Wage Changes in the Irish Labour Market: Within- and Between-Firm Effects

by

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Abstract

During the Great Recession many Irish workers experienced nominal earnings cuts. The proportion of all job stayers suffering earnings cuts trebled in the peak crisis years, with over 55% of workers receiving earnings cuts at the height of the crisis. However, while earnings cuts were common the evidence suggests substantial heterogeneity in earnings dynamics; at the same time as many workers were experiencing cuts, a substantial minority of workers continuing to receive earnings rises throughout the crisis. In this paper we use a unique dataset containing earnings data on every worker in every firm in Ireland from 2005-2013 to examine the relative role of worker and firm characteristics in explaining the observed heterogeneity in earnings dynamics. Our results show that firm effects play a smaller role in determining pay changes in Ireland. Although firm effects become more important in the peak year of the economic crisis, even then the vast majority of earnings changes continue to be driven by within firm rather than between firm forces. These finding raise a number of important questions about the role of morale and fairness in the wage setting process.

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1. Introduction

In any given year, the range of percentage wage changes received by workers is wide. In an international study covering sixteen countries, Dickens et al. (2007) described as "remarkable" the variation in percentage wage changes across individuals in nearly every country and in every year. Because of its importance in indicating downward nominal wage rigidity, there has been a particular interest in the extent to which nominal wage freezes – zero wage changes – are prevalent, with a 'spike' at zero found in the wage change distributions of many countries (Dickens et al., 2007). However, outside of these zero spikes, a wide range of wage changes are typically observed, including nominal wage cuts. In this paper, we examine the importance of the firm in the explaining the dispersion of wage changes. We do so using a unique matched employer-employee data set covering every firm and worker in Ireland from 2005-2013, a period which includes the years of the Great Recession, during which the Irish labour market was under substantial stress.

Our motivation for focussing on the role of the firm in determining wage changes is threefold. First, we aim to add to the fairly limited literature on the extent to which it is the identity of the firm that an employee works for that determines how fast their wages rise, and to what extent a worker's personal characteristics are dominant. Early analysis of the role of firms in wage setting often relied on wages for a single firm (Kahn and Sherer, 1990; Baker et al., 1994; Treble et al., 2001). However an increasing number of studies have begun to make use of matched employer-employee data sets to help understand the role of firms in the wage-setting process (Abowd et al., 1999; Cardoso, 1997, 1999, 2000; Dustmann and Meghir, 2005; Lazear and Shaw,

2009; Sorensen and Vejlin, 2011; Card et al., 2013).[1] Typically these studies find a significant role for both worker and firm level characteristics in wage levels, but a stronger role for individual characteristics in determining wage changes. It will be of interest to establish how patterns in the Irish labour market compare to those in other countries.

Secondly, we examine whether and how this breakdown between firm and individual effects is affected by a severe recession. Our data cover the period of the Great Recession, which affected Ireland particularly badly, with a dramatic increase in unemployment from 5.6% in 2008 to a peak of 15.1% in 2012 and a fall in employment of 15.9% over the same period. We therefore ask whether normal labour market processes persist in such a distressed labour market.

Finally, a particular point of interest is the question of whether negative wage changes (i.e. cuts) are qualitatively different to positive wage changes (i.e. rises) in terms of how they are determined. This question arises because as well as job losses being common in Ireland over the Great Recession period, nominal wage cuts became widespread: Doris et al. (2015) found that the proportion of all job stayers suffering earnings cuts trebled in the peak crisis years, with a majority of these workers affected by cuts in both 2008/09 and 2009/10.[2] However, the same paper found substantial heterogeneity in wage rises, with a substantial minority of workers continuing to receive earnings rises over these same years. In this paper, we wish to assess the extent to which the workers who received cuts were in different firms to those who received rises and whether, if a firm cuts wages for one of its workers, it tends to cut wages for a large proportion of its workforce.

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[1] For an overview of the use of matched employer-employee data in analysing labour markets see Abowd and Kramarz (1999).
[2] Among private sector workers, the pay reduction majority lasted for just one year (52% in 2008/09), with 47.5% having an earnings cut in 2009/10.

In Bewley's (1999) seminal work on why wages do not fall during a recession, he found that firms are very reluctant to cut nominal pay, and that almost all the firms that had cut wages in his study did so due to financial distress; none of the cuts were due to a weak labour market (Bewley, 1999, pp.200). The main reason given by firms for their reluctance to cut pay was that the negative effects on morale made cuts counter-productive. This would lead us to expect that some firms – those in real financial difficulty – would be willing to cut pay during the Great Recession, but others would avoid cuts altogether. Bewley also notes that it was accepted by firms that "the pay of ordinary workers could not be cut without cutting the pay of managers proportionately by as much or more" (Bewley, 1999, pp. 173) and that when asked why firms who were worried about adverse quits as a result of pay cuts did not cut the pay of all but the best workers, they responded that "the resulting inequities would cause too many problems with morale" (Bewley, 1999, pp. 174). Thus, it is implicit in Bewley's discussion that, where pay is cut, we should expect it to be cut for all workers, or at least for all workers above a particular point in the company's pay distribution. On this basis, we might expect to see the importance of the firm in determining wage changes growing substantially during the Great Recession period, and the within-firm variation being reduced.

