW on the gender wage gap in the UK can be interpreted as a lower bound, as the effect of the WFTC on wages may have worked in the opposite direction.

[4]The "New Deals" were set up to help vulnerable groups to find jobs or to increase their hours of work

3 Empirical Approach

3.1 Distribution Regression

Chernozhukov et al. (2013), inspired by Foresi and Peracchi's (1995) use of counterfactual distributions to model excess returns on financial markets, recently formalized procedures for inferring how policy interventions affect the entire marginal distribution of an outcome of interest. It is this distribution regression (DR) technique that we make use of in this paper. In practical terms, this involves running a series of probit models at each point of the wage distribution (that is, to estimate $F(w)$ for $w \in [w_{min}, w^{max}]$), separately for men and women and for each time period (*before* and *after*). The dependent variable is binary and takes the value of 1 if an individual in our sample has an hourly wage below w, and 0 otherwise, where w takes the value of each point of the wage distribution sequentially. These models are used to predict the probability that an individual has a wage below w in the distribution, as well as predicting what this probability would be if the individual was compensated as if they belonged to a different gender group or time period. We employ an Oaxaca-Blinder style decomposition of the marginal wage distributions of men and women before and after the introduction of the MW to identify what the wage gaps in each time period are, and if they have changed in the *after* period, all else held constant.

More formally, we are interested in the change in the distribution of wages for men and women observed before and after the introduction of the MW, given explanatory variables such as age, education, occupational type etc, holding the marginal distribution of these covariates constant. Marginal wage distributions are directly derived by integration of the conditional distributions over job and human capital characteristics:

$$F_{l,n}^{k,m}(w) = \int_{\Omega_h} \int_{\Omega j} F^{k,m}(w|x,c)\, h_{l,n}(x,c)\, dcdx \tag{1}$$

where $F^{k,m}(\cdot|x,c)$ is the conditional wage distribution function given human capital characteristics x and job characteristics c in gender group k at period m, and $h_{l,n}$ is the density distribution of human capital and job characteristics in gender group l at period n. So, $F_{l,n}^{k,m}(w)$ can either be an observed or a counterfactual marginal wage distribution where the superscript refers to the conditional wage distribution and the subscript refers to the covariate distribution. The conditional wage distribution can be that of women ($k = f$) or men ($k = m$) before ($m = b$) or after ($m = a$) the introduction of the MW and the covariate distribution can also relate to women ($l = f$) or men ($l = m$) before ($n = b$) or after ($n = a$) the introduction of the MW. Taking the example of $F_{f,b}^{f,b}(w)$, which is the marginal wage distribution of *female before* workers, with *female before* characteristics, sample estimates are obtained by replacing $F^{f,b}(\cdot|x,c)$ by estimates $\hat{F}^{f,b}(\cdot|x,c)$ derived from the predictions of a probit model (at w) estimated on the *female*

before sample and by averaging the predictions over our sample of N female workers before the introduction of the MW:[5]

$$\hat{F}^{f,b}_{f,b}(w) = \frac{1}{N_{f,b}} \sum_{i=1}^{N_{f,b}} \hat{F}^{f,b}(w|x_i, c_i) \tag{2}$$

The separation of conditional wage distributions and the distribution of characteristics offers a straightforward way to create counterfactual marginal wage distributions. For example,

$$\hat{F}^{m,b}_{f,b}(w) = \frac{1}{N_{f,b}} \sum_{i=1}^{N_{f,b}} \hat{F}^{m,b}(w|x_i, c_i) \tag{3}$$

is a counterfactual distribution that represents the distribution that would be observed among female workers before the introduction of the MW if the conditional wage distributions among male workers had prevailed over the female distributions.[6] Predictions are now based on a probit model estimated over the *male before* sample but averaged over the *female before* sample. The gender gap in pay before the introduction of the MW is then given by the difference between the counterfactual distribution and the observed distribution:

$$\begin{aligned} \hat{DF}^{b}(w) &= \hat{F}^{f,b}_{f,b}(w) - \hat{F}^{m,b}_{f,b}(w) \\ &= \frac{1}{N_{f,b}} \sum_{i=1}^{N_{f,b}} \left(\hat{F}^{f,b}(w|x_i, c_i) - \hat{F}^{m,b}(w|x_i, c_i) \right). \end{aligned} \tag{4}$$

The gender gap in pay after introduction of the MW can be written analogously

$$\begin{aligned} \hat{DF}^{a}(w) &= \hat{F}^{f,a}_{f,a}(w) - \hat{F}^{m,a}_{f,a}(w) \\ &= \frac{1}{N_{f,a}} \sum_{i=1}^{N_{f,a}} \left(\hat{F}^{f,a}(w|x_i, c_i) - \hat{F}^{m,a}(w|x_i, c_i) \right). \end{aligned} \tag{5}$$

The total impact of the MW is then given by

$$\hat{DDF}(w) = \hat{DF}^{b}(w) - \hat{DF}^{a}(w). \tag{6}$$

[5] Individual sampling weights are omitted from this expression for notational clarity, but they are used at all estimation stages.

[6] Observe that, in line with the whole literature on gender wage differentials, we use the counterfactual distribution as a device to quantify the magnitude of the wage differences between men and women. Causal inference based on a claim that the counterfactual distribution truly represents the distribution that would be observed if women were paid like men would require (implausible) assumptions about the absence of general equilibrium or feedback effects of the change in the conditional wage distributions onto the distribution of covariates (human capital and job characteristics).

One issue with this approach is that the MW (or other policies such as those described in Section 2.2) may have had side-effects on female employment on top of effects on wages, for example, with changes in work hours or occupations. To sort this out, we further factorize $D\hat{D}F(w)$ into a pure 'price' effect that reflects the MW impact on the relative compensation of men and women, and a 'composition' effect, through its influence on the characteristics and employment structure of women. To do so, we construct additional counterfactual marginal distributions that would be observed if the 'prices' after introduction of the MW were applied to the sample of women with job and human capital characteristics before the MW:

$$\hat{F}^{m,a}_{f,b}(w) = \frac{1}{N_{f,b}} \sum_{i=1}^{N_{f,b}} \hat{F}^{m,a}(w|x_i, c_i) \tag{7}$$
$$\hat{F}^{f,a}_{f,b}(w) = \frac{1}{N_{f,b}} \sum_{i=1}^{N_{f,b}} \hat{F}^{f,a}(w|x_i, c_i).$$

We then decompose the total change as:

$$\begin{aligned} D\hat{D}F(w) &= P\hat{D}F(w) + E\hat{D}F(w) \\ &= \underbrace{\left[\left(\hat{F}^{f,b}_{f,b}(w) - \hat{F}^{m,b}_{f,b}(w)\right) - \left(\hat{F}^{f,a}_{f,b}(w) - \hat{F}^{m,a}_{f,b}(w)\right)\right]}_{P\hat{D}F(w)} \\ &+ \underbrace{\left[\left(\hat{F}^{f,a}_{f,b}(w) - \hat{F}^{m,a}_{f,b}(w)\right) - \left(\hat{F}^{f,a}_{f,a}(w) - \hat{F}^{m,a}_{f,a}(w)\right)\right]}_{E\hat{D}F(w)} \end{aligned} \tag{8}$$

where the first term captures the price effect (the change in returns or unexplained factors), $P\hat{D}F(w)$, and the second term captures the composition effect (the change in characteristics or explained factors), $E\hat{D}F(w)$, of the MW.

3.2 Data

We use the Living in Ireland survey (LII) data and the British Household Panel Survey (BHPS) in our main analysis. The fact that the same set of households is interviewed each year means that it is possible to study changes in the characteristics and circumstances of particular households or individuals over time.

The original sample size for the two years of interest is $12,604$ in Ireland and $20,274$ in the UK. Most of the UK sample comes from England although there are smaller numbers of Scottish, Welsh and Northern Irish households also represented. We restrict our main sample to people observed in 1999 and 2001 in Ireland and 1998 and 2000 in the UK. We further restrict our

sample to those aged between 22 and 64 years of age, as under 22 year olds are not eligible for the MW in the UK. We also drop those still in education.[7] Of these, we observe 4,563 workers in Ireland and 7,732 workers in Britain for the two years in question. This constitutes our baseline sample, *Sample 1.* Appendix Table A.1 shows how these observations are split between men and women and the pre- and post-MW periods. Hourly wages are constructed from the current gross weekly wage and usual hours per week in LII and gross monthly pay (including overtime), standard weekly hours and paid overtime hours per week in BHPS. We normalise hourly wages to their level during the year of the introduction of the MW (so Irish wages are normalized to 2000 prices while British wages are normalized to 1999 prices), using Consumer Price Indices. The main changes observed in the sample composition between the pre- and post-MW periods are an increased hourly wage and an increase in the average age of the population.

An issue specific to the Irish data is the "refreshment" sample of 1,515 households that were added to the survey in 2000 to redress attrition over the life of the survey. To tackle this issue, we present results both with and without this refreshment sample for Ireland. Descriptive statistics relating to the Irish data without the refreshment sample, *Sample 1a*, are also provided in Table A.1. We additionally define a further sample which will be used for robustness checks in Section 5. *Sample 2* consists of all those who are observed both before and after the introduction of the MW and who work at least part-time ($\geq$ 15 hours per week) in both periods. Summary statistics relating to this sample are provided in Appendix Table A.2.

