

# **The Impact of the National Minimum Wage on the Wage Distribution, Poverty and the Gender Pay Gap**

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## Executive Summary

Deciding on the appropriate level of the National Minimum Wage (NMW) requires knowledge of how many workers will be affected by any given choice. One might think it would be a relatively simple matter to work out the numbers of low-paid workers but problems with UK statistics on hourly wages have made this more difficult than one might have anticipated or hoped. One consequence of this is that the estimates of the numbers of workers affected by the initial introduction of the NMW have been subject to substantial downward revisions. It is almost certain that the initial level of the NMW affected far fewer workers than anticipated.

The source of this problem is that there is no single ideal source of information on hourly wages. In this paper we analyse data from the Labour Force Survey (LFS). The LFS has two main sources of information on hourly wages:

- hourly pay: this is computed as a measure of weekly earnings divided by usual weekly hours
- hourly rate: this is the basic hourly rate

Initial estimates of the impact of the NMW used the hourly pay measure but it has become apparent that this measure has very substantial measurement error, resulting in an over-statement of the number of low-paid workers. The hourly rate measure is generally assumed to be a better measure of the 'true' hourly wage than hourly pay but the problem is that, while hourly pay is available for all those in work, hourly rate is only available for those paid by the hour and salaried workers do not answer this question. As a result, hourly rate is not available for more than 40% of workers.

Estimates of the impact of the NMW then try to impute the basic hourly rate for those for whom it is not observed i.e. there is a 'missing data' problem. The ONS

have suggested one methodology for doing this and provided estimates based on it but these estimates are only as good as the assumptions on which they are based. It is important to have some idea of whether the estimates are sensitive to alternative methods of solving the ‘missing data’ problem.

The main purpose of this paper is to investigate the robustness of estimates of the impact of the NMW to different methods of solving the ‘missing data’ problem.

By ‘impact’ we include:

- estimates of the numbers receiving the minimum wage
- estimates of the impact of changes in the minimum wage on the distribution of wages including any spill-over effects
- estimates of the impact of the minimum wage on other questions of interest like the impact on the gender pay gap or on poverty.

Our main conclusions are that:

- it is correct to think of the hourly rate as a better measure of the hourly wage than hourly pay.
- Estimates of the numbers affected by the NMW are sensitive to the precise methods used to compute them and this uncertainty should be a factor considered by the Low Pay Commission in its deliberations.
- The assumption made by the ONS to solve the ‘missing data’ problem is almost certainly wrong and leads to an over-estimate of the numbers of workers affected by the NMW.
- An alternative and, we argue, more plausible way of solving the ‘missing data’ problem (what we call the measurement error approach) suggests that an *upper* bound on the numbers of workers initially

receiving the NMW is 3.6% as opposed to about 5.5% based on ONS-style methodologies.

- The up-rating of the NMW to £4.10 in October 2001 affected approximately the same number of workers as did the introduction in April 1999. This conclusion does not depend on the methodology used to solve the 'missing data' problem.
- Spill-over effects from the NMW further up the distribution appear to be minimal.
- The introduction of the NMW reduced the gender pay gap by 0.3-0.4 percentage points.
- Using a better measure of the hourly wage does make the minimum wage appear better targeted on poor working households though the effect is quite small.

## **Introduction**

In deciding on the appropriate level for the NMW, one of the factors considered by the Low Pay Commission (LPC) is the likely number of people affected by it and the impact on the total wage bill. For the LPC to do its job properly requires good measures of the distribution of hourly wages and the impact of the NMW on it. One might think that providing such measures would be a simple task but it has become apparent that weaknesses in UK statistics on hourly wages makes this much more difficult than one might first have thought.

Prior to its introduction, the Low Pay Commission (LPC) estimated that around 2 million workers (or 9% of employees) would receive a wage increase, with the average wage increase being in the region of 30% (Low Pay Commission, 1998). However, since then the LPC has twice revised down its estimates of the number of workers affected to 1.5 million (6.4%) in February 2000 (Low Pay Commission, 2000) and then to 1.3 million (5.5%) in March 2001 (Low Pay Commission, 2001). The latest estimates produced by the ONS are slightly lower even than this.

The problem arises because none of the available survey data in the UK provides an accurate measure of individuals' hourly wages. The two surveys most commonly used for this type of analysis are the Labour Force Survey (LFS) and the New Earnings Survey (NES). The LFS is a household-based survey that samples about 60,000 households every quarter. Individuals are asked about their most recent earnings and their usual number of hours worked. An estimate of weekly earnings is divided by weekly hours to compute an hourly wage, called HOURPAY. However, there is good reason to think there is a large amount of measurement error in HOURPAY as a measure of hourly pay. We will discuss the source of this problem in

detail a later section. The earnings information in the NES is likely to be more accurate, since it is obtained directly from employers. However, since the NES sample is constructed from tax records, it under-samples workers with low earnings (mainly part-timers and women), and those who move jobs more frequently, and so is not very useful for measuring the extent of low pay. For this reason we do not use NES data for any of our estimates.

In this report we focus on LFS data. The most widely used measure of hourly earnings in the LFS is the HOURPAY measure described above. Figure 1 presents the bottom half of the distribution of this measure in March 1999 among adults (those aged 22+), just before the introduction of the NMW. This is the hourly earnings variable initially used to compute the impact of the NMW. Something like 8% of workers seem to be paid below the minimum, some on extremely low hourly wages. This ties in with the first estimates from the LPC on coverage of the NMW (Low Pay Commission, 1998).

Figure 2 then shows the percentage increase in wages at each percentile of the wage distribution between March and May 1999, over the period of introduction of the NMW. Also presented is the earnings increase required to raise all those initially paid below the minimum wage up to £3.60 by May 1999. This is denoted by the compliance change line. Although there is evidence of a greater increase in hourly wages for those at the bottom of the earnings distribution, the earnings increases for these workers fall a long way short of what would have been required to comply with the NMW. Indeed between 5% and 6% of workers are still apparently paid below the minimum suggesting a very serious problem with enforcement.

However, there are good reasons to think that these conclusions about the initial impact of the NMW are misleading because HOURPAY has very serious

problems of measurement error. This is likely to lead to an over-estimate of the extent of low pay, since the errors will result in a more dispersed distribution of hourly wages than is really the case. Measurement error is often not a problem when analysing averages, but when one wants to examine distributional measures such as the proportion paid below a certain wage it results in seriously biased estimates. The LPC were aware of these problems in the data and lobbied the Office for National Statistics to introduce a better measure of hourly wages. In March 1999 (one month before the minimum wage was introduced) changes were made to the LFS such that workers are now asked if they are paid by the hour and, if so, their hourly rate: this variable is denoted by HRRATE.

The distribution of HOURPAY and HRRATE are very different as Figure 3 shows. This plots the bottom half of the wage distribution for hourly pay and the hourly rate for those who respond to the hourly rate question (i.e. the samples are the same for the two distributions)<sup>1</sup>. One can clearly see that the hourly pay question has much more dispersion. It slightly over-states the numbers of workers initially paid below the minimum and seriously exaggerates the size of the gap.

Figure 4 then shows the percentage increase in wages at each percentile of the distribution of HRRATE from March to May 1999. This corresponds to Figure 2, which presented the same information using HOURPAY. The following features stand out. Only the bottom 1-2% now do not seem to comply, there is a large spike at the minimum wage with most individuals receiving a wage increase that exactly complies with the minimum wage. Secondly, to a first approximation the increase in wages seems to be confined to those initially paid below the minimum i.e. spill-over effects seem very small.

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<sup>1</sup> Note that because hourly-paid workers tend to have lower wages, the impact of the minimum wage on this sub-sample is larger than in the population as a whole.

The problem with all the results that are based on reported hourly rates is that not all workers who report a measure of hourly pay report an hourly rate. In 1999 only 30% of workers report an hourly rate though in subsequent years (when the routing of the question was changed) this rises to 40%. This does not matter if those who report an hourly rate are representative of the employed population as a whole but they are not. In particular, they tend to be lower-paid. This is confirmed in Table 1 where we report percentiles of the hourly pay distribution for those who do and do not report an hourly rate. For example, the 10<sup>th</sup> percentile of hourly pay for those who report an hourly rate is £3.35 per hour in March 1999 while it is £4.18 per hour for those who do not report an hourly rate. Those who report an hourly rate tend (unsurprisingly given the tendency for higher-paid workers to be ‘salaried’) to be worse-paid than those who do not. If we want some estimate of the impact of the NMW we need some way of imputing the hourly rate for those for whom it is missing.

The ONS proposed one way of solving this ‘missing data’ problem. But, these estimates are only as good as the assumptions made to solve the ‘missing data’ problem so that it is important to have some assessment of how good those assumptions are and whether the conclusions are sensitive to the methods chosen to solve the ‘missing data’ problem. Inevitably the ONS is expected to produce at most a handful of different estimates of the impact of the NMW so is forced to focus on a single method of dealing with the ‘missing’ data problem. But, we have the luxury of being able to present a range of estimates. If these estimates are all similar, one can feel reasonably confident about the impact of the NMW but if they are rather different then one must conclude that our knowledge is limited.

This report is an investigation into what we know and don't know about the impact of the NMW. Rather than provide a single estimate, it provides several estimates based on different methodologies in the belief that it is very unlikely that any single methodology is the right one and that one feels more confident in ones conclusions if they are robust to different ways of doing things. The report tries to provide answers to the following questions:

- is there any evidence that HRRATE is a better measure of the hourly wage than HOURPAY as has typically been assumed (perhaps, unsurprisingly, our answer is 'yes')
- what are the factors that determine the discrepancy between HOURPAY and HRRATE?
- what are the alternative methodologies that might be used to solve the 'missing data' problem?
- what do these alternative methodologies imply about: the numbers directly affected by the NMW?
- has the up-rating in the NMW kept the numbers receiving the NMW the same?
- What are the size of the spill-over effects from the NMW on those further up the pay distribution?
- what do better measures of hourly wages imply about the effect of the NMW on:
  - the gender pay gap
  - the targeting of the NMW on poor households.