To address these questions, we first use a variance decomposition technique to examine the relative contribution of within-firm and between-firm heterogeneity to the overall observed heterogeneity in individual earnings changes documented in Doris et al. (2015). We then analyse the determinants of individual workers' earnings changes within firms using econometric analysis. The remainder of the paper proceeds as follows. Section 2 discusses the macroeconomic and policy context for the period covered by our data; Section 3 reviews the relevant literature; Section

4 describes the data used for our analysis; Section 5 outlines the statistical and econometric methodologies used; Section 6 presents the results; and Section 7 concludes.

2. The Irish Macroeconomic and Policy Context, 2005-2013

As mentioned earlier, Ireland was one of the countries worst affected by the Great Recession. After a period of very rapid growth from 1994 to 2007, when the average annual GDP growth rate was over 7%, the economy collapsed, with output falling by over 10% in real terms between 2008 and 2010. Labour market indicators followed this pattern of boom and bust. Employment grew by 46% between 1998 and 2007, but then fell by 15.9% in the following 4.5 years. Similarly, the unemployment rate, which had been relatively stable at 4%-5% for most of the 2000s, rose from 5.6% in 2008 to 12% in 2009 and continued to rise further to a peak of 15.1% in 2012. It had fallen back to 14.7% by the end of 2013.

The effects of the global recession felt elsewhere were compounded in Ireland by the bursting of a property bubble and the subsequent collapse of output and employment in construction-related sectors. Because bank lending was so highly concentrated in construction, Irish banks experienced huge losses and the government decided to guarantee all bank liabilities in 2008. However, continued falling tax revenue and exposure to bank liabilities resulted in the government deficit rising from almost zero in 2008 to 13.9% in 2010 and a remarkable 32.3% in 2011[3], when banking losses crystallized. As a result, yields in Irish bonds reached unsustainable levels in 2010, and the government sought and accepted a rescue package from the EU, ECB and IMF.

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[3] This figure differs from that in Doris et al. (2015) due to data revisions.

The crisis resulted in the government undertaking a severe programme of austerity measures, combining tax increases and expenditure cuts. As part of the expenditure cuts, three rounds of pay cuts were undertaken in the public sector between 2009 and 2013, with cuts ranging from 5% to 10.5% at each round. Although public sector workers are not the focus of this paper, it might be expected that the fact that public sector workers were experiencing such cuts would have a demonstration effect that would make similar cuts more acceptable for private sector workers. An additional factor that may have made nominal wage cuts more acceptable was that inflation was negative in 2009 (-4.5%) and 2010 (-1%). And indeed, Doris et al. (2015) found that the proportion of all job stayers receiving wage cuts more than trebled during the crisis, rising from 17% in 2006 to 55% at the height of the crisis in 2009.

The data we analyse in this paper cover the last few years of the Irish boom, the sudden onset of the economic crisis, the ongoing period of the Great Recession and the first year of the recovery of the labour market. Having access to population earnings data over a period of such dramatic macroeconomic changes provides an opportunity to investigate how marked labour market changes impact on workers.

3. Literature Review

Initial analyses of the role of firms in the wage setting process tended to focus on wages within a single firm. For instance Baker et al. (1994) analyse salary data for a single firm from 1969-1988. They find significant variation in both wage levels and wage growth within the firm, even when the analysis is restricted to workers at the same level. They propose a simple learning model based on unobserved ability to explain the observed facts. More detailed comparative analysis of firms'

wage setting policies have until recently been limited by lack of appropriate data. Abowd et al. (1999) and Lazear and Oyer (2004) provide early analyses of the role of firms in wage setting using matched employer-employee data; in both cases, their focus is on wage levels rather than wage changes. Abowd et al.'s (1999) study covers over one million French workers from more than five hundred thousand firms and find that firm effects, while important, are not as important as individual effects in explaining the variation in wage levels in France. Similarly, Lazear and Oyer (2004) report that the wage levels of Swedish workers are more closely related to their skill sets than to their firms' fortunes.

With the growth in matched employer-employee data,[4] more recent analyses have considered the role of the firm in wage setting in greater detail. Cardoso (1997) looks at both worker and employer attributes as sources of wage dispersion and of its rising trend in Portugal during the 1980's and early 1990's. Cardoso (1999) extends this work using a multi-level wage regression model and finds that traditional wage progression models based on seniority lost influence over this period, whereas general skills became more valued by employers. Dustmann and Meghir (2005) use matched employer-employee data for Germany to examine the extent and reasons for individual wage growth over the life-cycle, distinguishing between the role of general, sector-specific and firm-specific skills. Their analysis suggest while general skills are important for skilled workers, unskilled workers benefit primarily from firm-specific wage growth.

Lazear and Shaw (2009) provide a collection of studies analysing the extent to which individual differences in wage levels and wage growth can be explained by differences within and between firms. For example, Alda et al. (2009) examine wage dynamics for Germany and find that

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[4] Abowd and Kramarz (1998) provide an early review of over 100 studies from more than 15 different countries exploiting matched employer-employee data.

there is substantial within-firm variation in wage changes. Contini et al (2009) analyse the within- and between-firm contributions to the dispersion in wage changes in Italy and find that the within-firm standard deviation of wage changes is almost as high as that of the individual wage change, while Borghans and Kriechel (2009) report that wage growth differences between firms account for very little of the observed heterogeneity in individual wage growth in the Netherlands. Lazear and Shaw (2009b) summarise the findings from this collection of work by emphasising the striking extent of within-firm variation in wage changes, accounting as it does for 60-80% of total dispersion for most countries.