4 Results

4.1 Distribution Regression Results

To start with, we plot the predicted distribution of wages for men and women in each time period against the actual distribution and find an excellent fit for our model (see Figures A.1 and A.2 in the appendix). Table A.4 in the Appendix shows the coefficients on the explanatory variables at four points in the wage distribution: the MW and the $25th$, $50th$ and $75th$ percentiles. For example, the negative coefficient on age at the $25th$ percentile of the *female before* group in Ireland indicates that, as age increases, women are less likely to be located in the lower quartile of the distribution in the year before the MW. Following Arulampalam et al (2007), we omit occupation and industry dummies as they may be endogenous if individuals choose them based

[7] Excluding students drops 8% of the Irish and 11% of the UK sample. The age restriction causes us to lose a further 25% of the Irish and 22% of the UK sample. When we drop the Scottish and Welsh refreshment samples in the British data as well as observations that were answered by proxy, we are down to 62% of the original Irish sample (7,861 observations) and 58% of the original British sample (11,782 observations).

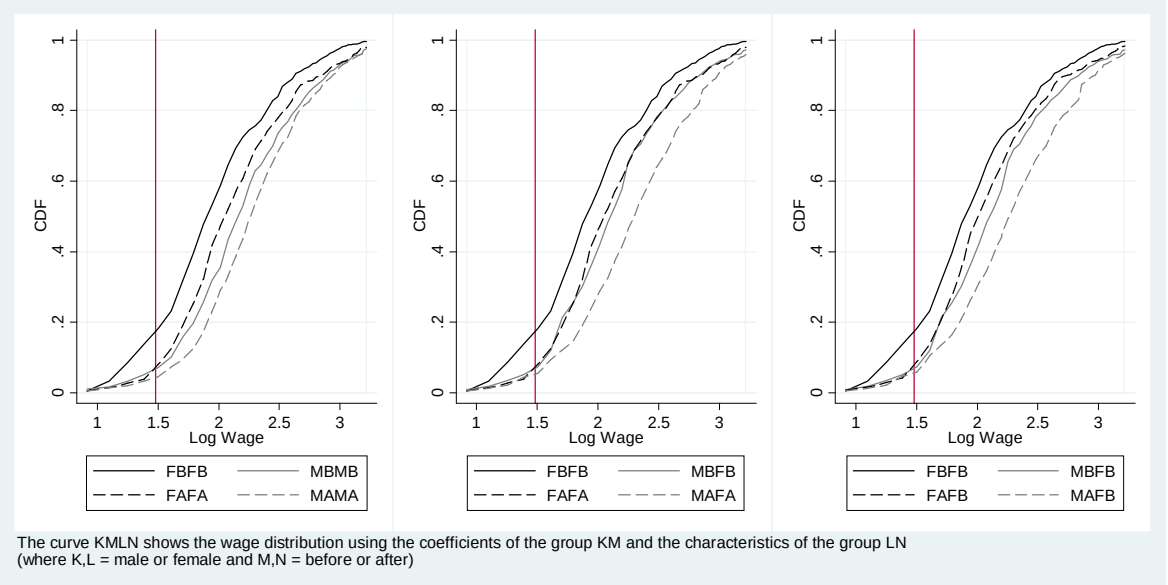
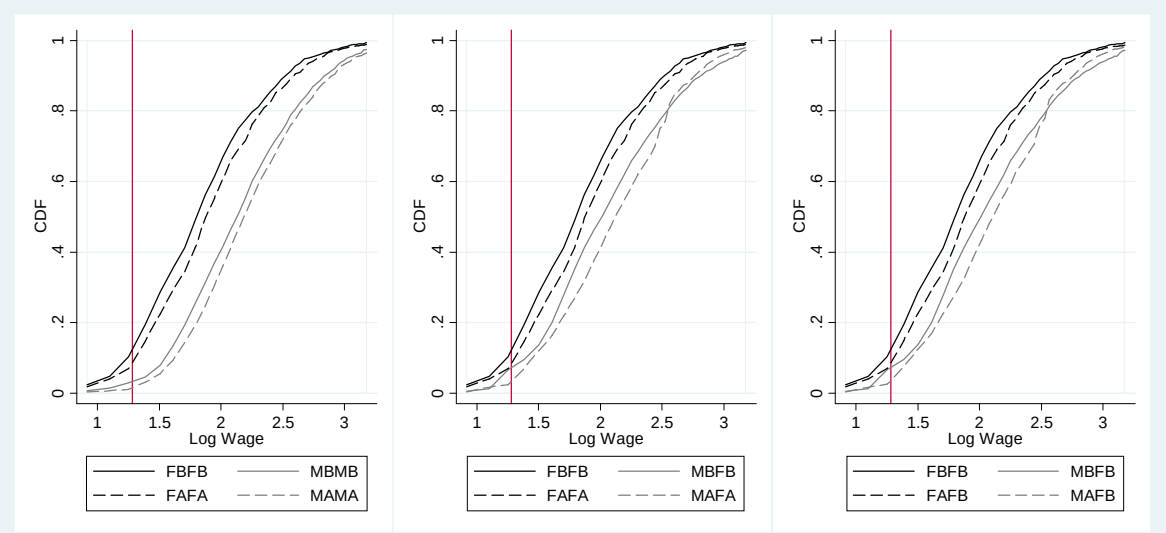


Figure 2: Predicted and Counterfactual Wage CDF's Before and After the MW (Ireland)

on earning prospects. We introduce these variables to the model in a robustness check in Section 5.

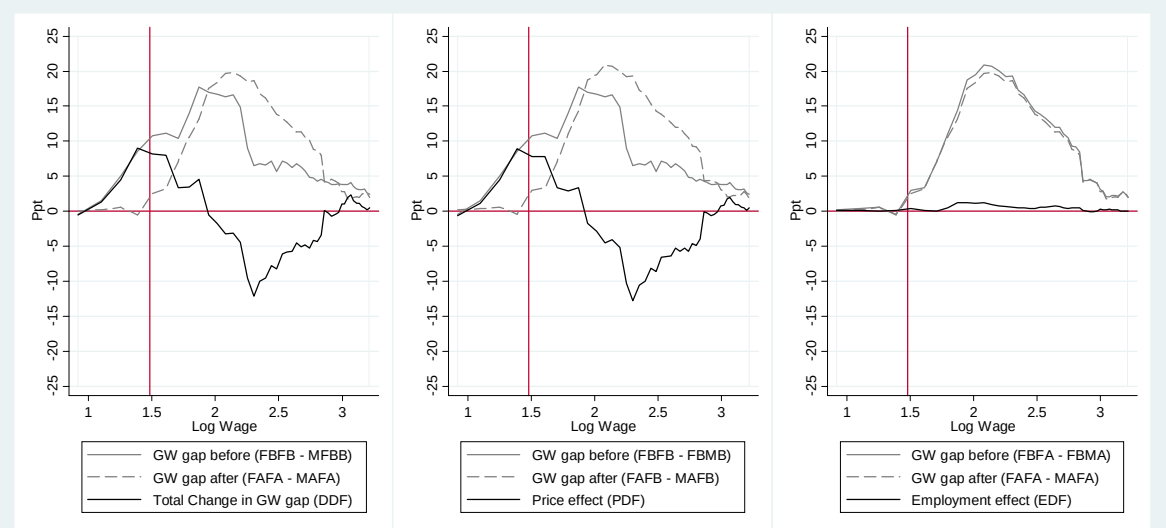
We depict our results using predicted and counterfactual cumulative distribution functions of wages for men and women in both countries. We show, in Figures 2 and 3, three distributions for each country and year. The distribution curve $KMLN = F_{l,n}^{k,m}(w)$ shows the wage distribution using the coefficients of the group k, m and the characteristics of the group l, n (where $k, l =$ male or female and $m, n =$ before or after). We show actual predicted distributions in the left panel ($FBFB, FAFA, MBMB$ and $MAMA$), counterfactual distributions where covariates are set to "*female*" characteristics ($XXFX$) in the middle panel, and counterfactual distributions where covariates are fixed to "*female before*" characteristics ($XXFB$) in the right panel.

In each of Figures 2 and 3, the CDF for female wages lies above that for male wages. Additionally, the CDF's for men and women *before* lie above those for men and women *after*. This is more pronounced at the bottom of the wage distribution, where the MW is at work. The counterfactual wage distributions, $MBFB$ and $MAFA$, which show the distribution of wages if females we paid as males, are lower than the predicted distributions for females, $FBFB$ and $FAFA$, while the counterfactual distribution, $MAFB$, which shows the distribution of female wages *before* if they were paid as males *after*, is also lower than $FAFB$, which shows the distribution of female wages *before* if they were paid as females *after*. These findings are all consistent with our expectation that men are paid better than women and that wages are higher after the introduction of a MW.



The curve KMLN shows the wage distribution using the coefficients of the group KM and the characteristics of the group LN
(where K,L = male or female and M,N = before or after)

Figure 3: Predicted and Counterfactual Wage CDF's Before and After the MW (UK)



The gender gaps depict the female - male difference in being paid below a certain log wage.
The change in the gender gap shows the before - after difference in these gaps

Figure 4: Gender Wage Gap Decomposition and its Change over Time (Ireland)

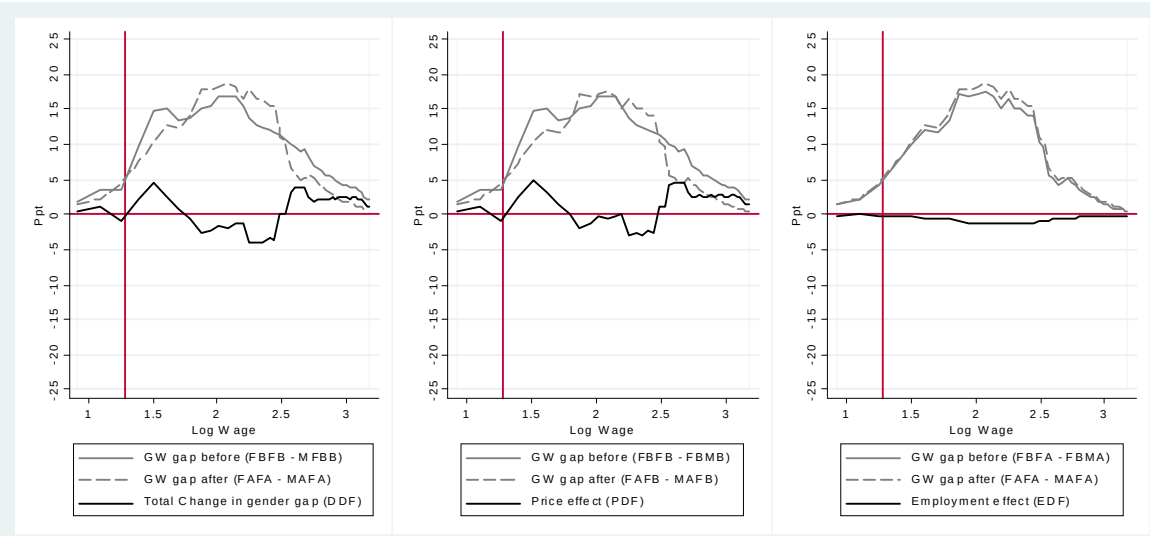


Figure 5: Gender Wage Gap Decomposition and its Change over Time (UK)