Our main conclusions are as follows:

- HRRATE is a better measure of the hourly wage than HOURPAY and one can explain some of the discrepancy between them using variables related to measurement error.
- The assumption made by the ONS to solve the ‘missing data’ problem is almost certainly wrong and leads to an over-estimate of the numbers of workers affected by the NMW.
- An alternative way of solving the ‘missing data’ problem (what we call the measurement error approach) suggests that an *upper* bound on the numbers of workers initially receiving the NMW is 3.6% as opposed to about 5.5% based on ONS-style methodologies.
- The up-rating of the NMW to £4.10 in October 2001 affected approximately the same number of workers as did the introduction in April 1999.
- Spill-over effects from the NMW further up the distribution appear to be minimal.
- The NMW has reduced the gender pay gap by 1-2 percentage points.
- Using a better measure of the hourly wage does make the minimum wage appear better targeted on poor working households though the effect is quite small.

The structure of the paper is as follows. In the next section we discuss the different measures of the hourly wage available in the LFS and the reasons why they may contain error. We then address the question of whether HRRATE is a better measure of the hourly wage than HOURPAY. The third section then models the discrepancy

between HOURPAY and HRRATE showing that one can find variables to explain at least part of it. The fourth section then discusses alternative methodologies for solving the ‘missing data’ problem, discussing three main approaches: inverse propensity score weighting, weighting based on matching predicted wages (which can be thought of as a variant of the ONS methodology) and what we call a measurement error approach. The fifth section then compares estimates of the numbers paid the minimum wage using these different methodologies. The sixth section then uses the propensity score and ONS methodologies to examine the impact of the minimum wage on the bottom half of wage distribution. The seventh section briefly considers the impact of the NMW on the youth labour market. The eighth section then considers the impact on the gender pay gap and the ninth section on the impact on poverty.

## **1. Error in Measures of the Hourly Wage**

There are a number of reasons why HOURPAY and HRRATE are both likely to have some measurement error within them. The main reasons are discussed below. For each source of measurement error, we discuss the likely impact on the average measurement error and the dispersion in it. For the analysis in a later section, where we model the discrepancy between HOURPAY and HRRATE, we also discuss observable variables that might be useful in doing this.

### a) Coding Errors

Some observations are simply likely to reflect incorrect coding of responses. When this occurs, there is no reason why the entered pay measure should make any sense at all so these will often be either extremely small or extremely large values.

There are some observations about which one has very strong suspicions that they are coding errors. For example in the period March 1999 to May 2002 there are 34 observations with reported hourly rates of over £100 per hour (corresponding to a full-time annual salary in the region of £200k). Among these workers, the modal hourly wage (albeit with 3 observations) is £360 per hour. All occurring in the period in which the minimum wage was £3.60 per hour. The reported occupations of these individuals are a cab driver/chauffeur, a warehouseman and a packer/bottler/canner/filler . It is just about conceivable that the chauffeur earning £700k per annum works for Elton John but a more plausible interpretation is that a decimal point was omitted when coding HRRATE for these individuals and they are really earning the minimum wage. It is likely that there are other similar coding errors though these are harder to detect.

One should emphasize that coding errors like this are very rare, but one should not conclude from this that they have no influence on studies of the wage distribution. The fact that they can be such large outliers means that they can have a large influence on some statistics: some evidence on this regard is presented below in Table 4.

Because the only coding errors that cause big problems are those at the extreme of the distributions, the best approach to dealing with them is to trim the distribution by discarding observations that are implausibly high or low. In what follows, we discard observations with HOURPAY or HRRATE below £1 per hour or above £100 per hour. The number of affected individuals is small – 112 observations on HOURPAY and 32 on HRRATE among those reporting both pay measures – and an indication that these probably are ‘mistakes’ is that only one observation is ‘trimmed’ on both criteria.

b) Proxy responses

A substantial fraction (just under 30%) of responses are from someone other than the person to whom they refer. These are likely to be less accurate and have more rounding (we present evidence on this below). One might think that proxy responses are right 'on average' but make mistakes above and below in which case the average level of measurement error would be unaffected but the dispersion would be higher among proxy responses. But, because both reported hours and earnings may be close to the 'usual' levels for proxy responses this could conceivably reduce the measurement error in HOURPAY.

c) Rounding in responses to pay and hours questions.

There is a natural inclination for those responding to surveys to give approximate answers to questions, partly to save time, partly out of ignorance about the actual values and partly to avoid appearing too anal.

Rounding might be expected to affect both HRRATE and HOURPAY. For HRRATE, the effect of rounding will be direct but for HOURPAY it will be indirect as this variable is computed by dividing a measure of weekly earnings (GRSSWK) by a measure of weekly hours and both rounding in weekly earnings and hours might occur. And, the weekly earnings measure, GRSSWK, is itself derived from a question about the level of gross pay (GROSS99) together with a question about the period that this covers.

When individuals round responses they are likely to give round numbers as their answers to survey questions. One can then look for evidence of rounding by looking for the numbers of people who give round numbers as their level of earnings or hours. But, there is a problem in that there is a tendency for some wages to really be in round numbers. For example, it is almost certainly true that many more individuals get paid

£5.00 per hour than get paid £4.99 per hour. But, we can get some idea of the extent of this problem by comparing the incidence of rounding among those whose pay was verified by looking at a pay slip with those for whom it was not. Table 2 presents the fractions of those reporting an hourly rate ending in a '10', a '50' and a '100' for those with and without the pay slip being seen and for personal and proxy responses. As one can see, the incidence of rounding is lower for those where the pay slip was seen and for those where there was a personal rather than a proxy response. In addition the difference between the personal and proxy responses is larger where the pay slip was not seen. For example, the last panel of Table 2 shows that 14% of personal responses who looked at a pay slip had an hourly rate that was a round pound. This rises to 18% for proxy responses where the pay slip was seen. For those where pay was not verified using a pay slip, this rounding was observed in 23% of personal responses and 33% of proxy responses.

Table 3 then considers the incidence of rounding in HOURPAY. To see the evidence of rounding, we use the variable GROSS99 that is gross pay before deductions: this can be reported for a number of pay periods, the most common of which are weekly, monthly and annual. We divide the observations into those for whom a pay slip was seen and for those who gave a personal response. Table 3 shows that for those who initially report an annual salary, the most likely rounding is to the nearest '1000', for those who report a monthly salary it is to the nearest '100', and for those with a weekly salary it is to the nearest '10'. And rounding is more likely for proxy responses and in cases where the pay slip is not seen.

Detecting rounding in the response to the hours question is more difficult as the fact that most people work 5 days a week naturally makes basic weekly hours a multiple of 5. But the fact that basic weekly hours are always recorded as integers

means that those working 7.5 hours a day will record their basic weekly hours as 37 or 38, which naturally over- or under-estimates the hourly wage by 1.3%.

Because one could round up or down it is not clear whether this has any effect on the average measurement error but it would be expected to increase the dispersion. In the empirical work we below we include dummy variables for whether the earnings variable is rounded and for whether the pay slip was seen.

d) Hourly pay includes overtime.

For those who work hours of paid overtime, HOURPAY will reflect the average pay rate over all hours worked and not just the basic hourly rate in which we are interested. If the basic hourly rate, HRRATE, is  $w$ , measured hourly pay, HOURPAY, is  $h$ , total hours of work are  $H$ , overtime hours are  $O$  and the overtime premium is  $\theta$  then we will have:

$$\ln(h) = \ln(w) + \ln\left(1 + \frac{\theta O}{H}\right) \approx \ln(w) + \frac{\theta O}{H} = \ln(w) + \frac{\bar{\theta} O}{H} + \frac{(\theta - \bar{\theta}) O}{H} \quad (1)$$

where  $\bar{\theta}$  is the average overtime premium. We expect this to be positive as 29% of workers report being paid at a higher rate for overtime hours and only 2% at a lower rate. As a result we would expect HOURPAY to exceed the true hourly wage and the measurement error will tend to be larger, the higher the proportion of hours that are worked as overtime. Also, because there is variation in the overtime premium, we might expect the dispersion in the measurement error to be larger, the higher the fraction of overtime hours worked.

e) Hourly pay can include bonuses.

This can be expected to increase the average measurement error and the dispersion given the large variation in bonuses that are likely. There is a question in the LFS

about whether the previous pay contained any additions to basic pay and we include this variable to see if HOURPAY is affected by it.

f) Last pay may differ from what is usual.

Because the hours measure used to construct HOURPAY is a usual hours measure while the earnings question relates to previous earnings that may have differed from usual earnings this can also cause measurement error in HOURPAY. It may be that differences in pay from the usual level are more common in one direction than another in which case there will be an effect on the average level of measurement error. But, one would certainly expect there to be more dispersion in measurement error among those for whom the last reported pay was not usual.

g) Whether there is commonly variation in hours.

If there is variation in hours this is going to cause variation in previous earnings and this will, again, cause measurement error in HOURPAY. Again, there is likely to be more dispersion in measurement error among those whose hours vary but the average level of measurement error may be higher or lower depending on whether the variation in hours is more commonly for them to be higher or lower than usual.

h) The length of the pay period

The longer the pay period, the more room there is for earnings and hours to refer to different period in time so it is plausible that measurement errors are more frequent among those with longer pay periods.

## **2. Does HOURPAY or HRRATE Contain More Measurement Error?**

The previous section has given good reasons why both HOURPAY and HRRATE contain some measurement error, and neither can be thought of as an error-free observation of the true hourly wage. But, one should not conclude from this that both

HOURPAY and HRRATE are equally poor measures of the true hourly wage. The existing literature has assumed that HRRATE is a more accurate measure of the hourly wage than HOURPAY. In this section we present evidence in support of this view.