More recently Sorenson and Vejlin (2011) find that worker effects explain almost twice as much of the variation in wage growth as firm effects using Danish longitudinal matched employer-employee data from 1980-2006. Kurmann et al. (2014) analyse the extent and consequences of wage rigidity using administrative worker-firm linked data from the US Census Bureau. They find that the distribution of earnings changes during the Great Recession varied considerably across firms, with a substantial fraction exhibiting none of the asymmetries typically associated with downward rigidity.

In this paper we extend the previous literature by examining the contribution of firms to wage dispersion in Ireland from 2005-2013 using a unique matched employer-employee data set covering every firm and every employee over that period. There have been no previous studies of within-firm dispersion using Irish data and so providing such a study is one of our contributions. In addition, since our data extends to 2013, we are able to provide the first analysis of the role of firm-specific factors in wage adjustments in response to the Great Recession.

4. Data

The analysis is based on data taken from the Job Churn (JC) dataset, which is a longitudinal administrative dataset covering the years 2005-2013 that has been compiled by the Irish Central Statistics Office (CSO). These data combine three elements. Data on annual income and weeks worked are provided by the tax authorities in respect of every worker who was an employee during that year. Information on workers' age, sex and social welfare class are provided by the Department of Social Welfare. Finally, data on the sector in which each firm operates and the enterprise's ownership structure come from the CSO's Central Business Register. Anonymised worker and firm identifiers are included in the dataset to allow longitudinal analysis.

There are several significant advantages to using the JC data to examine firm- and individual-level earnings inequality. Firstly, the data cover every employer and almost every employee in Ireland over this period. Since employers are obliged to file tax returns for every worker, problems associated with non-response and attrition are absent, other than as a result of firms going out of business. The fact that the data cover the population of both firms and workers allows us to carry out detailed analyses of within- and between-firm inequality in Ireland over the period. Moreover, because they are administrative data based on tax returns, the earnings data are largely free from measurement error; it is an offence to misreport workers' earnings in these returns. Finally, the data cover the period from 2005 to 2013, allowing us to compare earnings dynamics before, during and in the immediate aftermath of the crisis.

Despite the advantage of having population-level coverage of workers and firms, it should also be noted that there are some important gaps in the data because of the limited covariates that are available. Gender, age and nationality are provided, as is the industrial sector in which the firm

operates. However, no data are available on the education level, occupation, labour market experience or job tenure of the workers. To the extent that wage levels capture human capital characteristics, the omission of education and labour market experience can be overcome to some extent, but the fact remains that some interesting questions regarding pay structure cannot be addressed with the available covariates.

A further potential drawback is that earnings are defined in the JC data as annual 'reckonable income' for the calendar year; this is gross income from all sources including bonuses and taxable benefits-in-kind, after non-taxable pension contributions have been deducted. No information is available on hours of work. Although it would be interesting to distinguish between base pay and other pay (for example, overtime and bonuses), this distinction cannot be made here. Doris et al. (2015) used an alternative dataset in which hours of work are available, the EU Survey of Income and Living Conditions (EU-SILC), to assess whether the increase in the prevalence of earning cuts in the JC data was driven by cuts in hours of work, and concluded that they were not. However, the EU-SILC data is not suitable for firm level analysis, since firm identifiers are not available.

Because of the different wage-setting mechanisms that pertain in the public and private sectors, we focus only on private sector workers throughout this paper. In addition, we consider only workers aged 25-60 and only firms with at least 10 such workers. This minimum number of workers is set to ensure that measures of within-firm variation in earnings are meaningful. We also use observations only on job stayers who work for the same firm for all weeks of both years of a year pair for which a pay change is calculated. These restrictions on the subset of workers that we

use for the analysis leave us with between 300,000 and 385,000 individual pay change observations and 6,000-7,000 firms in any given year.

5. Methodology

Our first aim is to decompose the heterogeneity of individual pay changes into a part that is due to the firm that the individual works in and a part that is due to the individual's characteristics as they are rewarded within the firm. We therefore begin with a simple variance decomposition of the dispersion in pay changes into a within-firm and a between-firm component, following Lazear and Shaw (2007), using:

$$\sigma_1{}^2 = \sum_{j=1}^{F} p_j \, \sigma_j^2 + \sum_{j=1}^{F} p_j \left(\overline{\Delta w_J} - \overline{\overline{\Delta w}} \right)^2 \tag{1}$$

where $\sigma_1{}^2$ is the overall variance of earnings changes, σ_j^2 is the variance of earnings changes within firm j, p_j is the share of workers in the economy who are working in firm j, $\overline{\Delta w_J}$ is the mean earnings change across workers in firm j and $\overline{\overline{\Delta w}}$ is the mean earnings change in the economy. Thus, the first term gives the within-firm variance and the second term gives the between-firm variance. This variance decomposition is carried out separately for each year pair from 2005/06 to 2012/13.[5]