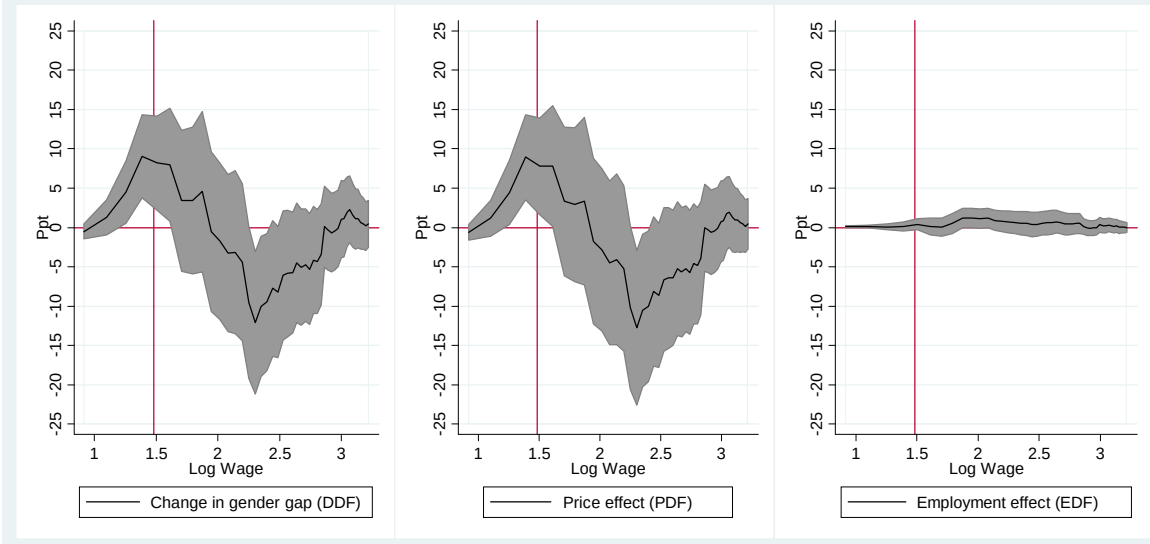


Figure 6: Change in the Gender Wage Gap over Time (Ireland)

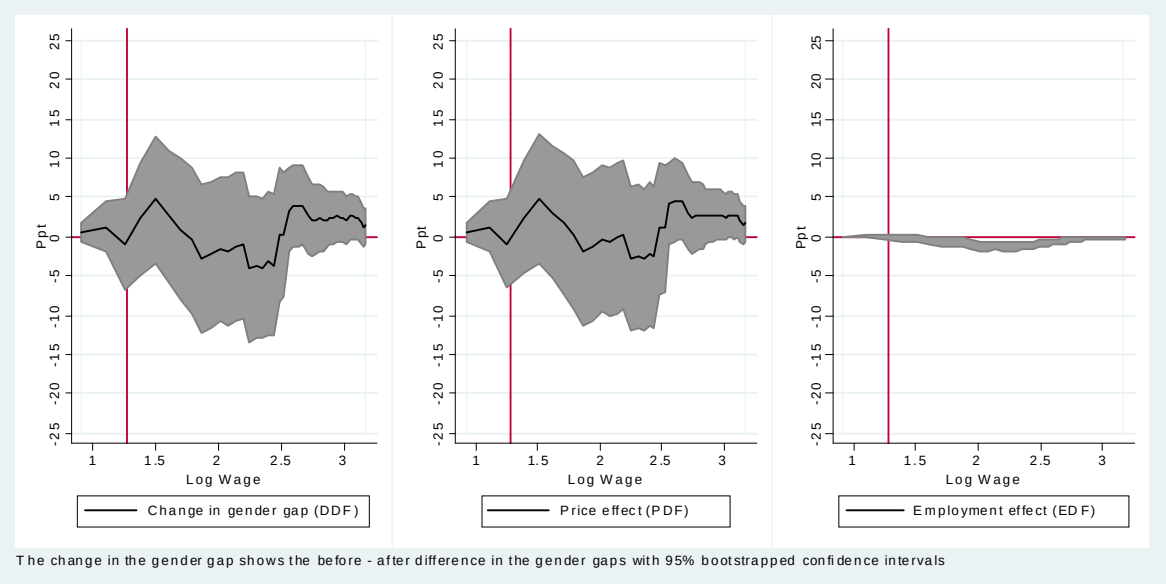


Figure 7: Change in the Gender Wage Gap over Time (UK)

We use the simple measures, described in equation (6) to depict the effect of the MW on the gender wage gap in a more intuitive fashion. Figures 4 and 5 show the counterfactual gender wage gaps before and after the introduction of the MW, and the difference between them. It is clear that the gap varies throughout the distribution and by country. Importantly, we note that the gender wage gap in the UK is about half the magnitude of that in Ireland at each country's MW level, and is higher further up in the wage distribution. This is in line with the findings of Arulampalam et al (2007) who estimate that the Irish gender wage gap is $40-80\%$ higher than the British one in the lower quarter of the wage distribution but is lower at the top of the wage distribution.

Figures 6 and 7 show the *DDF*, the *PDF* and the *EDF* with 95% bootstrapped confidence intervals. To recap on these differences in wage gaps, the *DDF* shows the effect of the MW on the counterfactual wage distributions of men and women. This is decomposed into a price (*PDF*) and composition effect (*EDF*). They are interpreted as follows: A value of 1 indicates that there is a 1 ppt reduction in the difference between a woman's probability of being paid below w and a man's probability of being paid below w i.e. a reduction in the gender wage gap.

In Ireland, there is up to a 10 percentage point (ppt) reduction in the difference between a women's probability of being paid below around £5.20 compared to a man's probability of being paid below £5.20. This is mainly due to the price effect of the MW, as seen in the *PDF* graph, but there is also a small positive composition effect. As 15% of the Irish population still earn less than £5.20 in 2001, this reduction in the gender wage gap in this portion of the distribution

is both statistically and economically significant. Additionally, as the MW was set at £4.40, we note a small spillover as its effect on the gender wage gap (although decreasing) can be seen up to approximately £6 per hour. A similar effect was found in the Ukraine with the MW postively affecting the wages of women above the MW but not those of men (Ganguli & Terrell, 2009). We also observe a negative spillover effect in the form of an increase in the gender wage gap further up in the wage distribution. Between the median and 75th percentile of hourly wages, there is an increase in the gender wage gap which almost exactly mirrors the decrease in the lower half of the wage distribution, reaching -11 ppt at its largest point. This effect becomes smaller or disappears in a number of sensitivity checks (as we will show in Section 5) We therefore conclude that there may be a small negative spillover effect of the MW on the gender wage gap in the middle of the wage distribution but that this effect may also be due to a pre-existing trend. We will elaborate on this in more detail in Section 5.

Meanwhile, in the UK, the effect of the MW seems ambiguous across the wage distribution. There is a decrease of around 5 ppt in the gender wage gap around the MW but the effect is not statistically significant. This overall effect is mainly composed of a price effect which is also not statistically significant. However, there does appear to be a small negative composition effect in the upper half of the wage distribution.

4.2 Mean Effects

It is possible to assess how DR results compare with a standard Oaxaca-Blinder decomposition at the mean. Using the DR framework, we can summarize the effects identified at specific levels of w on mean wages, as is more traditionally looked at. Mean wages and counterfactual mean wages are recovered easily from marginal distributions and everything follows from there, for example:

$$\mu_{f,b}^{f,b} = \mu(F_{f,b}^{f,b}) = \int_0^\infty w dF_{f,b}^{f,b} \tag{9}$$

This can be estimated from the marginal distribution estimates by numerical integration

$$\hat{\mu}_{f,b}^{f,b} = \sum_{g=1}^{K} \frac{1}{2}(\omega^g + \omega^{g-1})(\hat{F}_{f,b}^{f,b}(\omega^g) - \hat{F}_{f,b}^{f,b}(\omega^{g-1})) \tag{10}$$

where $\{\omega^1, \ldots, \omega^K\}$ is a grid of points on the domain of definition of wages at which we evaluate the marginal distributions[8], and $\omega^0 = 0$ (where $\hat{F}_{f,b}^{f,b}(\omega^0) = 0$). Results, in Table A.3, show that the overall gender wage gaps at the mean, as well as the explained and unexplained components

[8] To ease computation, we start the grid at approximately 2.5 in national currency in each country and stop it at 25. This encompasses over 95% of the wage distribution in each country.

are roughly the same whether we use DR or the standard Oaxaca-Blinder decomposition at the mean. The mean unexplained gender wage gap increases from $14-16\%$ in Ireland and decreases from $19-16\%$ in the UK between the pre- and post-MW periods.