In the absence of an observation on the true hourly wage one might think it would be impossible to provide any assessment of whether HRRATE or HOURPAY is the more accurate measure. But, we argue that this is too pessimistic a conclusion: that a study of the discrepancy between HOURPAY and HRRATE can shed light on which is the most accurate measure even if it can never be conclusive. So, in what follows, we study,  $\varepsilon$ , the log of HOURPAY,  $h$ , minus the log of HRRATE,  $w$ , i.e we have:

$$\varepsilon = \ln(h) - \ln(w) = \varepsilon_h - \varepsilon_w \quad (2)$$

where  $\varepsilon_h$  is the measurement error in the log of HOURPAY and  $\varepsilon_w$  is the measurement error in the log of HRRATE. We will refer to  $\varepsilon$  as the discrepancy: as (2) shows, one can interpret it as the difference in the measurement errors.

Whether HOURPAY or HRRATE contains more measurement error is a matter of some importance. For, given the fact that it is likely that the true hourly wage is likely to be related to whether the hourly rate is observed or not, a decision on which of the measures is more reliable affects the choice of the hourly wage variable on which most emphasis is placed and affects the identification strategy that is most plausible for solving the ‘missing data’ problem.

One way of getting some idea of which measure contains more measurement error is to regress the discrepancy on the two individual hourly wage measures. To formalize this, suppose that the true variable is  $x^*$  (assumed to be distributed normally

with variance  $\sigma^2$ ), and one has two measures of  $x$  which are both potentially measured with error,  $x_1$  and  $x_2$ . Assume that:

$$x_i = x^* + \varepsilon_i, \quad i = 1, 2 \quad (3)$$

where it is assumed that  $\varepsilon_i$  is normally distributed with variance  $\sigma_i^2$ , independent of  $x^*$  and each other (i.e. it has a classical format<sup>2</sup>). Define the difference between the two measures of  $x$  as:

$$\varepsilon = x_1 - x_2 \quad (4)$$

Then, we must have:

$$E(\varepsilon | x_1) = \frac{\sigma_1^2}{\sigma^2 + \sigma_1^2} \quad (5)$$

and:

$$E(\varepsilon | x_2) = -\frac{\sigma_2^2}{\sigma^2 + \sigma_2^2} \quad (6)$$

What (5) and (6) say is that the variable with the most measurement error will have the largest coefficient (in absolute terms) in a regression of the discrepancy on the individual variables. In addition, a variable with zero measurement error will have a coefficient of zero.

Table 4 does this exercise for the discrepancy with our data. We report the results of a number of regressions: when all the data is used and when it is trimmed and also some median regressions. A number of features emerge very strongly. First, the coefficient on HOURPAY is always much larger in absolute terms than the coefficient on HRRATE suggesting there is substantially more measurement error in HOURPAY. Secondly, trimming the data has a dramatic effect. This can be seen most clearly by comparing the second and fourth columns of Table 4. Throwing away

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<sup>2</sup> Note that, for our data, classical measurement error is not a good assumption so this should be thought of as being for expositional purposes only.

32 observations on HRRATE reduces the coefficient on HRRATE by 40% suggesting that a handful of observations that are probably coding errors account for much of the observed measurement error. Our trimming is very cautious: there is perhaps a case for doing more. Further evidence of this can be seen in the median regressions that attach less weight to outliers. The coefficient on HRRATE is now reduced to zero.

This evidence suggests very strongly that, as one might suspect, there is more measurement error in HOURPAY than in HRRATE and that previous investigators have been right to focus on HRRATE as a better measure of the hourly wage. But, as the previous section has made clear there are some variables that might be expected to be related to the discrepancy between HOURPAY and HRRATE. The next section provides some statistical models for the discrepancy between HOURPAY and HRRATE.

### **3. Modelling the Discrepancy between Hourpay and Hrrate**

The discussion in an earlier section suggests that the distribution of the discrepancy,  $\varepsilon$ , is likely to depend on some observable variables. This section provides more formal evidence for this view. Quantile regression is a good way to look for these effects. We estimate models for the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles.

It makes sense to think about the effect that different variables have on the average value of the discrepancy and the dispersion in the discrepancy. For the average value of the discrepancy, it makes sense to look at the median regressions and for the dispersion in the discrepancy it makes sense to look at various interquartile measures (the 50-10, 50-25, 75-50, 90-50). To see the impact of a particular variable on, for example, the 90-50 differential one simply takes away the regression

coefficient for the 50<sup>th</sup> percentile from the coefficient for the 90<sup>th</sup> percentile. A variable will increase (reduce) dispersion at the top of the distribution if the coefficient for the 90<sup>th</sup> percentile is larger (smaller) than that for the 50<sup>th</sup> percentile. Similarly, a variable will increase (reduce) dispersion at the top of the distribution if the coefficient for the 50<sup>th</sup> percentile is larger (smaller) than that for the 10<sup>th</sup> percentile.

Table 5 reports estimates of the quantile regression models. As well as the variables related to measurement error discussed in the first section, we also included a set of standard controls: a quadratic in age and job tenure, sex, race, education, region and month. In addition, we report regressions which both exclude (the first five columns of Table 5) and include (the last five columns of Table 5) the log of the hourly rate. Consider the impact of the variables in turn.

First, the impact of proxy responses: proxy responses tend to have a median response for the discrepancy that is a bit lower than other responses but the effect is tiny and on the margins of statistical significance. The only sizeable effect of proxy responses is that the 50-10 difference is 2.5 percentage points. Overall, it is surprising how little difference proxy responses make.

If the payslip is seen the median discrepancy is larger but dispersion below the median is reduced (as one might expect). However, dispersion above the median is increased contrary to what one might have thought: perhaps those who retain their payslips tend to be people for whom pay varies a lot so they want to keep track of what is happening.

If there is rounding in the reported earnings figure, this has a small effect on the median discrepancy but, as one might expect, it tends to increase the dispersion.

The effect of overtime hours is large and puzzling. We include separate variables for the proportion of overtime hours if overtime is rewarded at a premium rate and if it is not. In both cases the higher the proportion of overtime hours, the lower the median discrepancy between HOURPAY and HRRATE. This is the opposite of what one would expect, particularly if over-time hours are rewarded at a premium rate. There are a number of possible hypotheses for this.

First, it may be the case that the type of workers who work overtime (particularly paid over-time) differ from those who do not and tend to be lower-paid. If this was the case we might expect to see similar effects on hourly pay and the hourly rate. In fact, the large coefficients reported in Table 5 seem to be the result of an effect of overtime on hourly pay and not the hourly rate. Secondly, it could be caused by ‘division bias’, the fact that HOURPAY is computed by dividing weekly earnings by weekly hours. However, a simple ‘division bias’ cannot explain the results as the overtime hours variable is the *proportion* of total hours that are over-time. But, a more subtle form of ‘division bias’ could emerge if there was more measurement error in overtime hours than in basic hours (imagine the case where there was no variation in basic hours). There is some evidence for this hypothesis: if one considers workers who are in the same job in two successive quarters of the LFS the correlation between their reported usual basic hours in the two quarters is 0.9 whereas it is 0.7 for the usual paid overtime hours. However, it is not clear whether this can entirely explain the problem. If one uses the proportion of overtime hours from the previous quarter on the right-hand side of the discrepancy equations estimated in Table 5 then one obtains the same qualitative results. But, our results do suggest that some more thought should be given to the role of overtime hours in the construction of HOURPAY.

If the previous pay contained a bonus, this is an additional reason why HOURPAY tends to be above HRRATE as one might expect. For those who receive a bonus, the estimates suggest that the median discrepancy between HOURPAY and HRRATE is 10%. Bonus payments are also associated with more dispersion at the top but not at the bottom which is what one might expect if, as seems plausible, bonus payments are skewed towards the right.

If the last pay was the same as usual this has a powerful effect in reducing the dispersion in the discrepancy between HOURPAY and HRRATE and also has a negative effect on the median discrepancy that is quite large. This suggests that when pay differs from usual it is more likely to do so in an upward than a downward direction.

If pay is only reported as a banded variable this tends to reduce dispersion at both the top and the bottom of the distribution. The same is true if an expected pay level is reported.

The longer the pay period the lower the level of dispersion at the top of the distribution and the larger at the bottom. If actual equal normal hours then this appears to reduce dispersion at the bottom though the effect is small.

These results are not sensitive to the inclusion or exclusion of the log of the hourly rate. The effect of that variable itself is, as one might expect, to reduce the median discrepancy. But it also seems to reduce dispersion at the top while increasing it at the bottom.

With the exception of the results on the effect of overtime hours (which remain very puzzling) the results reported in this section are in line with what one would expect. They certainly show that the variables one would expect to be of some use in explaining the discrepancy are significant in doing so.

So far, the analysis has been entirely descriptive, about the properties of HOURPAY and HRRATE. One of the conclusions has been that HRRATE is a better measure of the hourly wage than HOURPAY. But, as discussed earlier, HRRATE is only observed for 40% of workers so that one needs some way of solving the ‘missing data’ problem. The ways in which this might be done are the subject of the next section.

#### **4. Alternative Methods for Solving the ‘Missing’ Data Problem**

The basic problem with providing a good estimate of the impact of the NMW on the pay distribution is that the pay measure that is observed for everyone, HOURPAY, is widely acknowledged to contain a large amount of measurement error (something that our results in sections 2 and 3 confirm) and the better measure of the hourly wage, HRRATE, is observed only for those who are paid by the hour. Any attempt to estimate the full impact of the NMW on the pay distribution must find a way of solving this ‘missing data’ problem.

Any such solution must, as will become apparent below, make some assumption that allows one to extrapolate from the distribution of HRRATE among those for whom it is observed to those for whom it is not. It is important to realize that these assumptions are ultimately not testable: they can be more plausible or implausible. We will describe three such identifying assumptions.