As discussed earlier, it may also be useful to focus particularly on the incidence of pay cuts, rather than on the percentage pay change. To this end, we also employ a decomposition of the variance of pay cuts, as follows:

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[5] Thus, although both the firm and the worker must be observed in both years of the year pair, firms and workers can enter and exit the population, so it is not the case that the same workers and firms are observed across all years.

$$\sigma_2^2 = \sum_{j=1}^{F} p_j \sigma_j^2 + \sum_{j=1}^{F} p_j \left(\overline{c_j} - \overline{\overline{c}} \right)^2 \tag{2}$$

In this case, σ_2^2 is the overall variance of a variable c that denotes a pay cut; this is a binary variable equal to one if the difference in earnings between time t-1 and t is less than -0.1% and zero otherwise. σ_j^2 is the variance of pay cuts within firm j, p_j is the share of workers working in firm j, $\overline{c_j}$ is the proportion of workers whose earnings were cut within firm j and $\overline{\overline{c}}$ is the proportion of workers whose earnings were cut in the economy as a whole.

Although it is not our main focus of interest, in order to compare the Irish labour market with those of other countries, we also report the results of an analogous decomposition of pay levels into within- and between-firm components, using the following:

$$\sigma_3^2 = \sum_{j=1}^{F} p_j \sigma_j^2 + \sum_{j=1}^{F} p_j \left(\overline{w_j} - \overline{\overline{w}} \right)^2 \tag{3}$$

In this case, σ_3^2 is the overall variance of the level of earnings, σ_j^2 is the variance of earnings within firm j, p_j is the share of workers who are working in firm j, $\overline{w_j}$ is the mean level of earnings across workers in firm j and $\overline{\overline{w}}$ is the mean level of earnings in the economy.

While the decomposition of earnings changes detailed in (1) above allows us to examine the relative importance of within-firm and between-firm heterogeneity for the overall dispersion of wage changes in the economy, it does not explain how wage changes are determined within firms. To examine this issue in more detail, we estimate firm fixed-effects models of individual wage changes for each pair of years in our sample. In particular, the model we estimate is given by:

$$\Delta ln w_{ijt} = X_{ijt} \beta_t + \mu_j + \epsilon_{ijt} \tag{4}$$

where Δlnw_{ijt} is the log wage change for worker i in firm j between t-1 and t and X_{ijt} is a vector of the characteristics of worker i in firm j at time t-1. The inclusion of the firm fixed effects, μ_j, means that the estimated βs capture the average within-firm effect of a given worker characteristic on the size of a worker's pay change, expressed as a proportion. This model will allow us to answer questions such as whether men are more or less likely to receive bigger percentage pay rises within a firm, and whether pay is more likely to rise more for those at the bottom or at the top of the within-firm wage distribution.

6. Results

6.1. Variance Decompositions

As mentioned in Section 3, the literature on decomposing wage levels into between- and within-firm parts is more extensive than that on the decomposition of wage changes. It is therefore of interest to see where the Irish labour market lies in terms of the findings of this literature. Accordingly, Table 1 reports the decomposition of annual earnings levels in the JC data, based on equation (3) above. The variance column indicates how earnings inequality evolved in Ireland over the nine year period. This shows that inequality was stable from 2005 to 2009, but then began to increase so that by 2013, inequality in annual earnings had increased by just under 10 per cent.

The decomposition results in the remaining columns of Table 1 show that, prior to the crisis, the breakdown between within- and between-firm factors in determining the overall variance of earnings levels was 58% to 42%. This accords with many of the results reported in Section 3 above, where the variance decomposition for wage levels is typically found to indicate

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that both within- and between-firm factors are important, with within-firm factors more likely to dominate than between-firm ones. It is notable, however, that from 2010, the proportion of the (growing) variance that is accounted for by between-firm effects increases so that by the end of the period, the proportion of the overall variation in annual earnings that is accounted for by the firm that the worker is in has increased from 42% to 48%. Thus the growth in earnings inequality experienced over this period is mainly accounted for by between-firm inequality. It is worth noting that even during the crisis period, this variance decomposition gives results that are well within the range of those obtained for other countries.

We now turn to the analysis of earnings changes. Before carrying out the variance decomposition analysis, we first document the location and spread of the pay change distribution over our data period. Table 2 shows the mean and standard deviation of the difference in log annual earnings for each year pair,[6] as well as the median, 10th percentile and 90th percentile pay change. The data clearly show the shift to the left of the pay change distribution as a result of the crisis: in 2005/06 and 2006/07, annual earnings were growing strongly, with a mean change of 6.8% in both years. The first signs of the oncoming crisis can be seen in 2007/08 figures, and by 2008/09, both mean and median wage changes are negative, which reflects the severity of the effects of the recession on workers. Thereafter, some recovery is seen, but the mean wage change remains below 3% throughout, and the median change is even lower, lying between 1% and 1.5%.