We can also invert the estimated distribution function to obtain counterfactual quantiles. Consider $Q^{k,m}_{l,n,\tau}$ the τth quantile of the counterfactual distribution $F^{k,m}_{l,n}$. The estimated counterfactual quantile is:

$$Q^{k,m}_{l,n,\tau} = \{\widehat{F}^{k,m}_{l,n}(\tau)\}^{-1} \tag{11}$$

We can therefore look at the gender wage gaps at a number of other points in the distribution ($p10, p25, p50$, $p75$ and $p90$) for comparison with the mean (see Table A.3). Although the mean unexplained gap in Ireland increases slightly over the period, this mean effect is composed of a significant decrease at $p10$ and a smaller increase at $p75$ of the wage distribution. The decrease in the mean unexplained gap in the U.K is largely due to a decrease in the glass ceiling at $p90$ of the wage distribution. These results highlight the importance of analyzing the entire distribution of wages in a study such as this.

5 Robustness Checks and Additional Results

To complement these results and to ensure that they are not the result of different before/after samples, pre-existing trends in the GW gap or the model specification, we conducted a number of robustness checks.

5.1 Alternative Sample Definitions

We first used a number of different sample definitions. First of all, to deal with the issue of the refreshment sample detailed in section 3.2, we restrict the Irish data to those who are not part of this boost sample (*Sample 1a* - see Table A.1). The results, in Figure A.3 in the Appendix, show that the magnitude of the price and composition effects are almost unchanged.

We then define one, more restrictive, subsample for each country which discards some of the sample heterogeneity. *Sample 2* restricts the analysis to those observed both before and after the introduction of the MW and who work at least 15 hours per week in both periods. This allows to capture only the effect of the MW on those who were at work before its introduction. Summary statistics relating to this sample are provided in Table A.2 in the Appendix. The change in the gender wage gap due to the MW, using this sample is detailed in Figures A.4 and A.7 in the Appendix. For the Irish case, we find that the balanced panel (*Sample 2*) gives larger reductions in the gender wage gap in the bottom half of the distribution while registering no increase further up in the distribution. The small positive spillover effect just above the

MW persists while the negative spillover effect further up in the distribution is smaller and not statistically significant. The zero price effect and the negative composition effect observed in the UK are robust to the restrictive subsample.

5.2 De-trending the Effect

In order to ensure that the results presented to now are not the result of pre-existing trends in the gender wage gap, we present here a set of results which detrends the change in the gender wage gap between the pre- and post-MW period, using the change in the gender wage gap between one year prior to the pre-MW period and the pre-MW period. So, taking the U.K as an example, we subtract the change in the gender wage gap between 1997 and 1998 from the change in the gender wage gap between 1998 and 2000, depicted in Figure 7, to identify the *de-trended* change in the gender wage gap due to the introduction of the MW. As Figure 7 essentially shows a difference-in-difference, with the difference between male and female wages in 2000 subtracted from the differences between male and female wages in 1998, this detrended effect can be thought of as a triple difference with the *change* in the gender wage gap between 1997 and 1998 subtracted from the *change* in the gender wage gap between 1998 and 2000.[9]

Results are shown in Figures A.5 and A.8 in the Appendix. We find that the decrease in the *de-trended* gender wage gap at the bottom of the wage distribution in Ireland is similar to the baseline effect observed in Figure 6 and that the negative spillover effect observed further up in the distribution is no longer present. The confidence intervals for this measure are, however, much larger. In the UK, we again observe a statistically insignificant and ambiguous effect of the MW on the gender wage gap across the wage distribution.

5.3 Adding Occupation and Industry Dummies

In our baseline model, we follow Arulampalam et al (2007) in omitting occupation and industry dummies as they may be endogenous if individuals choose them based on earning prospects. Here, we present results which incorporate these variables into the model as a robustness check. We introduce a dummy variable for working in a manual job, for working in the public sector and for working in the tertiary (services) industry compared to the primary/secondary industries (see

[9] For Ireland, we subtract the change in the gender wage gap between 1998 and 1999 from the change in the gender wage gap between 1999 and 2001. To identify the effect of the MW on the gender wage gap, we look at a two year period, *t-1* to *t+1* with the MW coming into effect in period *t*. As such, it might make more sense to detrend the effect based on the two year period prior to *t-1*. Unfortunately, the 1997 Irish data does not have labor income (just overall income) so it is incomparable to the other years making this impossible, for Ireland at least. We perform this two-year detrending exercise for the UK and results are similar to those depicted here, based on a one-year detrending exercise.

Table A.1 for summary statistics relating to these variables).[10] The results from this broader model of wages are presented in Figures A.6 and A.9 in the Appendix. The Irish results indicate that controlling for industry and occupation type leads to a similar correction of the gender wage gap at the bottom of the distribution which peaks at 13 ppt. The increase in the gender wage gap observed further up in the wage distribution in Figure 6 becomes smaller and is not statistically significant when we control for industry and occupation type. The UK results are similarly ambiguous across the wage distribution, regardless of whether industry or occupational characteristics are accounted for.

6 Country Comparisons

In line with the main results for the UK (Robinson, 2002 and Robinson 2005), but using a different data source and method, we found no significant effect of the British MW on the gender wage gap. We do find a potential composition effect of $1-2$ ppt in the UK but, as it is located in the middle of the wage distribution, it is unlikely to be caused by the introduction of the MW. It it likely to be a result of a combination of policies that were introduced in this period, such as the WFTC, which affected the employment of women more than men. We find that the introduction of a MW of IE£4.40 in neighbouring Ireland led to a reduction in the gender wage gap of $5-15$ ppt in the lower half of the wage distribution, where the gap is defined as the difference between a man and a woman's probability of earning below a certain wage, w. Given that this probability gap reaches a peak of 15 ppt in this region of the wage distribution, the MW was responsible for up to a 100% reduction in this measure of wage gaps, in the bottom half of the distribution. Given this large effect of the MW on the Irish gender pay gap, why then do we find no effect in the UK?

While the Irish MW had a large impact on the wage distribution in its vicinity, particularly the female wage distribution, the year after the introduction of the British MW still saw a large proportion of people, mainly women, earning below the legal limit (see Figure 8). So while $FAFA$ has shifted downwards around the MW level in the UK, it has not done so to the extent that it has in Ireland, nor indeed to the extent that we might reasonably expect, given the new wage legislation. Robinson (2002) found a similar phenomenon using Labour Force Survey data so we conclude that this is not due to specific problems with the dataset that we use, but a result of general measurement error, black market work and lax enforcement.[11] Additionally, figures from the Office for National Statistics indicate that, even in 2013, 10% of women on

[10] Model coefficients are available from authors on request.

[11] Robinson (2002) finds that 13.3% of women are earning less than the NMW before its introduction and 6.6% are earning less than it afterwards. The corresponding figures for men are 3.9% and 1.8% respectively.

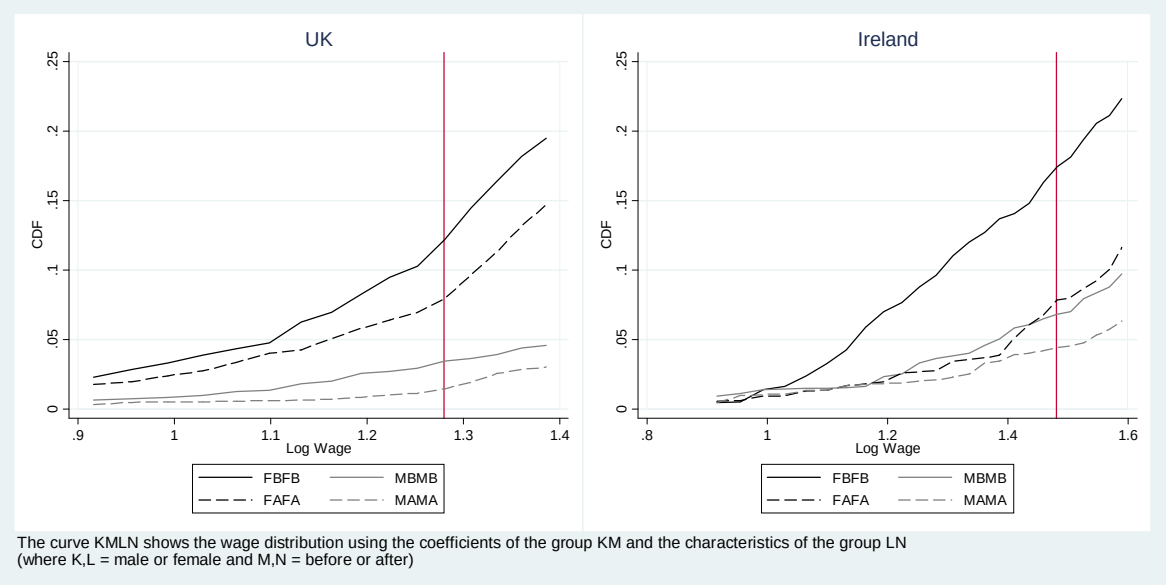


Figure 8: Predicted Wage CDF's in the UK and Ireland before and after MW

adult rates earned less than stg£6.40 per hour. Looking at part-time females alone, 10% of these earned less stg£6.19 per hour. As the 2013 MW was stg£6.31 per hour, many women were still earning less than the MW in 2013. Data from the Office for National Statistics shows than jobs held by women are more likely to be paid at less than the MW while official figures relating to enforcement in the UK indicates 17,000 workers were identified as being paid less than the MW in 2012. By contrast, there was and is still no obvious compliance problem with the Irish MW (O'Neill et al, 2006).