Perhaps the most common type of assumption in the ‘missing data’ literature is to assume that, conditional on some set of covariates,  $x$ , the distribution of the variable of interest is independent of whether it is observed or not. The variable of interest here is the hourly rate, which we will denote by  $w$ . Define a binary variable  $R$

that takes the value 1 if the hourly rate is observed and 0 if it is not. Hence, if  $f_{a|b}(\cdot)$  denotes the density function of a conditional on b, the identifying assumption is that:

$$f_{w|x,R}(w|x, R=1) = f_{w|x,R}(w|x, R=0) = f_{w|x}(w|x) \quad (7)$$

In the language of Rosenbaum and Rubin (1983), response is ignorable conditional on x. The conditioning variables, x, are very important in this application as it is completely implausible to assume that (7) holds if we do not have any covariates: as shown in Table 1 the distribution of HOURPAY is completely different for those for whom HRRATE is observed and for whom it is not.

One of the ‘x’ variables that might be included in (7) is HOURPAY. Let us denote the value of HOURPAY by h. Then, explicitly acknowledging the role of HOURPAY, (7) can be written as:

$$f_{w|h,x,R}(w|h, x, R=1) = f_{w|h,x,R}(w|h, x, R=0) = f_{w|h,x}(w|h, x) \quad (8)$$

There are a number of ways in which this assumption can be used to provide estimates of the ‘true’ distribution of hourly wages: we describe two of them below.

a. The Propensity Score Method

Let us first consider the propensity score method. To economize on notation let us write  $z=(h,x)$ . The unconditional distribution of w (which is what we are ultimately interested in) can be written as:

$$f_w(w) = \int f_{w|z}(w|z) f_z(z) dz \quad (9)$$

where  $f_z(z)$  is the joint distribution of  $z=(h,x)$ . This can be written as:

$$f_w(w) = \int [f_{w|z,R}(w|z, R=1) p(z) + f_{w|z,R}(w|z, R=0)(1-p(z))] f_z(z) dz \quad (10)$$

where  $p(z)$  is the probability of  $R=1$  given  $z$ , the propensity score. Using the identification assumption of (8), (10) can be written as:

$$f_w(w) = \int f_{w|z,R}(w|z, R=1) f_z(z) dz \quad (11)$$

The important thing to note about (11) is that while the distribution of HRRATE conditional on  $z$  appears, the distribution of  $z$  is that for the whole population. This is not the same as the overall observed hourly rate distribution which is given by:

$$f_{w|R}(w|R=1) = \frac{\int f_{w|z,R}(w|z, R=1) p(z) f_z(z) dz}{\int p(z) f_z(z) dz} \quad (12)$$

The simplest way to compute the wage distribution in (11) is to re-weight each observation for whom the hourly rate is observed. The weight that we want to give each observation is given by:

$$j(z) = \frac{\int f_z(z') p(z') dz'}{p(z)} = \frac{p}{p(z)} \quad (13)$$

where  $p$  is the overall proportion of the sample for whom  $R=1$ . The weights to be used are the inverse of the response propensity: this is the response propensity weighting of Little (1988).

This may seem very abstract so an example may help. Suppose there are only two hourly rates in the economy - high and low – with 50% of the population in each group. Suppose that one only observes the hourly rate for 25% of those with the high wage but one observes the hourly rate for 75% of those with the low wage (and, to keep things simple, assume that these response rates are known). Overall 50% of the population report an hourly rate – this is the  $p$  in (13).

If one made no attempt to correct for the differential response rate one would incorrectly conclude that 75% of the population have the low wage as three times as many workers are observed with a low wage as with a high wage. How can propensity score re-weighting give us the correct answer? For every individual reporting a low wage, the weight as given in (13) is computed using  $p=0.5$  and

$p(z)=0.75$  leading to a weight of  $2/3$ . For individuals reporting a high wage,  $p=0.5$  and  $p(z)=0.25$  leading to a weight of 2 i.e. three times as high as for those with a low wage. A weighted average of the proportion with the low wage will then be 0.5 as, though there are three times as many individuals reporting a low wage, each of them only gets a third of the weight of each individual reporting a high wage.

This example over-simplifies the problem as, in practice, the response propensities are unknown and must be estimated. This can be done straightforwardly by estimating a binary response model (we use a probit model in our applications) for the probability of observing an hourly rate. One can then use the resulting estimates to predict the probability of an hourly rate being observed for each observation. Then, for each individual for whom the hourly rate is observed, one constructs a weight proportional to the inverse of this predicted probability. The ‘true’ wage distribution is then computed as the weighted distribution of the observed hourly rates.

It is well-known that this procedure, while consistent, lacks precision when the propensity score is low as the associated weights are very high in this case. This means that this methodology is not suitable for estimating the top of the wage distribution where very few workers are paid by the hour. But, it is likely to be more reliable in the bottom half of the pay distribution that is the main interest here.

b. Predicted Wage Matching: An ONS-style Methodology

The methodology developed by the ONS (Stuttard and Jenkins, 2001) and based on the work of Skinner and Beissel (2001) is based on an assumption similar to that contained in (7) but somewhat stronger. They assume that  $(h,x)$  only affect the distribution of the hourly rate through an effect on the mean of the distribution.

Imposing a stronger identifying assumption will lead to a gain in efficiency if the assumption is correct but risks making mistakes if it is not<sup>3</sup>.

We are not going to provide a detailed description of the ONS method but the most important features of it are as follows. A regression for the log of the hourly rate is estimated for a set of covariates and predicted values generated. Individuals without an hourly rate are then ‘matched’ with someone for whom an hourly rate is observed and who has a similar predicted hourly rate and they are then given the actual hourly rate of their ‘match’. This type of procedure is what is known as "hot deck imputation within imputation classes".

The hot-deck imputation method is not the only choice that could be made about the way to solve the ‘missing data’ problem under this identifying assumption. In many ways it is simpler (and less vulnerable to sampling variation) to estimate the overall distribution of  $w$  by re-weighting those observations for whom  $w$  is observed. The weights used are proportional to the inverse of the response propensity for someone with the same predicted hourly rate.

To see this consider the following. The ONS methodology assumes that for a given linear combination of  $z=(h,x)$ ,  $\hat{w} = \beta'z$ , the distribution of  $w$  conditional on  $(\hat{w}, z)$  is independent of  $z$  i.e.  $\hat{w}$  is a sufficient statistic. They also assume that  $\hat{w} = E(w|z)$  but that does not matter here. Now, if  $f_z(z)$  is the marginal density of  $z$  in the population and  $p(z)$  is the probability that someone with characteristics  $z$  reports an hourly wage, we will have:

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<sup>3</sup> The assumption that the  $x$  variables are only ‘mean-shifters’ is a testable assumption and the tests we have done indicated that it fails. For example the distribution of the ‘residuals’ from the hourly rate equation differs according to the level of the predicted hourly rate. Though this may not make much difference to the estimates in practice.

$$\begin{aligned}
f_{w|\hat{w},R}(w|\hat{w},R=1) &= \frac{\int_{\beta'z=\hat{w}} f_{w|z,R}(w|z,R=1) p(z) f_z(z) dz}{\int_{\beta'z=\hat{w}} p(z) f_z(z) dz} \\
&= \frac{\int_{\beta'z=\hat{w}} f_{w|z}(w|z) p(z) f_z(z) dz}{\int_{\beta'z=\hat{w}} p(z) f_z(z) dz} = f_{w|\hat{w}}(w|\hat{w})
\end{aligned} \tag{14}$$

where the first equality follows from (8) and the second from the assumption that  $\hat{w}$  is a sufficient statistic.

Given the result in (14), one can simply apply the earlier result to show that one should re-weight the data using weights proportional to the inverse of the propensity score for a given predicted wage.

The ONS matching procedure can be thought of one way of doing this re-weighting as the process of finding a match for those without an hourly rate among those with an hourly rate and a similar predicted wage will tend to produce an average number of matches that is identical to the propensity score. The two methods would produce identical results in an infinitely large sample but the imputation seems less than ideal in a relatively small sample as the matching procedure inevitably introduces some sampling variation into the estimates. The one ‘advantage’ of the ONS matching procedure is that it provides an estimate of the hourly rate for those for whom it is not directly observed.

Note that, although this methodology is closest in spirit to the ONS methodology it will not produce identical estimates in practice. For this reason, we refer to it as an ‘ONS-style’ estimate. The differences arise because of differences in the way in which HRRATE is modelled, and because of differences in the way in which the re-weighting and donor assignment is done. If two apparently equally

reasonable modelling decisions lead to different estimates then one should probably conclude that estimates of numbers affected by the NMW are imprecise.

c. Why the ONS Identification Assumption is Likely to be Wrong

The ONS approach is based on the most common identification assumption used in the ‘missing data’ literature and, consequently, represents a natural starting point. Unfortunately, there is a good reason to think it is inappropriate in this particular application. To see this note that the identification assumption in (8) can be written in the following way:

$$\begin{aligned} \Pr(R = 1|w, h, x) &= \frac{\Pr(w, R = 1|h, x)}{\Pr(w|h, x)} \\ &= \frac{\Pr(w|h, x, R = 1)\Pr(R = 1|h, x)}{\Pr(w|h, x)} = \Pr(R = 1|h, x) \end{aligned} \quad (15)$$

This can be interpreted in the following way. It says that the probability of observing HRRATE is independent of the true value of HRRATE once we control for the level of HOURPAY and other covariates, x. Another way of understanding it is to note that the identifying assumption is that, conditional on (h,x), w and R are independent of each other. One can write this independence assumption either in the form of (8) or (15).