Table 2 also reveals significant heterogeneity in wage growth across individual workers. Even in 2006/07, when the median wage change is 6.8%, the worker at the bottom 10th percentile of wage changes experiences a reduction in earnings of 4.6%; the worker at the 90th percentile

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[6] The difference in log earnings is approximately equal to the percentage increase or (if negative) decrease in absolute earnings.

receives an earnings increase of 19.9%. Even greater variation is evident at the height of the crisis in 2008/09, with the standard deviation of wage changes increasing substantially to 15.5% from a pre-crisis norm of about 14%. In 2008/09 the median job-stayer in Ireland experiences a pay cut of 0.6%. However, the worker at the 10th percentile of the wage change distribution receives a substantial 17.1% cut in earnings, while those at the 90th percentile of the distribution see their earnings increase by 10.3%. In the aftermath of the crisis, the standard deviation decreases again back to close to pre-crisis norms, and the same pattern is seen of large earnings cuts at the bottom of the pay change distribution, together with large increases at the top. While it is evident that many workers experienced significant hardship as a result of the recession, this was not true of every worker.

As noted earlier, one possible explanation is that the observed heterogeneity reflects differences between firms in pay adjustment strategies. Alternatively, the heterogeneity may reflect differences within firms, as some workers receive large rises while other workers in the same firm receive smaller rises or cuts, perhaps reflecting incentive structures within firms or differences in occupational labour markets. The decomposition presented in Table 3 addresses the question of which of these explanations is more important and clearly comes down in favour of within-firm heterogeneity. In the pre-crisis years, the proportion of the variance of earnings that is accounted for by within-firm variance lies between 85% and 88%. This proportion is larger than many of the results reported in similar international studies. For example Lazear and Shaw (2009) report that the within-firm dispersion of wage growth typically accounts for about half of the dispersion of overall wage growth for a country, only exceeding 70% in two of their studies – for manufacturing workers in Norway and all workers in Italy. Within-firm dispersion in pay changes seems to be particularly important in the Irish setting.

Turning to the effect of the Great Recession on firm behaviour with respect to wage growth, Table 3 shows clearly that with the onset of the crisis, the proportion of the variance of earnings growth accounted for by within-firm factors fell sharply to 75% in 2008/09. This fall is consistent with the plausible suggestion that some firms were affected worse than other firms by the recession, perhaps because of their sector or location, so that the dispersion of firm profits increased, leading to the firm that a worker was working for becoming a much more important factor in determining his/her wage increase. Notwithstanding the increase in the importance of the between-firm variance, however, within-firm factors remain strongly dominant in determining the variance of wage changes. Moreover, the drop in importance of the within-firm variance is very temporary; by 2010/11, it is back to its previous level of 85%, and then surpasses it in the two subsequent years, rising to 90%. It seems that, for the variance of wage changes, there was a one-year shock, and then a return to business as usual.

The above decomposition focuses on the variance of wage changes within and between firms but does not pay any attention to the shape of the distribution of these changes. It could be that variances within firms are all similar, resulting in a high proportion of the total variance being attributed to within-firm effects, but that higher moments of the within-firm wage change distribution are quite different. This may particularly arise if negative pay changes are qualitatively different to positive ones; for example, the distribution of earnings changes for firms whose median pay change is negative could be skewed to the left, while for firms giving mostly pay rises, it may be skewed to the right. In this case, the variance of pay changes within firms could be similar, but not because the shapes of the firms' distributions are similar. To examine this issue we carry out the decomposition of the earnings cut binary variable described by equation (2) above. This allows us to examine the extent to which the prevalence of wage cuts within a firm

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explains the heterogeneity in the overall propensity to receive wage cuts. As discussed in the Introduction, morale considerations lead us to expect a low variation in the extent of pay cuts within firms but substantial differences between firms.

The results of this pay cut decomposition are given in Table 4. The first point to note is that the incidence of pay cuts increases sharply with the onset of the crisis, and then remains high in the following years. As a result, unlike the case for the variance of earnings changes, the variance of pay cuts stays substantially higher than in the pre-crisis period until the end of our data period. Turning to the decomposition itself, we see that the results are in keeping with those presented for pay changes. Although the contribution of between firm effects increased during the recession, differences within firms still account for over 3/4s of the variance in wage cuts.

To examine this in more detail Figure 1 shows the histogram of the employment-weighted incidence of earnings cuts within firms for 2008/09, the peak year for wage cutting. The figure shows that the distribution is almost uniform, with very few firms at or near zero (no cuts) or one (all cuts). Figure 2 shows the same histogram, but without employment weighting. A prominent spike is now visible at one, which tells us that those firms that did cut pay for everyone tended to be very small; perhaps morale considerations are more important within small firms than within large ones. Nevertheless, even in the unweighted histogram, the vast majority of firms – about 90% – cut pay for some workers but not for others. This is not in line with morale-based explanations of resistance to pay cuts.

6.2. Within-Firm Regressions

We now turn to regression analysis to examine the factors that are important in explaining wage adjustments within firms, and particularly to see whether these factors changed during the crisis. We estimate the fixed effects regression model given in equation (4), regressing individual annual earnings changes on a vector of individual characteristics including age, initial pay (which we may regard as a proxy for initial skill level), gender and nationality. Note that fixed firm-level characteristics cannot be included, as these are not identified once a firm fixed effect is introduced. As for the variance decomposition analysis, the observations used are restricted to job stayers aged 25-60 working with the same firm in each year of a given year pair and to firms with at least 10 such workers; as before, the individuals and firms included can vary across year pairs. The results are given in Table 5.