We check how the British MW would have affected the gender wage gap if it had been as *effective* as the Irish MW at increasing the lowest wages, i.e. if, even with the existing UK MW, the proportion of people earning less than this amount was similar to the proportion of Irish people earning less than the Irish MW after its introduction. We perform an extrapolation exercise similar to Chernozhukov et al. (2013) in constructing the new counterfactual distributions of wages after the hypothetical implementation of this *effective* MW in the UK in 1999. In short, we take the proportion by which the conditional distribution of wages in Ireland is reduced at the Irish MW after its introduction, and then reduce the conditional distribution of British wages before the introduction of the MW by that same factor, up to the British MW level. We do this separately for men and women and construct the same summary measures for the estimation of the change in the gender wage gap as before. Denote m^{uk} and m^{ie} the British and Irish MW's. We disregard the sub- and superscripts elaborated in eq (1) in order to generalize, except for $n = b, a$ which indicates which sample (before or after) is in question. The new counterfactual

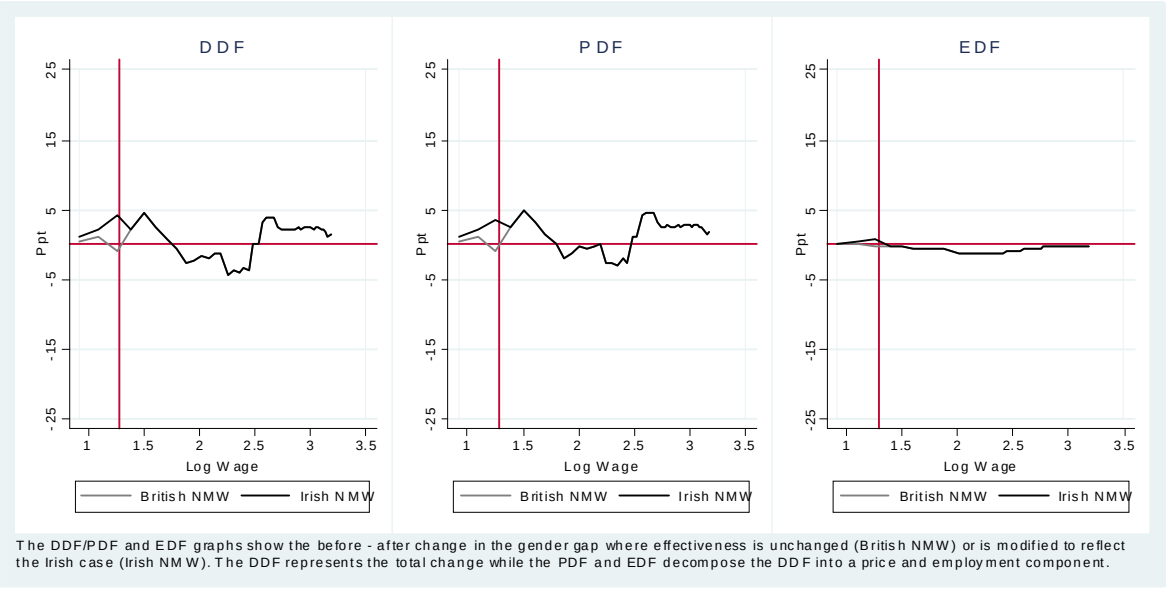


Figure 9: Effect of British and Irish MW's on Wage Distributions in the UK

marginal wage distributions are constructed as follows for men and women seperately:

$$F_a^{uk*}(w) = F_a^{uk}(w) \text{ if } w \geq m^{uk} \tag{12}$$

$$F_a^{uk*}(w) = F_b^{uk}(w).\frac{P_a^{ie}(w < m^{ie})}{F_b^{ie}(m^{ie})} \text{ if } w \leq m^{uk} \tag{13}$$

Figure 9 shows that increasing the effectiveness of the British MW to the Irish level could result in a narrowing of the gender wage gap of up to 6 ppt, below the level of the MW. At the mean, this increased effectiveness would decrease the unexplained gender wage gap after the introduction of the MW from the 16% observed in Table A.3 to 15%.[12]

To put this into the context of the literature, the two main studies relating to the UK find ambiguous effects of the MW on the gender pay gap. Firstly, Robinson (2002) finds no evidence that the British MW narrowed the gender wage gap at the bottom of the distribution, concluding that the eradication of gender wage inequality in the country will need to come from reducing the occupation and skills gap. In a separate study in 2005, Robinson finds that the overall gender pay gap narrowed by around $1-2$ ppt in regions where the bite of the MW was large and/or where women comprise a relatively large share of the low paid. However, at the bottom

[12]Results available from author on request

of the distribution, she reports that the MW worked in favour of men who, on average, were paid much further below the minimum than women. In comparing the experience of the UK to that of Ireland, we can now add to this debate with evidence that the negligible effect of the British MW on the gender wage gap was also due to the disproportionate number of women still earning less than the legal threshold after its introduction in the UK.

7 Conclusion

National minimum wages can be controversial tools for redistribution due to their potential effects on employment and wages further up in the distribution. To contribute to the debates surrounding the MW, we look at an indirect effect of its introduction on another key labour market indicator, the gender gap in pay. Using a new methodology, we find strong evidence that the MW can reduce the gender wage gap at the bottom of the wage distribution by up to 100%. This is in line with some previous findings for the Ukraine (Ganguli & Terrell, 2009). We also find some small positive spillover effects whereby the gender pay gap is reduced up to a wage rate of 1.4 times the MW. We find some evidence that there may be negative spillover effects in the middle of the distribution but these are not measured precicely.

We find discrepancies in how effective a gender equality tool the MW is by country. A small or zero effect is found for the UK with no spillover effects confirming previous results from Robinson (2002, 2005) and Stewart (2012). Our cross-country comparison shows that enforcement issues and the black market may interfere with the effectiveness of the MW in the UK and that more compliance would lead to the closing of the gender wage gap at the bottom of the wage distribution and a reduction in the mean gender wage gap by 1 ppt in the UK. Overall however, despite the compression of the bottom of the wage distribution in Ireland by the MW, there is little change in the mean gender wage gap in Ireland due to pre-existing trends in the gender wage gap further up in the wage distribution combined with potentially negative spillover effects of the MW.

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A Appendix

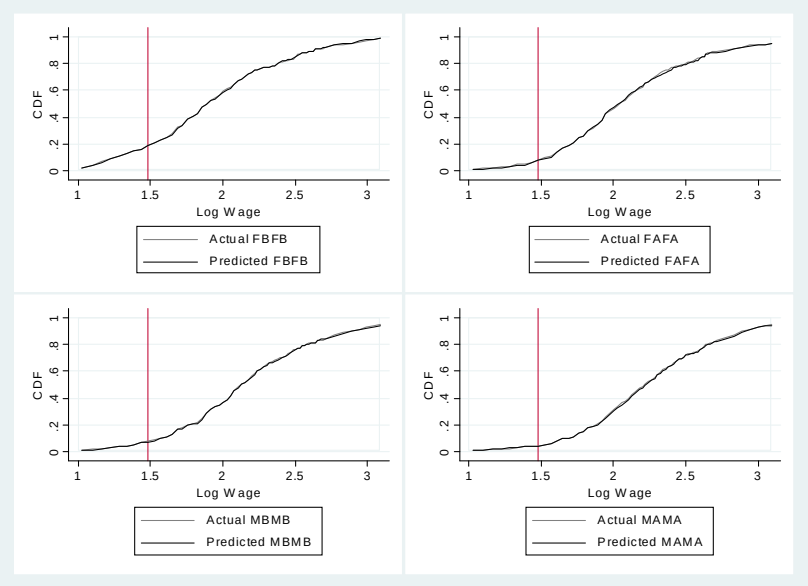

Figure A.1: Actual vs Predicted CDF's of Hourly Wages (Ireland)

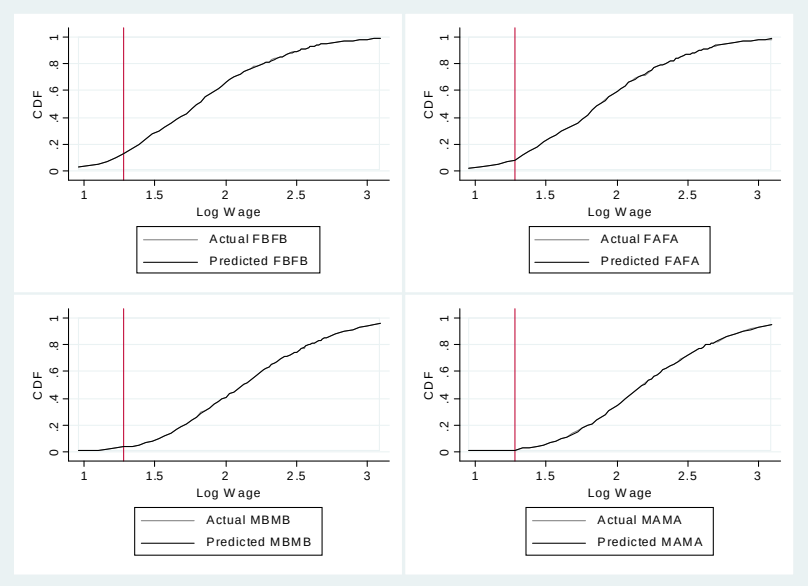

Figure A.2: Actual vs Predicted CDF's of Hourly Wages (UK)