It is important to realize that this identifying assumption is highly implausible if, as is indeed the case, HOURPAY is significant in explaining whether HRRATE is observed or not. The reason is that HOURPAY can be thought of as containing both a part related to the true hourly rate and a part that is measurement error. The assumption in (15) then implies that the measurement error part of HOURPAY is useful in predicting whether an hourly rate is observed and not the true hourly rate part. There is no good reason to believe this: it seems much more plausible to think

that the true hourly rate part contains the useful information as it seems sensible to believe that those with higher wages are less likely to be paid by the hour. This bias is likely to lead to an over-estimate of the numbers receiving the NMW using the ONS and propensity score methodologies: as we shall see below, our other estimates do suggest this to be the case. This problem has been noted by the ONS but not much has been done about it.

Given this, it is more plausible to reverse the roles of  $w$  and  $h$  in (15) and to assume that the true hourly rate is of use in predicting whether an hourly rate is observed but that the measurement error is not. Conditional on the hourly rate,  $w$ , HOURPAY is then assumed to have no extra explanatory power in predicting whether an hourly rate is observed. One can then modify the identifying assumption to:

$$\Pr(R = 1|w, h, x) = \Pr(R = 1|w, x) \quad (16)$$

This identifying assumption is much more plausible. It acknowledges that the true level of hourly pay is important in determining whether an hourly rate is observed but assumes that the measurement error part of hourly pay has no power to explain whether an hourly rate is observed<sup>4</sup>.

An alternative way of writing this identifying assumption is then to note that:

$$\begin{aligned} f_{h|w,x,R}(h|w, x, R = 1) &= \frac{f_{h,R|w,x}(h, R = 1|w, x)}{f_{R|w,x}(R = 1|w, x)} \\ &= \frac{f_{R|w,h,x}(R = 1|w, h, x) f_{h|w,x}(h|w, x)}{f_{R|w,x}(R = 1|w, x)} = f_{h|w,x}(h|w, x) \end{aligned} \quad (17)$$

Note that this also implies that:

$$f_{h|w,x,R}(h|w, x, R = 1) = f_{h|w,x,R}(h|w, x, R = 0) = f_{h|w,x}(h|w, x) \quad (18)$$

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<sup>4</sup> One should recognize that both HOURPAY and HRRATE contain measurement error though it is much larger in HOURPAY. In this situation HOURPAY may contain useful information on the true hourly rate that is not contained in HRRATE and nece be useful in predicting whether an hourly rate is observed. But, as we are using HRRATE as the true value for those for whom it is observed, we do not do anything about this here.

By comparison with (8), one can note that the roles of  $h$  and  $w$  have been reversed. One interpretation of (18) is that it says that the measurement error is independent of whether an hourly rate is observed or not: consequently, we call this the measurement error assumption.

d. Estimating the True Wage Distribution with the Measurement Error

Assumption

One can understand the principle behind identification in this case quite simply though executing it in practice is not so straightforward. One needs to estimate  $f_{w|R}(w|R=0)$  i.e. the distribution of the hourly rate for those for whom it is not observed. It is perhaps more helpful to think in terms of estimating  $f_{w|h,x,R}(w|h,x,R=0)$ . Now, we observe the distribution of  $h$  conditional on  $x$  for those without an observed hourly rate: denote this distribution as  $f_{h|x,R}(h|x,R=0)$ .

And, this distribution can be written as:

$$f_{h|x,R}(h|x,R=0) = \int f_{h|w,x,R}(h|w,x,R=0) f_{w|x,R}(w|x,R=0) dw \quad (19)$$

Both the distributions on the right-hand side of (19) are unknown but the identification assumption of (18) can be used to write this as:

$$f_{h|x,R}(h|x,R=0) = \int f_{h|w,x,R}(h|w,x,R=1) f_{w|x,R}(w|x,R=0) dw \quad (20)$$

and it is now only  $f_{w|x,R}(w|x,R=0)$  that is unknown and what we want to estimate.

One can think of estimation as being trying to find  $f_{w|x,R}(w|x,R=0)$  to satisfy (20).

This is an example of what is known in the statistical literature as an inverse problem, and these are known to be tricky.

One way of understanding why it is tricky is to imagine that both  $h$  and  $w$  are discrete random variables with an equal number,  $n$ , of points of support.

$f_{h|x,R}(h|x, R=0)$  and  $f_{w|x,R}(w|x, R=0)$  will then be n-dimensional vectors and  $f_{h|w,x,R}(h|w, x, R=1)$  an n x n matrix. One can only estimate  $f_{w|x,R}(w|x, R=0)$  if  $f_{h|w,x,R}(h|w, x, R=1)$  is of full rank in which case the estimate of  $f_{w|x,R}(w|x, R=0)$  will be given by:

$$f_{w|x,R}(w|x, R=0) = f_{h|w,x,R}(h|w, x, R=1)^{-1} f_{h|x,R}(h|x, R=0) \quad (21)$$

The problem comes from the fact that, as one increases n (so the discrete random variable approaches a continuous one) the columns of  $f_{h|w,x,R}(h|w, x, R=1)$  are likely to be close to linearly dependent leading to large imprecision in the estimation of  $f_{h|w,x,R}(h|w, x, R=1)^{-1}$  and, consequently, through (21) a lot of imprecision in the estimation of  $f_{w|x,R}(w|x, R=0)$ . We do not have a solution to this problem and we have not managed to make the measurement error approach provide reliable estimates of the whole of the wage distribution. But, we have used it to compute an upper bound on the number of workers receiving the NMW.

Our strategy for doing this is the following. First, we discretize both HOURPAY and HRRATE by rounding values to the nearest 5p. There is not much information lost in this as something like 70% of observations on HRRATE are a multiple of 5p. Once we recognize that HOURPAY and HRRATE are discrete variables, one can write (20) as:

$$f_h(h_i|x, R=0) = \sum_j f_{h|w}(h_i|w_j, x, R=1) f_w(w_j|x, R=0) \quad (22)$$

where  $f_{h|w}(h_i|w_j, x, R=1)$  is the probability of observing HOURPAY in the ith category given HRRATE in the jth category,  $f_h(h_i|x, R=0)$  is the probability of observing HOURPAY in the ith category, and  $f_w(w_j|x, R=0)$  is the probability of

observing HOURPAY in the  $i$ th category given HRRATE in the  $j$ th category all given  $x$  and the appropriate value of  $R$ .

There is a choice between modelling the discrete density functions in (22) in a parametric or non-parametric way. Both methods have advantages and disadvantages. A non-parametric method imposes less structure and is less vulnerable to model misspecification. But, it is much more vulnerable to small sample sizes, particularly if one includes much in the way of control variables. In contrast parametric methods lessen the problem of small sample sizes but increase the vulnerability to model misspecification.

Here, we use a non-parametric approach to put an upper bound on the number of people paid the minimum wage. One of the features of the joint distribution of HOURPAY and HRRATE is that, given HRRATE, the modal value of HOURPAY is equal to HRRATE i.e. there is a group of workers who have zero discrepancy. So, for those reporting HRRATE equal to the minimum wage, there is a group of workers who report HOURPAY as being the minimum wage as well. Using (22) we have that:

$$f_h(mw|x, R=0) \geq f_{h|w}(mw|mw, x, R=1) f_w(mw|x, R=0) \quad (23)$$

where  $mw$  is the minimum wage. This can be re-arranged to yield:

$$f_w(mw|x, R=0) \leq \frac{f_h(mw|x, R=0)}{f_{h|w}(mw|mw, x, R=1)} \quad (24)$$

Both probabilities on the right-hand side of (24) can be estimated and this can be used to estimate the fraction of workers without an observed hourly rate who are paid the minimum wage.

e. A Note of Caution

One must also recognize the fact that hourly-paid workers may simply be so different from workers who are not paid by the hour that there is no plausible way to ‘solve’ the missing data problem. In this case one must be honest and say that it is simply not possible to provide a reliable estimate of the impact of the NMW. To give an example where this might be the most honest conclusion, suppose that one only observed the wages of men but wanted to ‘estimate’ the wages of women. One can make identifying assumptions like the ones used here e.g. that the distribution of wages among women will be the same as that among men with similar observed characteristics. But, we know that all such assumptions are ‘wrong’: one will make big mistakes in predicting the wages of women using methodologies similar to the ones used here. One must be open about the possibility that this is the situation we are faced with in the case of estimating hourly wages for those who are not paid by the hour.

**5. Estimates of the Number of Workers Affected by the NMW using different methodologies.**

In this section we present estimates of the number of workers paid the NMW using the propensity score, predicted wage matching and measurement error approaches described above. We are particularly interested in the numbers receiving the minimum wage just after introduction and just after the up-rating to £3.70 in October 2000 and to £4.10 in October 2001. We also investigate how sensitive both these approaches are to the covariates included.

In what follows we restrict attention to those aged 22 and above (i.e. those eligible for the adult NMW) and to main jobs only. We exclude second jobs (which

exist for approximately 8% of the population) for the reason that the LFS has no information on the hourly rate in second jobs and the hourly pay cannot be computed in exactly the same way as it is for the main job. But ONS estimates do include an estimate of the number of second jobs being paid the NMW so ours are not directly comparable. As the data suggests that second jobs have lower wages than main jobs we are likely to be under-estimating the number of jobs affected by the NMW though this effect is likely to be very small in practice.

Table 6 presents estimates of the impact effect of the introduction of the NMW over March – May 1999 using the predicted wage matching methodology. The first column gives the raw distribution of the hourly rate in different pay bands, which can be thought of as the estimate when no covariates are included. We then include controls for age, education, gender, race, temporary, part-time, public sector, month and employer size. As can be seen from the second column, this substantially reduces the measures of the extent of low pay. For example, the unweighted estimates suggest that 11.5% of workers were paid below £3.60 in March 1999 while introducing the covariates makes this fall to 7.1%. Similarly the unweighted estimates suggest 9.9% of workers paid within 1p of £3.60 in May 1999 while this falls to 6.3% in the second column.