Turning first to initial pay, we see that within firms, pay changes were progressive with higher paid workers receive smaller pay rises/bigger pay cuts throughout the period. The coefficient becomes markedly more negative in 2008/09, possibly reflecting greater employer concerns about morale. Alternatively the negative coefficient of initial pay may reflect regression to the mean: workers higher up the within-firm earnings distribution in a given year are likely to have arrived there through a combination of talent and good fortune. The luck element is unlikely to persist into the following year, resulting in lower wage rises for better paid workers, whereas workers at the lower end of the distribution are unlikely to see their bad luck continue into the next period, resulting in relatively larger pay gains. However, it is more difficult to understand why this would have become more pronounced during the Recession.

With respect to age, the negative coefficients show that older workers receive smaller pay awards within firms in all years, which is consistent with concave age-earnings profiles. However,

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the size of the coefficient drops substantially in 2008/09. It does recover slightly thereafter, but the coefficient is still half its pre-crisis size by the end of our period: in 2005/06, a worker who was 10 years older than another within the same firm could expect to have a pay increase 1.3% lower than his younger colleague, whereas by 2012/13, his expected pay increase would be only 0.7% lower.

In all years, male workers receive larger pay changes within firms even after controlling for initial pay. This result may reflect males having a reward structure with lower initial pay and higher earnings growth than women, who are placed on flatter profiles. The result is, of course, also consistent with discrimination. However, it is noteworthy that the male advantage drops from about 1.5% to about 1% with the onset of the crisis and stays at this lower level thereafter. It is not obvious why the Great Recession would have induced a reduction in discrimination. One plausible explanation for the drop in the male coefficient is that men were more effective at using the tightness of the labour market during the boom to their benefit in wage bargains, but this advantage evaporated once unemployment rose. Alternatively it may reflect sectoral changes in employment resulting from the Recession.

Finally, the effect of Irish nationality is interesting. Before the onset of the crisis, being Irish has a negative effect on the size of pay changes. However, once the recession takes hold, the coefficient becomes zero, and then turns positive. It could be that the characteristics of Irish workers became more favourable relative to non-Irish workers over the period, perhaps because of differential emigration from the Irish and non-Irish groups, i.e. if better Irish workers tended to remain in Ireland, while better non-Irish workers tended to leave.

The last row of the table shows the proportion of the variance due to between-firm effects, after controlling for the independent variables. There are differences between these figures and

those obtained from the variance decomposition reported in Table 3. As expected the proportion of the variance attributed to between-firm effects is greater once worker characteristics have been accounted for; the between-firm variance accounts for between 16% and 34% of the overall variance of pay rises using this methodology, as opposed to 10% to 25% in the un =adjusted analysis. However, the time patterns are very similar in the two sets of results: the between proportion rises substantially in 2008/09, then falls back to pre-crisis levels and ends up lower at the end of the data period than at the start.

As mentioned previously, it is not possible to include firm size as an explanatory variable in the fixed effects model, as the identification of the firm size parameter would be from firms who are changing their size substantially, who are probably very untypical of all firms. However, firm size is potentially an important variable in the analysis for two reasons. Firstly, firms that are large tend to be foreign-owned and/or exporters to a far greater extent than small and medium sized firms (Lawless et al., 2012); they therefore face different competitive environments than other firms. Secondly, the wage change histograms presented earlier provide some evidence that across-the-board pay cuts were more common in small firms, perhaps because the morale effects of treating workers differently are stronger in small firms.

We have therefore estimated the fixed effects model separately for three firm size categories: small firms, with 10-49 workers in the first year of the relevant year pair; medium firms, with 50-249 workers; and large firms, with over 250 workers. The results are reported in Table 6. For each variable, the first row replicates the result shown in Table 5; the additional rows are the results of models estimated separately for small, medium and large firms respectively. The results show that there are some differences in the sizes of coefficients between small, medium and

large firms. For example, the initial pay effect is slightly more negative for small firms than for others, while the effect of being Irish is slightly more negative in large firms, and the effect of being male is more positive in large firms. However, overall the time patterns are very similar across all firm sizes.

Table 6 also reports the proportion of the variance within a firm-size category that is due to between-firm differences within a size class after controlling for the independent variables. In this respect, it is clear that large firms differ from small and medium firms. Among large firms, an even lower proportion of the total variance is accounted for by between-firm effects than is the case for small or medium firms. This may indicate that morale considerations are less important in larger firms.

The overall picture that emerges is of a labour market in which within firms forces dominate pay changes, although firm identity did become more important during the Great Recession, particularly where the firm was relatively small.

7. Conclusion

Since the seminal work of Bewley (1999), morale considerations are commonly invoked to explain why firms do not cut wages; the same considerations suggest that firms will cut wages only in extreme circumstances, and if they do, they will cut wages for all workers. We use Irish data on the population of firms and their employees from 2005-2013 to examine whether these expectations are met in reality. Ireland is a particularly interesting case because of the widespread pay cuts that were imposed on workers during the Great Recession. In such circumstances, it might

be expected that the variance of wage changes would be driven by the between-firm variation, with the employer's identity key to the size and direction of a worker's pay change.