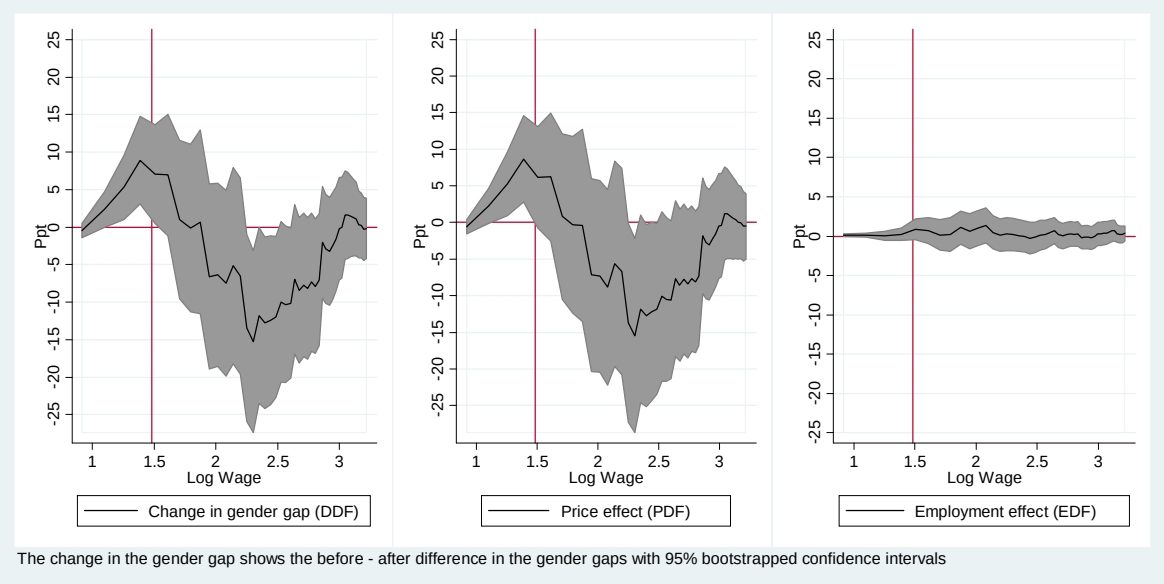

Figure A.3: Total, Price and Composition Effect of the MW on the Gender Wage Gap (Sample 1a, Ireland)

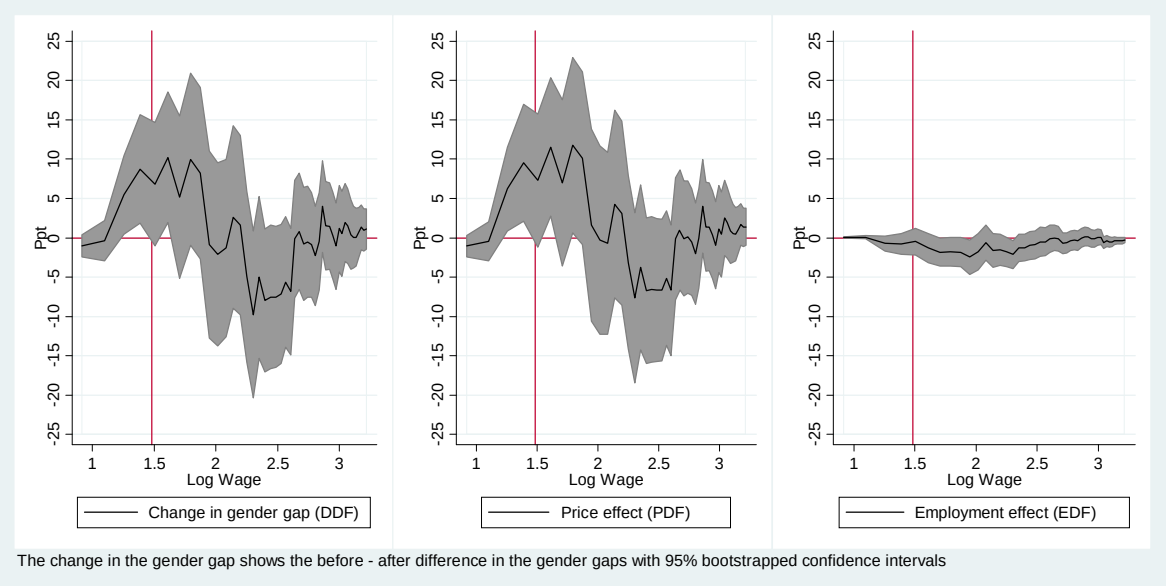

Figure A.4: Total, Price and Composition Effect of the MW on the Gender Wage Gap (Sample 2, Ireland)

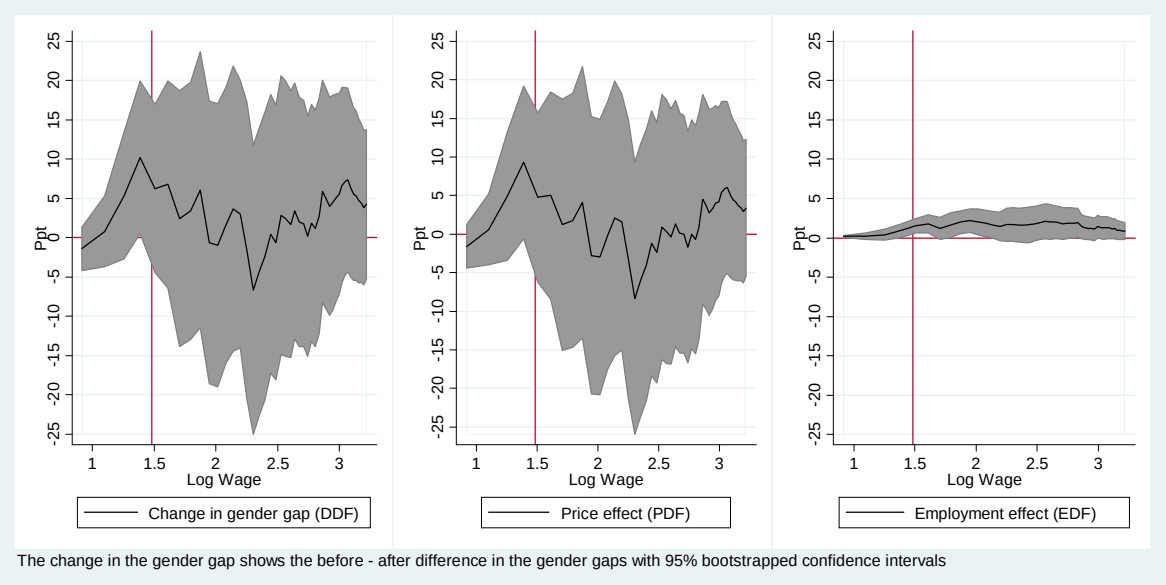

Figure A.5: Total, Price and Composition Effects of the MW on the Gender Wage Gap (Detrended Effects, Ireland)

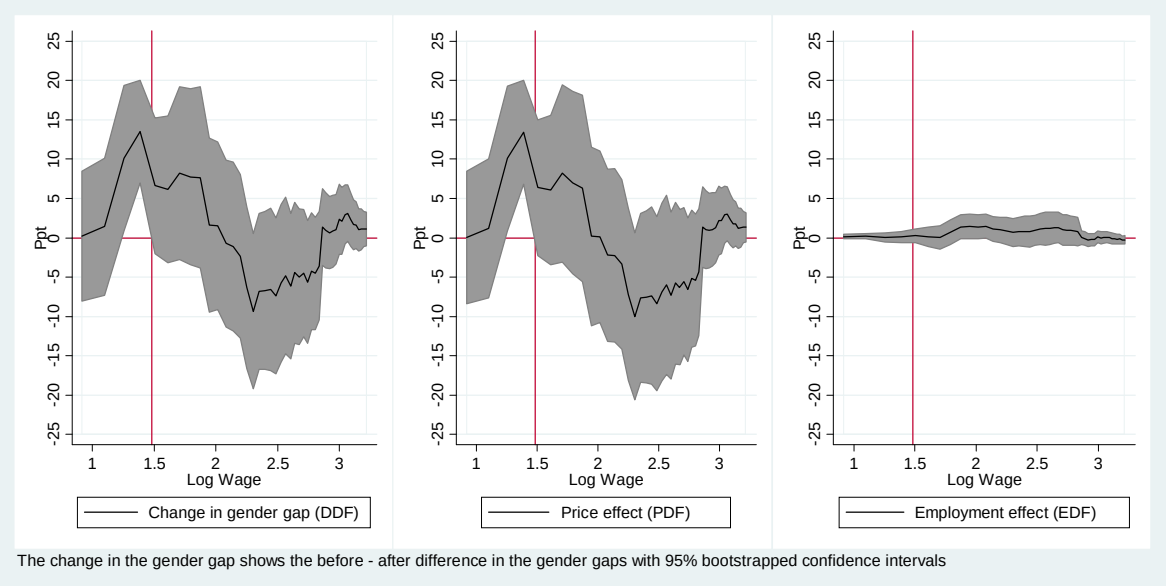

Figure A.6: Total, Price and Composition Effects of the MW on the Gender Wage Gap (Including Occupations and Industries, Ireland)

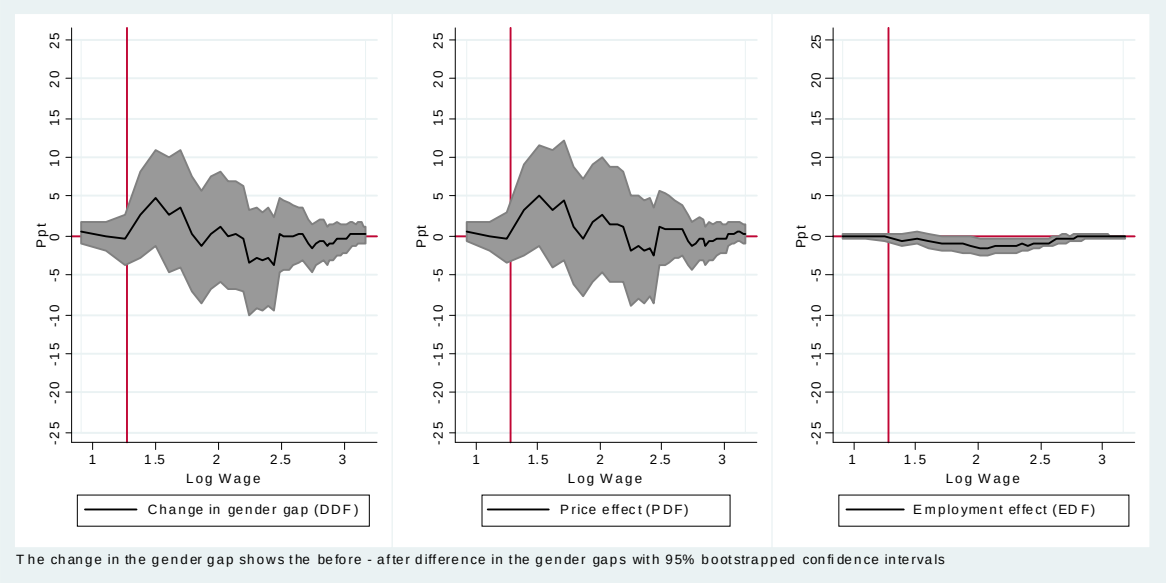

Figure A.7: Total, Price and Composition Effect of the MW on the Gender Wage Gap (Sample 2, UK)