These estimates are sensitive to the covariates used. Including industry and occupation dummies leads to a further fall in the estimates of the number of low-paid workers as does the inclusion of a dummy variable for a proxy response. For example, the proportion paid below the NMW in March 1999 falls somewhat with the inclusion of these variables, as does the proportion paid within 1p of the NMW in May 1999. The final column also includes the log of the observed hourly pay. Inclusion of this variable leads to a further substantial fall in the estimates of the

extent of low pay and the impact of the NMW. We estimate that some 6.7% of employees were paid below £3.60 in March 1999 and 5.3% were paid within 1p of £3.60 in May 1999 with this full specification. These results are broadly similar to the estimates produced by the ONS although they imply somewhat more low pay than the ONS find in their preferred specification restricting attention to LFS main jobs only.

Table 7 presents estimates of the impact effect of the NMW using the propensity score methodology. The first column presents the unweighted hourly pay distribution again for reference. In the basic specification the estimated proportion paid below the minimum wage in March 1999 is higher than that estimated the predicted wage matching methodology at 8.5% compared to 7.1%. However, the estimated spike at the minimum wage in May 1999 is similar using the two methodologies; 6.4% and 6.3% respectively. As one adds in more covariates the difference between the two methodologies is reduced. For example, adding industry and occupation dummies reduces the proportion below the minimum wage in March to 7.3% using the propensity score method compared to 6.9% using predicted wage matching. The full specification including hourly wage suggests that somewhere between 6.2 and 6.7% were paid below the minimum wage in March 1999. By May 1999 the spike within 1 penny of the minimum was between 5.3 and 5.8%, with 1.2 – 1.4% still paid below the legislated minimum.

Another way of looking at these results is graphically. Figure 5 presents the bottom half of the hourly rate distribution, both unweighted and using the two re-weighting methodologies for March 1999, immediately prior to the introduction of the NMW. The basic conclusion that weighting leads to a lower estimate of the extent of low pay can be clearly seen and also the fact that estimates using the two re-weighting methodologies are very similar.

Now consider the modest up-rating in the NMW in October 2000 by 10p an hour to £3.70. It appears that this increase has very little impact on the pay distribution. Tables 8 and 9 present the distribution of hourly pay between September – November 2000, the period of increase, using the predicted wage weighting and propensity score approaches respectively. Results are again reported for the unweighted pay distribution, and for a range of specifications with different covariates. In the actual distribution some 3.7% are paid the minimum wage of £3.60 in September 2000, a fall from May 1999 that is the result of the erosion of the NMW in real terms over the period. Some 4.6% are paid below the new minimum of £3.70 and only 4.0% are paid this new minimum in November 2000. This is far below the 9.9% paid the minimum in May 1999 right after introduction, which supports the view that the real value of the minimum wage had eroded significantly by this time. The weighted estimates of the pay distribution suggest that even less were actually affected by the new minimum wage. The fully specified models estimate that between 2.9 – 3.0% were paid below £3.70 just before the increase and between 2.0 – 2.3% were paid the new minimum a month after the increase. The 10 pence increase in October 2000 did very little to reverse the real erosion of the minimum wage.

Of more substantive importance is the October 2001 increase in the adult minimum wage to £4.10 per hour. We now use the same methodology to analyse the impact of this increase on the wage distribution. Table 10 and 11 presents the wage distribution in September and November 2001 using the wage weighting and propensity score approaches respectively. We report the unweighted distribution and then the estimated distribution under various specifications of covariates. Looking first at the un-weighted distribution we find that some 9.5% of employees are paid below £4.10 in September 2001. By November 2001 many of these have had their

wages raised to the minimum wage so that 8.4% are paid within 1 pence of the minimum and 2.7% are still below it. As we have seen above these raw figures over-estimate the true extent of low pay. Once we re-weight the wage distribution using either methodology to correct for measurement error we find far fewer employees on low pay. The full specifications with individual and job characteristics, occupation and industry dummies, controls for proxy response and the mis-measured hourly pay suggest that somewhere between 5.1 and 5.2% are paid below the new minimum of £4.10 in September 2001. By November 2001 we find 4.8 – 5.2% paid the new minimum with only a small proportion of workers still paid below it. These estimates of the proportions received the NMW just after the 2001 increase are similar to those just after the introduction in May 1999 suggesting that this increase restored the real value of the NMW to something like its original level.

As discussed in an earlier section, these estimates of the numbers receiving the NMW are all likely to be over-estimates because the assumption on which they are based - that those with similar levels of the covariates and HOURPAY are likely to have the same level of HRRATE whether they are paid by the hour or not – is probably not true. Given that those paid by the hour are more likely to be low-paid one would expect these to be over-estimates of the impact of the NMW. We now present some estimates based on the alternative ‘measurement error’ approach to the ‘missing data’ problem. We use the approach described in (24) to provide an upper bound on the numbers receiving the NMW.

Table 12 reports the estimates. We look at three sample periods: the three months after each of the changes in the NMW: May-July 1999, October-December 2000, and October-December 2001. We use three months instead of the one month we used in the other methodologies as it is important to get the sample size up

particularly when estimating the proportion of those with an hourly rate equal to the minimum wage who also report hourly pay equal to the minimum wage. But, our experimentation suggested that our results are not very sensitive to the sample period used. We also report estimates with and without a (limited) set of covariates: again, this appears to make very little difference to the results. When covariates are included, we estimate the probabilities on the right hand side of (24) by probit models.

The most important conclusion from Table 12 is that the measurement error approach implies that at most 3.6% of workers were paid the NMW both at the time of introduction and after the up-rating to £4.10 in October 2001. This contrasts strongly with the estimates based on the propensity score and predicted wage matching re-weighting that suggested an estimate in the region of 5.5%. As was expected, the ONS-style methodologies seem to have over-estimated the impact of the NMW but the extent of the over-estimate is large – at least 50% above the true level.

Because this is a dramatic conclusion, it is worthwhile trying to understand where it comes from. The difference in the two estimates are in the proportion of those who do not report a value of HRRATE who are estimated to be paid the minimum wage. For the ONS-style estimates, this is of the order of 3.6%, for the measurement error approach it is around 1.4%.

Where does the 1.5% come from? Consider the period October-December 2001. In this period 11.7% of those who report HRRATE of £4.10 (the minimum wage) also report HOURPAY of £4.10. The measurement error approach assumes this percentage is also true for those for whom HRRATE is not observed. So, when we observe that only 0.17% of those without an hourly rate report HOURPAY equal to £4.10 this implies that no more than  $0.17/11.7$  of these workers can be paid the minimum leading to an estimated percentage of 1.4%.

In other respects, conclusions about the impact of the NMW are similar: in particular the up-rating to £4.10 in October 2001 appears to have restored the minimum wage to its original real value.

## **6. Spillover Effects of the NMW**

So far, all the discussion has been about estimating the numbers paid close to the NMW. But, it is possible that the NMW also has an effect on those further up the wage distribution – what are called spillover effects. In this section we provide estimates of these. Because we have not managed to get the ‘measurement error’ approach to provide reliable estimates of the impact of the NMW on the pay distribution, we report only results from the predicted wage matching and propensity score re-weighting methodologies.

A graphical way to examine the impact of introduction of the minimum wage on the pay distribution is shown in Figure 6. This presents the percentage change in the wage at different percentiles of the estimated hourly pay distribution between March and May 1999. Figure 6 presents this for the estimated wage using the ONS methodology and Figure 7 using the propensity score method. Also presented on each figure is the compliance change, the wage increase required to comply with the minimum wage legislation. We focus here just on the bottom half of the distribution since this is the region of the wage distribution we are most interested in. Note that both methodologies do not work very well for the top half of the wage distribution. This is because there are fewer hourly wage rates reported for this part of the distribution. We can see that there are estimated wage falls for those above the 40<sup>th</sup> percentile using the propensity score method. These are likely to be due to the scarcity of data in this region of the distribution.

The results from the two methodologies are similar. As we saw above around 7% of workers are estimated to be below the minimum wage prior to introduction in March 1999. Almost everyone who has a wage below the NMW had this raised to the minimum on introduction. There is only a small proportion whose wage increase is below the compliance wage increase. Also, there is not much evidence of wage increases for those just above the minimum wage. The worry that introduction of the minimum wage would lead to spill-over effects further up the distribution doesn't appear to be supported by the data. There is some evidence of wage rises further up the distribution in the ONS results but these are unlikely to be connected to the NMW itself. Indeed they may be a result of data limitations further up the hourly pay distribution.

So far we have only examined short run changes right at the point of introduction of the minimum wage. We have only presented the impact of the hourly wage distribution a month after introduction. However, it may well be that the full impact of the minimum wage on the pay distribution was not immediate. We now examine longer run changes in the pay distribution after introduction. First, we present graphically the change in wages at different percentiles of the hourly pay distribution between March – May 1999, March 1999 – September 2000 and March 1999 – September 2001. Figure 8 presents this using the ONS wage weighting method and Figure 9 using the propensity score method. The wage changes are normalised to the change in the median wage over each of these time periods. So the figures present the change in the wage for each period relative to the change in the median. A positive number implies the wage at a given percentile is rising faster than the median, and vice versa.

The change to May 1999 is the same as that presented in Figures 6 and 7, except now this is normalised to the change in the median. We can see that the bottom percentiles are rising substantially more than the median over the period of introduction: the bottom percentile is rising between 15 and 23% faster than the median. Note that in the propensity score results the median is actually falling over this period. However, by September 2000 this increase has tapered off so that large parts of the hourly pay distribution have fallen relative to the median. And by September 2001 they have fallen further still. These results suggest that the introduction of the minimum wage had a one-off impact on the hourly pay distribution, raising wages at the bottom relative to the median. However, over time the impact of the minimum wage has tailed off as wages have once again risen faster higher up the distribution than they have at the very bottom.

Figures 10 and 11 present the same information graphically from the wage weighted and propensity score approach for the rise in the NMW to £4.10 in October 2001. Again we present the estimated change in each percentile of the wage distribution between September and November 2001 using the full model, and also the compliance change. We find that the change in the estimated wage distribution almost exactly tracks the compliance change, except for a small proportion at the bottom of the pay distribution. Also, there is no evidence of spill-over effects onto wages above the minimum wage. If anything wages just above the minimum seem to be falling somewhat over this two month period.