Our results show that firm effects play a smaller role in determining pay changes in Ireland than in other countries for which similar analyses are available. Although firm effects become markedly more important in the peak year of the economic crisis, the vast majority of earnings changes continue to be driven by individual worker characteristics rather than by the firm employing the worker. This finding runs contrary to our expectations. A stronger role for the firm is seen when the variance of the incidence of pay cuts is investigated directly, but nevertheless, the vast majority of pay cuts occur in firms where other workers' pay is not cut.

Based on a fixed effects model of individual pay changes, there does seem to be some evidence of changing personnel practices as a result of the Great Recession in Ireland. These changes occur across all firm sizes and in many cases persist beyond the immediate onset of the crisis. When account is taken of worker characteristics, a greater role is seen for the firm in determining the variance of pay changes. But again, a substantial majority of the variance of individual pay changes is accounted for by individual worker characteristics rather than the firm employing the worker.

In thinking about the implications of these results for our understanding of nominal wage rigidity, several possibilities arise. The dominance of within firm forces in determining wage changes in Ireland suggests perhaps that morale issues are less important than employers gave Truman Bewley to understand in his interviews with them. However, it is also possible that workers' morale is affected less negatively by pay cuts when reports of other workers' pay cuts are widespread, even if the pay of co-workers is not being cut. Alternatively, perhaps the negative

morale implications of workers within the same firm being given differential pay changes are

entirely offset by workers' gratitude for retaining their jobs in a highly distressed labour market.

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Table 1. Variance Decomposition of Individual Annual Earnings Levels

Year	Overall Variance, Earnings Levels	Between Proportion	Within Proportion
2005	0.387	0.42	0.58
2006	0.382	0.43	0.57
2007	0.382	0.42	0.58
2008	0.383	0.42	0.58
2009	0.379	0.43	0.57
2010	0.396	0.44	0.56
2011	0.412	0.46	0.54
2012	0.417	0.46	0.54
2013	0.425	0.48	0.52

Table 2: Distribution of Individual Annual Earnings Changes

Year	Mean Earnings Change	Std. Dev. Earnings Change	Median	10th Percentile	90th Percentile
2005/06	0.068	0.137	0.058	-0.042	0.196
2006/07	0.068	0.140	0.068	-0.046	0.199
2007/08	0.048	0.144	0.045	-0.069	0.175
2008/09	-0.022	0.155	-0.006	-0.171	0.103
2009/10	0.003	0.144	0	-0.108	0.129
2010/11	0.019	0.146	0.008	-0.084	0.143
2011/12	0.021	0.143	0.011	-0.077	0.136
2012/13	0.027	0.136	0.015	-0.069	0.142

Table 3: Variance Decomposition of Individual Annual Earnings Changes

Year	Overall Variance, Earnings Change	Between Proportion	Within Proportion
2005/06	0.0187	0.13	0.87
2006/07	0.0196	0.12	0.88
2007/08	0.0207	0.15	0.85
2008/09	0.0239	0.25	0.75
2009/10	0.0207	0.18	0.82
2010/11	0.0211	0.15	0.85
2011/12	0.0204	0.10	0.90
2012/13	0.0185	0.10	0.90

Table 4: Variance Decomposition of Individual Annual Earnings Cuts (Binary Variable)

Year	Earnings Cuts Proportion	Overall Variance, Earnings Cuts	Between Proportion	Within Proportion
2005/06	0.184	0.150	0.100	0.900
2006/07	0.191	0.154	0.114	0.886
2007/08	0.246	0.186	0.144	0.856
2008/09	0.523	0.249	0.260	0.740
2009/10	0.475	0.249	0.245	0.755
2010/11	0.393	0.239	0.182	0.818
2011/12	0.353	0.228	0.143	0.857
2012/13	0.333	0.222	0.144	0.856

Table 5: Fixed Effects Model of Individual Annual Earnings Changes[*]

	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Initial Pay	-0.0303	-0.0277	-0.0390	-0.0578	-0.0380	-0.0319	-0.0390	-0.0388
Age	-0.0013	-0.0013	-0.0011	-0.0003	-0.0005	-0.0006	-0.0006	-0.0007
Male	0.0150	0.0151	0.0141	0.0092	0.0122	0.0105	0.0107	0.0109
Irish	-0.0110	-0.0106	-0.0060	-0.0000	-0.0008	0.0013	0.0007	0.0040
Constant	0.4334	0.4092	0.4993	0.5973	0.4165	0.3679	0.4465	0.4533
Between Firm %	20.1	17.1	21.2	33.6	23.3	23.2	16.1	15.7

[*] Given the very large samples used in our analysis all coefficients are highly statistically significant.