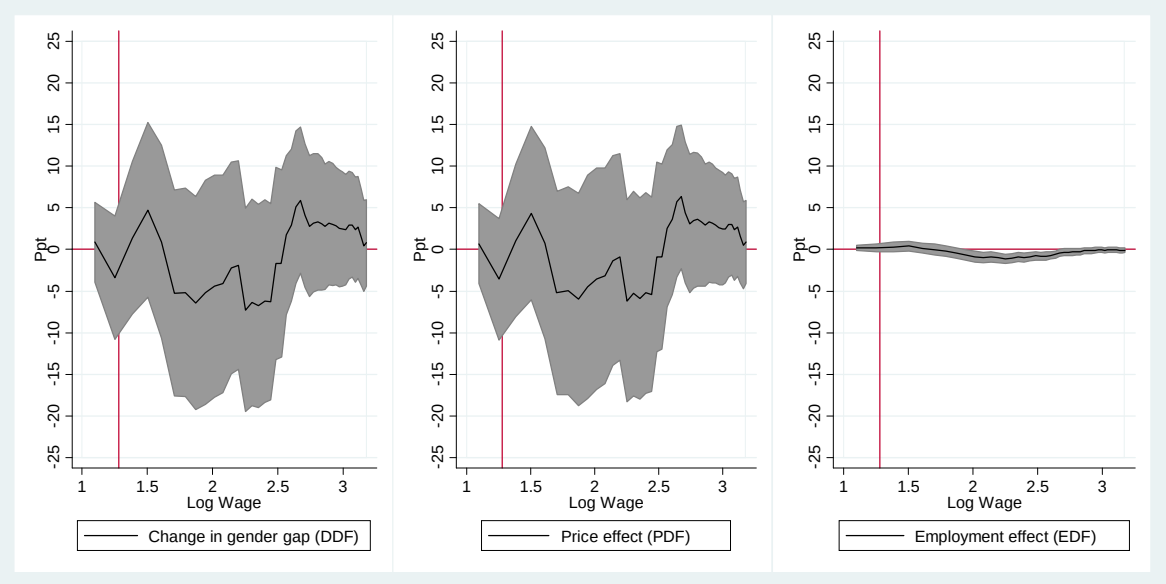

Figure A.8: Total, Price and Composition Effects of the MW on the Gender Wage Gap (Detrended Effects, UK)

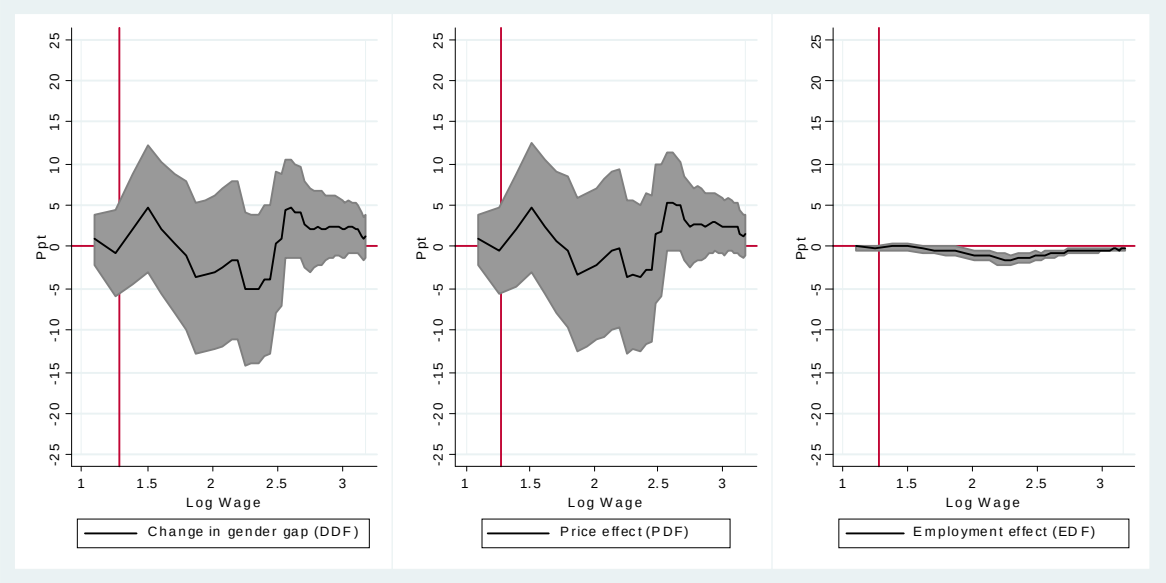

Figure A.9: Total, Price and Composition Effects of the MW on the Gender Wage Gap (Including Occupations and Industries, UK)

Table A.1: Descriptive Statistics before and after MW Introduction in Ireland and the UK

	Sample 1: all						Sample 1a: all without refreshment sample					
	Men			Women			Men			Women		
	Before	After	Diff.	Before	After	Diff.	Before	After	Diff.	Before	After	Diff.
Ireland												
Hourly wage	10.38	11.46	1.09***	8.31	9.29	0.98***	10.38	12.00	1.63***	8.31	9.35	1.03***
Hours	40.97	40.80	-0.17	31.42	30.96	-0.45	40.97	40.59	-0.38	31.42	30.30	-1.11**
Age	39.65	40.38	0.73	37.79	39.23	1.44***	39.65	42.10	2.46***	37.79	40.47	2.68***
University	0.16	0.16	0.00	0.18	0.17	-0.00	0.16	0.15	-0.01	0.18	0.16	-0.01
No education	0.46	0.42	-0.03*	0.30	0.31	0.01	0.46	0.46	0.00	0.30	0.36	0.05**
Married	0.64	0.64	0.00	0.59	0.58	-0.02	0.64	0.71	0.07***	0.59	0.62	0.03
Temporary job ‡	0.10	0.07	-0.03**	0.17	0.14	-0.03**	0.10	0.06	-0.04***	0.17	0.12	-0.05***
Part-time job ‡	0.04	0.04	-0.01	0.25	0.24	-0.00	0.04	0.04	-0.00	0.25	0.25	0.01
Manual ‡	0.55	0.52	-0.03	0.38	0.37	-0.01	0.55	0.54	-0.01	0.38	0.38	0.01
Public sector ‡	0.31	0.30	-0.00	0.36	0.37	0.01	0.31	0.32	0.01	0.36	0.37	0.01
Tertiary sector ‡	0.57	0.57	-0.00	0.82	0.84	0.02	0.57	0.57	0.00	0.82	0.84	0.01
N =	*1112*	*1323*		*914*	*1214*		*1112*	*716*		*914*	*649*	
U.K.												
Hourly wage	9.87	10.28	0.41*	7.17	7.78	0.61***						
Hours	42.37	42.32	-0.05	30.11	30.48	0.37						
Age	39.83	40.62	0.79**	40.42	41.16	0.74**						
University	0.25	0.26	0.01	0.19	0.20	0.01						
No education	0.48	0.47	-0.00	0.59	0.57	-0.02						
Married	0.65	0.64	-0.01	0.64	0.64	-0.00						
Wales	0.05	0.05	0.01	0.05	0.05	0.01						
Scotland	0.07	0.08	0.02*	0.09	0.10	0.01						
N. Ireland	0.00	0.00	0.00	0.00	0.00	-0.00						
London	0.09	0.09	-0.00	0.10	0.10	-0.00						
Temporary job ‡	0.04	0.03	-0.02**	0.07	0.05	-0.02**						
Part-time job ‡	0.02	0.02	-0.01	0.25	0.24	-0.01						
Manual ‡	0.45	0.46	0.01	0.29	0.27	-0.02						
Public sector ‡	0.20	0.19	-0.01	0.38	0.40	0.02						
Tertiary sector ‡	0.58	0.59	0.01	0.85	0.86	0.01						
N =	*1904*	*1860*		*2023*	*1945*							

*Selection from the Irish Living in Ireland survey and British Household Panel Survey is those between 22 and 65 and not in education. The before period is 1999 in Ireland and 1998 in the UK while the after period is 2001 in Ireland and 2000 in the UK. The refreshment sample was added to the Irish data in 2000. Significance levels are represented by * p<0.1 ** p<0.05 *** p<0.01*