The main conclusion of this section is that spill-over effects from the minimum wage further up the pay distribution seem to have been very small both in the period immediately after introduction (or a rise) and over a longer period.

These conclusions based on the Figures are impressionistic. But Tables A1 through A3 in the Appendix present our estimates of the cumulative proportions of workers in different 10p bands.

## **7. The Impact of the NMW on the Wage Distribution of Young People**

Our analysis so far has focused exclusively on those aged 22 or above who are eligible for the adult minimum wage. But for those aged 18-21 inclusive there has been a lower rate, £3.00 per hour in the period April 1999 to May 2000, £3.20 in the period June 2000 to September 2001, and £3.50 since October 2001.

Estimates provided by the ONS suggest that more young people are paid the adult than the youth minimum wage though there is a substantial fraction paid below the adult rate. Our estimates of the distribution of wages for young people using our alternative methodologies confirm this<sup>5</sup>.

Table 13 presents estimates using predicted wage re-weighting while Table 14 reports the results using inverse propensity score weighting. The final column of Table 13 suggests that, just after the introduction of the NMW 6.2% of young people received the youth minimum while 10% received the adult minimum. One should also note that 11.7% were paid between the youth and the adult minimum. By October 2001 only 2.9% received the youth rate compared to 7.4% receiving the adult rate with 13.4% paid between (mostly paid the ‘round’ number of £4.00 per hour). The results using inverse propensity score re-weighting reported in Table 14 are similar though the estimates of the proportions receiving the youth rate just after introduction are noticeably higher. But, again there is perhaps some weak evidence for the declining use of the youth minimum rate.

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<sup>5</sup> Note that the ‘missing data’ problem is less severe for young people as a higher fraction report an hourly rate. This makes estimates less sensitive to the different methodologies chosen.

## 8. The Impact of the NMW on the Gender Pay Gap

Women are much more likely to receive low pay than men are. The majority of workers who are affected by the minimum wage are women so one would expect the introduction of the minimum wage to raise the wages of women relative to men and to reduce the gender pay gap. However, studies that have examined the impact of the minimum wage on gender pay differentials have found only very small impacts on the gender pay gap (Robinson, 2001, Dex, Sutherland and Joshi, 2000). This of course could be a result of mis-measurement in hourly pay. Therefore, in this section we use our methodology to estimate the differential impact of the minimum wage on the wages of men and women.

Tables 15 and 16 present estimates of the hourly wage distribution in March and May 1999 using the predicted wage re-weighting methodology for men and women respectively. The first column of each table reports the raw (un-weighted) hourly wage distribution. We can see from this that the incidence of low pay is much higher for women than it is for men. For example, in March 1999 some 6.5% of men are paid below the minimum wage of £3.60 compared to 16.2% of women. By May 1999 the proportion at the minimum wage is 4.2% for men and 14.8% for women. These raw figures suggest that far more women have received a pay rise on introduction than men, which is likely to impact upon the gender pay gap. Of course these figures take no account of the sample selection in response to the hourly wage question. The rest of the columns in these tables present the re-weighted estimates of the pay distribution controlling for different sets of covariates. As we saw above this re-weighting reduces the estimates of the numbers on low pay. However, the impact on men and women is slightly different. Including a full set of controls in the wage

weighting method reduces the estimated proportion of men below the minimum wage in March 1999 to 3.5%. For women this is reduced to 11.2%. Looking at the proportion paid the minimum after introduction in May 1999 provides an even stronger contrast. We estimate that about 1.9% of men are at the spike compared with 10.0% of women. The results from the propensity score method are presented in Tables 17 and 18. The overall story is much the same, with perhaps slightly fewer women affected than we find using the wage re-weighting. Our results suggest that at least three times as many women were affected by the introduction of the minimum wage than men.

Figures 12 to 15 present the change in the hourly pay distribution between March – May 1999 at each percentile for men and women using both the wage weighting and propensity score approach. The results are reported for the models with a full set of covariates. Also reported are the compliance changes required to conform with the minimum wage legislation. We can see that the estimated proportion of men affected by introduction is much lower than women. There appears to be almost full compliance with the minimum wage for both men and women. Also, there is little evidence of spill-over effects for either gender.

The results for men do appear to be much more volatile than for women, particularly further up the pay distribution. This may well be because a smaller sample of men reporting an hourly rate means the re-weighting is more sensitive. This is a particular problem with the propensity score results where we estimate substantial falls in wages above the 25<sup>th</sup> percentile wage. Because of this it is difficult to estimate changes in the gender pay gap as it is traditionally measured; i.e. changes in the relative average or median wages of men and women. However, if we assume that wages above the minimum wage are unaffected by the introduction of the

minimum we can estimate the impact on the average wages of men and women from the increases in wages below the minimum. The estimated effects on the mean wage ratio are relatively small. We estimate that the ratio of average women's to men's hourly wages rose by between 0.3 and 0.4 percentage points depending on the re-weighting method used. So although around 11.2% of women receive an average wage increase of about 10%, this has little effect on mean hourly pay for women. In addition, about 3.5% of men receive a wage increase of about 9%, so the effect on the ratio of men's to women's pay is small.

Tables 19 to 22 present estimates of the hourly pay distribution in September and November 2000, which spans the October 2000 increase in the minimum wage to £3.70. Results are reported for men and women using both the wage re-weighting and the propensity score re-weighting approaches. Again the columns of the tables present the raw distributions and estimates for a different set of covariates. These results tie in with those reported above where we found far fewer employees affected by this uprating of the minimum wage than by introduction. We find that only about 1% of men and just over 3% of women are affected by this increase in the minimum wage.

More significant was the increase in the minimum in October 2001 to £4.10. Tables 23 to 26 present the same information but for September and November 2001, which spans this up-rating. From the raw (un-weighted) distribution we see that 5.1% of men are paid below the new minimum just prior to up-rating and that 3.6% are paid at the new minimum just after. This compares with 12.3% of women below in September 2001 and 11.8% at the minimum in November 2001. Re-weighting using either technique reduces these numbers substantially. The full specifications suggest that between 2.6 and 2.7% of men are paid below prior to up-rating and between 1.6

and 1.8% are paid at the minimum afterwards. For women, between 7.1 and 7.4% are below the new minimum prior to the increase and between 7.4 and 8.3% are paid at the new minimum just after. So the impact on wages for both men and women is less than the introduction of the minimum wage in April 1999.

Figure 16 to 19 present the estimated impact on the bottom half of the wage distribution for men and women using the wage –re-weighting and the propensity score re-weighting techniques. We see that fewer men than women have their wages raised by the up-rating in the minimum and that there appears to be little in the way of spill-over effects on wages above the minimum. Again the results are more volatile for men than women due to sample size differences. Assuming that wages above the new minimum are unaffected we can calculate the impact of this up-rating on the gender pay gap. Again we find small effects on the mean wage ratio of mens’ and womens’ pay. This is increased by only about 0.1 – 0.2 percentage points, an effect smaller than at introduction because the rise in the minimum wage is from a situation in which some minimum wage is in force.

## 9. **The link between the National Minimum Wage and Household Incomes**

One of the main controversies surrounding the introduction of the minimum wage is concerned with the extent to which a minimum wage can relieve poverty. Arguments against using a minimum wage as an anti-poverty tool stem from the view that low wage workers do not live in poor households; they are likely to be teenagers or working wives whose income is not that important for overall household well-being. Furthermore, the poor are those without work; pensioners, unemployed and inactive. These views have been changed somewhat by recent evidence. While it is clear that a minimum wage cannot directly affect individuals without work, evidence

suggests that the link between low pay and poverty has increased over the last few decades (Dickens, 1999).<sup>6</sup>

However, this research is based on measures of hourly pay that contain measurement error, and so may wrongly identify individuals as being minimum wage workers. In addition, the household income information that is used in these studies may also contain measurement errors. In this section we examine the extent to which these errors affect the estimates of the link between low pay and low household incomes.

To do this we ideally require a measure of household income and a decent measure of hourly rates in the same data set. Unfortunately the LFS does not contain good information on household incomes.<sup>7</sup> However, we can construct a measure of total weekly household earnings from the LFS and use this as a proxy for income. We then examine the extent to which different measures of hourly pay affect the correlation with household earnings.

Firstly we construct net weekly household earnings by summing earnings across all working individuals in the household. We then equalise this using McClement's equivalence scales, based on total household composition. And compute household earnings deciles across individuals who are in work. Table 27 then presents information on the distribution of minimum wage workers across these equalised household earnings deciles, using different measures of hourly pay. Affected workers are here defined as having a wage below the minimum in March 1999. Columns 1 and 2 present the distribution of affected workers based on the hourly pay measure and the hourly rate measure, for those individuals with an hourly

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<sup>6</sup> Also, because low paid individuals move in and out of work it may be that a minimum wage can affect persistent poverty (Stewart, 1999).

<sup>7</sup> While information is now collected in the LFS on a range of income sources these are unreliable and contain many missing values.

rate. Note that because we have to restrict to individuals with an hourly rate to make this comparison there will not be an equal number of individuals in each decile (since those reporting an hourly rate are more likely to have a low income).

Using the derived hourly pay measure, which contains measurement errors, we find that about 35% of those affected are in the bottom decile and 62% are in the bottom three deciles. Using the hourly rate measure we find 40% affected workers in the bottom decile and 66% in the bottom three deciles. So the two different measures for this group who report an hourly rate are not drastically different. However, these measures do not allow for the differential response to the hourly rate question. The final two columns of Table 27 present the re-weighted estimates of the distribution of affected workers across deciles using the propensity score and wage re-weighting approaches outlined above. Again these re-weighting procedures make little difference to the results. There is some variation in the proportion observed in the bottom decile but the overall correlation between low wages and low household earnings is not greatly affected by the measure of hourly wage utilised. Table 28 presents the same information for workers affected by the minimum wage increase to £4.10 in October 2001. Again the results are not significantly affected by the hourly wage measure used.