Table 6: Fixed Effects Model of Individual Annual Earnings Changes: for All Firms and by Firm Size

	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Initial Pay: All	-0.0303	-0.0277	-0.0390	-0.0578	-0.0380	-0.0319	-0.0390	-0.0388
Small	-0.0366	-0.0357	-0.0435	-0.0588	-0.0415	-0.0387	-0.0368	-0.0370
Medium	-0.0259	-0.0216	-0.0328	-0.0496	-0.0318	-0.0240	-0.0265	-0.0272
Large	-0.0276	-0.0247	-0.0391	-0.0621	-0.0392	-0.0314	-0.0487	-0.0477
Age: All	-0.0013	-0.0013	-0.0011	-0.0003	-0.0005	-0.0006	-0.0006	-0.0007
Small	-0.0009	-0.0011	-0.0010	-0.0005	-0.0006	-0.0005	-0.0005	-0.0007
Medium	-0.0014	-0.0014	-0.0011	-0.0004	-0.0005	-0.0006	-0.0007	-0.0008
Large	-0.0015	-0.0015	-0.0012	-0.0002	-0.0005	-0.0006	-0.0006	-0.0006
Male:All	0.0150	0.0151	0.0141	0.0092	0.0122	0.0105	0.0107	0.0109
Small	0.0134	0.0129	0.0118	0.0055	0.0119	0.0085	0.0103	0.0090
Medium	0.0123	0.0147	0.0120	0.0053	0.0098	0.0073	0.0060	0.0081
Large	0.0178	0.0167	0.0169	0.0139	0.0138	0.0138	0.0142	0.0143
Irish: All	-0.0110	-0.0106	-0.0060	-0.0000	-0.0008	0.0013	0.0007	0.0040
Small	-0.0097	-0.0081	-0.0036	-0.0005	-0.0012	0.0028	0.0031	0.0041
Medium	-0.0099	-0.0113	-0.0058	-0.0006	-0.0001	0.0025	0.0023	0.0051
Large	-0.0127	-0.0121	-0.0077	0.0006	-0.0010	-0.0004	-0.0024	0.0030
Constant: All	0.4334	0.4092	0.4993	0.5973	0.4165	0.3679	0.4465	0.4533
Small	0.4845	0.4825	0.5295	0.5881	0.4410	0.4252	0.4093	0.4246
Medium	0.3911	0.3461	0.4304	0.5174	0.3557	0.2868	0.3213	0.3374
Large	0.4148	0.3861	0.5169	0.6522	0.4347	0.3738	0.5577	0.5522
Between Firm %: All	20.1	17.1	21.2	33.6	23.3	23.2	16.1	15.7
Small	19.6	16.7	21.3	31.1	23.4	26.1	17.8	17.0
Medium	12.5	11.8	13.3	25.9	18.4	12.9	11.8	12.0
Large	7.3	9.9	13.2	15.9	16.4	9.8	9.8	7.4

Figure 1: Employment-Weighted Distribution of Within-Firm Pay Cut Incidence, 2008/09
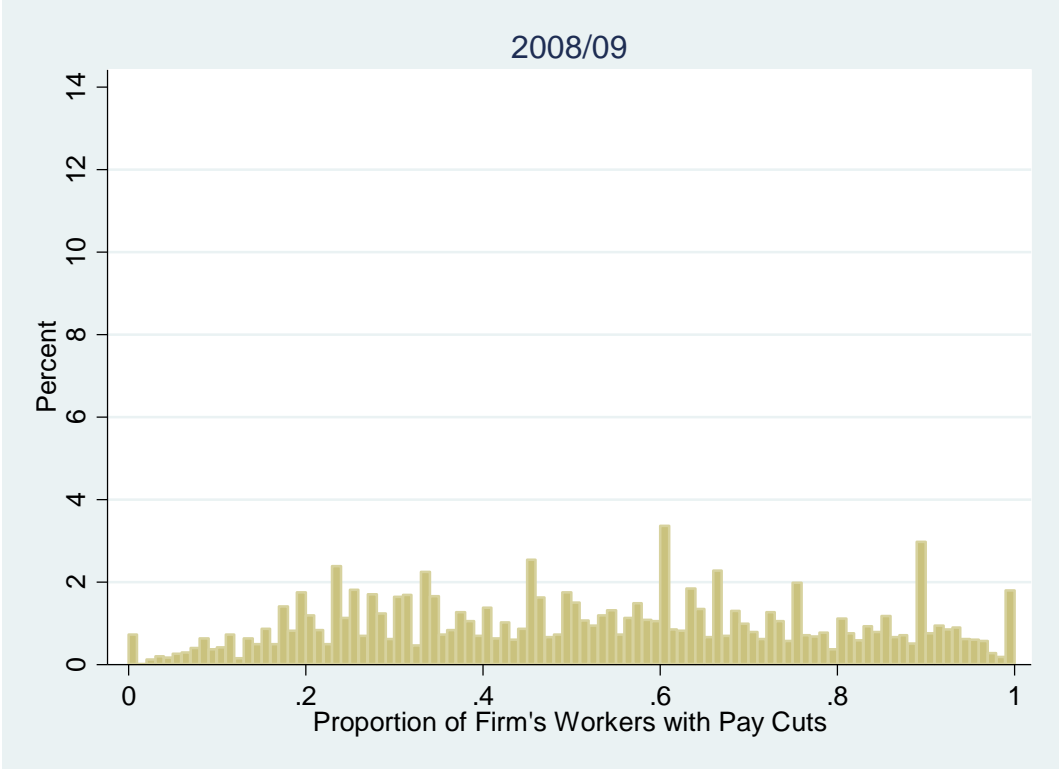

Figure 2: Non-Weighted Distribution of Within-Firm Pay Cut Incidence, 2008/09