‡ as a proportion of those working

Table A.2: Descriptive Statistics: Alternative Selection

	Sample 2: balanced panel of workers					
	Men			Women		
	Before	After	Diff.	Before	After	Diff.
Ireland						
Hourly wage	10.74	12.01	1.27***	8.42	10.01	1.59***
Hours	41.35	41.15	-0.21	33.39	33.03	-0.36
Age	39.93	42.00	2.06***	37.54	39.57	2.03***
University	0.16	0.16	0.00	0.19	0.19	0.00
No education	0.46	0.44	-0.01	0.27	0.29	0.01
Married	0.69	0.72	0.03	0.58	0.60	0.02
Temporary job ‡	0.08	0.05	-0.03**	0.16	0.11	-0.05**
Part-time job ‡	0.03	0.02	-0.00	0.17	0.15	-0.02
Manual ‡	0.55	0.52	-0.03	0.34	0.31	-0.03
Public sector ‡	0.33	0.33	0.00	0.37	0.39	0.02
Tertiary sector ‡	0.56	0.57	0.01	0.82	0.83	0.01
N =	*639*	*639*		*497*	*497*	
U.K.						
Hourly wage	9.84	10.77	0.93***	7.34	8.09	0.75***
Hours	42.48	42.16	-0.32	32.86	33.14	0.28
Age	39.59	41.59	2.00***	40.08	42.08	2.00***
University	0.25	0.26	0.00	0.20	0.20	0.00
No education	0.47	0.46	-0.01	0.57	0.56	-0.01
Married	0.66	0.69	0.03*	0.62	0.65	0.03*
Wales	0.05	0.05	0.00	0.05	0.05	0.00
Scotland	0.06	0.07	0.00	0.09	0.10	0.00
N. Ireland	0.00	0.00	0.00	0.00	0.00	0.00
London	0.09	0.09	-0.00	0.10	0.10	0.00
Temporary job ‡	0.03	0.02	-0.01**	0.05	0.03	-0.02**
Part-time job ‡	0.01	0.01	-0.00	0.14	0.13	-0.01
Manual ‡	0.45	0.44	-0.00	0.24	0.23	-0.01
Public sector ‡	0.21	0.20	-0.01	0.41	0.42	0.00
Tertiary sector ‡	0.58	0.59	0.01	0.84	0.85	0.00
N =	*1517*	*1517*		*1423*	*1423*	

*Selection from the Irish Living in Ireland survey and British Household Survey is those between 22 and 65 and not in education. The minimum wage was introduced in 1999 in the UK and 2000 in Ireland. Sample 2 is a balanced panel of those who work at least 15 hours per week in both periods. Significance levels are represented by * p<0.1 ** p<0.05 *** p<0.01*

‡ as a proportion of those working

Table A.3: Decomposition of the Gender Wage Gap at the Mean and at Percentiles

	Standard mean decomposition		Distribution regression mean decomposition		Distribution regression P10		Distribution regression P25		Distribution regression P50		Distribution regression P75		Distribution regression P90	
	national currency	% of male wage	national currency	% of male wage	national currency	% of male wage	national currency	% of male wage	national currency	% of male wage	national currency	% of male wage	national currency	% of male wage
Ireland Before														
Wage gap	2.07	21%	2.07	21%	1.40	28%	1.30	20%	1.90	22%	2.50	20%	3.60	21%
Explained	0.61	6%	0.70	7%	0.20	4%	0.50	8%	0.60	7%	1.10	9%	1.60	9%
Unexplained	1.46	**15%**	1.37	**14%**	1.20	**24%**	0.80	**12%**	1.30	**15%**	1.40	**11%**	2.00	**11%**
Ireland After														
Wage gap	1.43	13%	1.39	13%	0.80	14%	1.20	17%	1.80	19%	2.20	17%	1.60	9%
Explained	0.27	3%	-0.32	-3%	0.50	9%	0.10	1%	-0.20	-2%	-0.60	-5%	-0.80	-4%
Unexplained	1.70	**16%**	1.71	**16%**	0.30	**5%**	1.10	**15%**	2.00	**21%**	2.80	**21%**	2.40	**13%**
UK Before														
Wage gap	2.37	25%	2.36	25%	1.20	25%	1.60	27%	2.20	26%	3.40	28%	4.10	25%
Explained	0.58	6%	0.58	6%	0.70	15%	0.70	12%	0.90	11%	0.70	6%	0.40	2%
Unexplained	1.79	**19%**	1.78	**19%**	0.50	**10%**	0.90	**15%**	1.30	**15%**	2.70	**23%**	3.70	**22%**
UK After														
Wage gap	2.29	23%	2.26	23%	1.20	24%	1.70	26%	2.10	24%	3.10	25%	3.60	21%
Explained	0.67	7%	0.71	7%	0.80	16%	0.70	11%	0.50	6%	0.50	4%	1.30	8%
Unexplained	1.63	**16%**	1.55	**16%**	0.40	**8%**	1.00	**15%**	1.60	**18%**	2.60	**21%**	2.30	**14%**

Selection from the Irish Living in Ireland survey and British Household Panel Survey is those between 22 and 65 and not in education. Wage gaps are expressed per hour in national currency and as a proportion of male wages

Table A.4: Coefficients of Distribution Regression of Hourly Wage at the MW and Percentiles

	Ireland															
	NMW		p25		p50		p75		NMW		p25		p50		p75	
Variable	FBFB								FAFA							
Age	-0.24	***	-0.24	***	-0.30	***	-0.30	***	0.00		-0.07		-0.11	**	-0.17	***
Age2	0.00	***	0.00	***	0.00	***	0.00	***	-0.00		0.00		0.00	*	0.00	***
Low education	0.58	***	0.85	***	1.42	***	1.49	***	0.41	**	0.66	***	0.80	***	1.05	***
High education	-0.77	**	-0.85	***	-1.26	***	-1.77	***	-0.08		-0.57	**	-0.91	***	-1.26	***
Married	0.14		0.07		0.05		-0.44	**	-0.05		0.10		-0.17		-0.29	*
Temporary	0.76	***	0.51	***	0.29		0.53	**	0.71	***	0.70	***	0.62	***	0.65	***
Part-time	0.27		0.65	***	0.45	**	0.36		0.42	**	0.58	***	0.29	*	0.10	
Constant	2.91	**	3.97	***	6.37	***	7.95	***	-1.81		0.25		2.36	**	4.79	***
	MBMB								MAMA							
Age	-0.11	*	-0.02		-0.16	***	-0.15	**	0.01		-0.02		-0.04		-0.10	**
Age2	0.00	*	0.00		0.00	***	0.00	**	-0.00		0.00		0.00		0.00	
Low education	0.26		0.29	*	0.59	***	0.76	***	-0.07		0.41	***	0.69	***	1.05	***
High education	-0.28		-0.72	***	-1.21	***	-1.36	***	-0.98	***	-1.23	***	-0.83	***	-1.16	***
Married	-0.42	**	-0.61	***	-0.56	***	-0.71	***	-0.79	***	-0.55	***	-0.43	***	-0.58	***
Temporary	0.26		0.18		0.38		0.55		0.80	***	0.63	**	0.57	**	0.20	
Part-time	-0.57		0.67	**	0.44		0.83	***	0.30		0.70	**	0.11		-0.23	
Constant	0.84		0.06		3.49	***	4.53	***	-1.78		-0.58		0.79		3.02	***

	UK															
	NMW		p25		p50		p75		NMW		p25		p50		p75	
	FBFB								FAFA							
Age	-0.03		-0.00		-0.09	***	-0.15	***	-0.01		0.01		-0.05		-0.12	**
Age2	0.00		0.00		0.00	***	0.00	***	0.00		0.00		0.00		0.00	**
High education	-0.42	**	-0.78	***	-0.99	***	-0.99	***	-1.04	***	-1.23	***	-1.22	***	-1.15	***
Low education	0.39	***	0.45	***	0.39	***	0.45	***	0.28	**	0.41	***	0.29	***	0.31	**
Married	-0.09		-0.10		-0.10		-0.03		-0.10		0.02		-0.02		0.02	
Wales	0.06		0.23		-0.03		0.10		0.51	**	0.26		0.04		0.12	
Scotland	0.03		-0.11		-0.06		0.18		0.20		-0.11		-0.03		0.33	*
N. Ireland	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
London	-0.69	***	-0.77	***	-0.66	***	-0.33	**	-0.50	**	-0.80	***	-0.69	***	-0.66	***
Temporary	-0.09		0.03		-0.16		0.01		0.39	*	0.37	**	0.14		-0.09	
Part-time	0.65	***	0.70	***	0.45	***	0.27	**	0.39	***	0.76	***	0.55	***	0.42	***
Constant	-0.89		-0.64		2.18	***	4.11	***	-1.56		-1.16		0.97		3.41	***
	MBMB								MAMA							
Age	-0.17	***	-0.17	***	-0.19	***	-0.24	***	-0.01		-0.11	***	-0.19	***	-0.24	***
Age2	0.00	***	0.00	***	0.00	***	0.00	***	0.00		0.00	***	0.00	***	0.00	***
High education	-0.41		-0.36	**	-0.76	***	-0.98	***	-0.19		-0.42	**	-0.74	***	-1.03	***
Low education	0.33	*	0.47	***	0.44	***	0.42	***	0.46	*	0.43	***	0.44	***	0.39	***
Married	-0.14		-0.21	**	-0.13		-0.17	*	-0.73	***	-0.39	***	-0.40	***	-0.22	**
Wales	0.28		0.21		0.22		0.39	*	0.70	**	0.13		0.30		0.12	
Scotland	0.16		0.15		0.08		0.28		0.52	*	0.35	*	0.06		0.32	*
N. Ireland	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
London	-0.21		-0.33	*	-0.54	***	-0.39	***	0.07		-0.26		-0.47	***	-0.33	**
Temporary	0.94	***	1.02	***	0.68	***	0.30		0.46		0.77	***	0.48		0.36	
Part-time	1.03	***	0.96	***	0.75	***	0.09		0.85	*	0.75	*	0.49		-0.19	
Constant	1.43		2.30	***	3.81	***	5.80	***	-2.29		0.85		3.41	***	5.79	***

*Coefficients from 4 points of the distribution regression model using Sample 1 (those in the Living in Ireland and British Household Panel Survey data aged 22-65 and not in education). FBFB and FAFA refer to the female sample before and after the introduction of the NMW, respectively. MBMB and MAMA refer to the male sample for the same periods. Statistical significance at the 1%, 5%, 10% levels are indicated by ***, ** and * respectively.*

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