A different way of looking at the same information is to consider the share of the total gains from the introduction of (or rise in) the NMW that is accounted for by people in the different deciles. This exercise is done for March 1999 (i.e. just before introduction) in Table 29 and September 2001 (i.e. just before the rise to £4.20) in Table 30. The main conclusion is that using either of the re-weighting methodologies rather than the distribution of hourly pay makes the share of the gains from the minimum wage going to those in the lowest decile much larger and the share going to

those in the highest deciles less. Again, this suggests that using better measures of hourly wages makes the NMW seem somewhat better targeted on poverty.

## **10. Conclusions**

This paper has investigated the impact of the NMW on the distribution of wages. What might appear to be a very simple task is made more difficult by weaknesses (largely unavoidable) in the UK statistics on hourly pay. Any attempt to provide an assessment of the impact of the NMW on the pay distribution must use some method to address the ‘missing data’ problem caused by the fact that the hourly wage is not directly observed for 60% of workers. We have investigated a number of different methods for solving this ‘missing data’ problem and one must recognize that many conclusions about the impact of the NMW are sensitive to the assumptions made.

Our most startling conclusion is that the assumption used by the ONS to provide estimates of the impact of the NMW is almost certainly invalid and that a more plausible methodology leads to estimates of the impact of the NMW that are much lower than previous estimates. In fact, the ONS estimates may have over-estimated the numbers paid the minimum wage at the period of introduction by 50%.

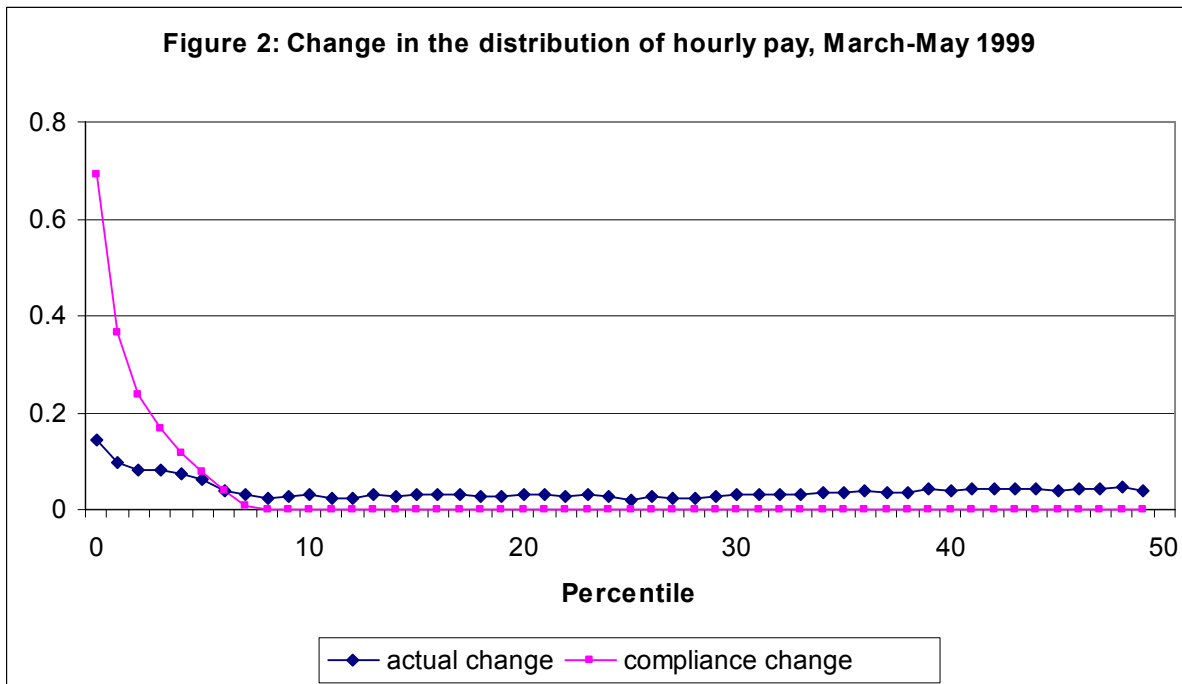
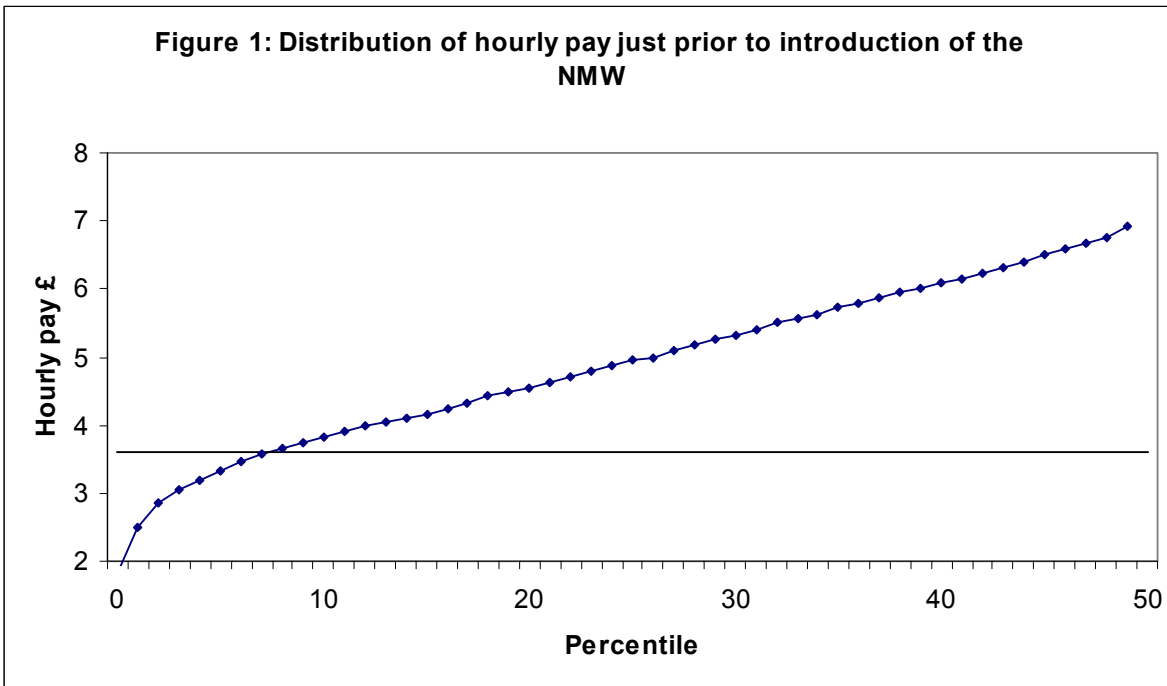
Our new methodology is not without its problems itself. In particular, though the estimates of the proportion affected reported above do seem robust, we have not been able to use it to produce reliable estimates of the impact of the NMW on wages further up the wage distribution. The honest conclusion is that there remains very considerable uncertainty about the true impact of the NMW.

Other conclusions are less sensitive to the methodology used. The up-rating to £4.10 in October 2001 appears to have restored the NMW to its initial level in real terms. And, there is very little evidence of spill-overs from the minimum wage

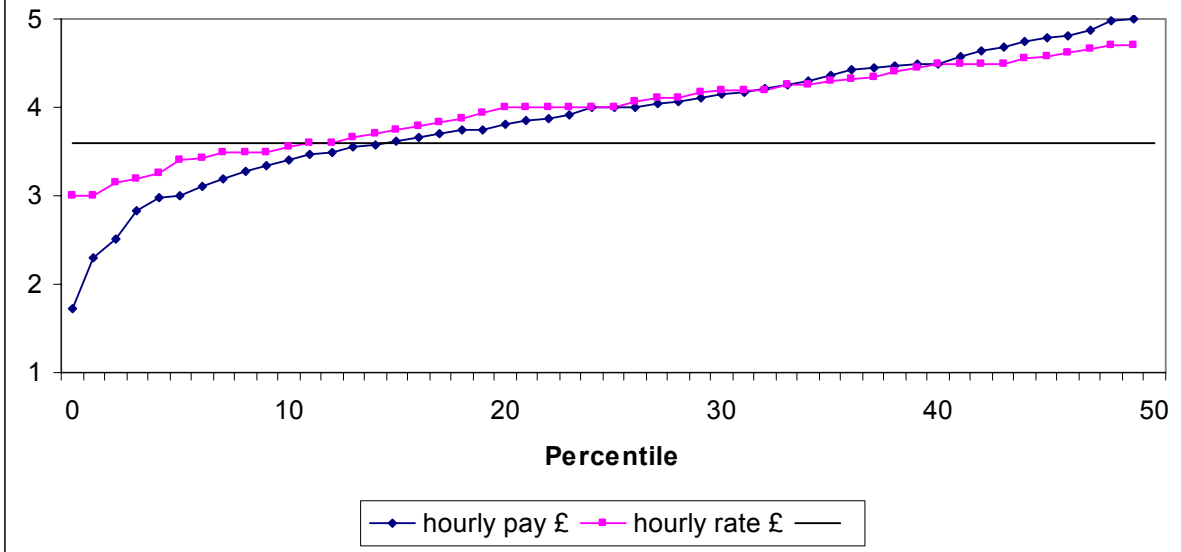
further up the pay distribution. Finally, the introduction of the NMW appears to have reduced the mean gender pay gap by 0.3 - 0.4 percentage points and a better measure of hourly wages does appear to imply that the minimum wage is slightly better targeted on poor households than previously thought.

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**Figure 3: The distributions of hourly pay and hourly rate compared, March 1999**



**Figure 4: The change in the distribution of un-weighted hourly rate, March-May 1999**

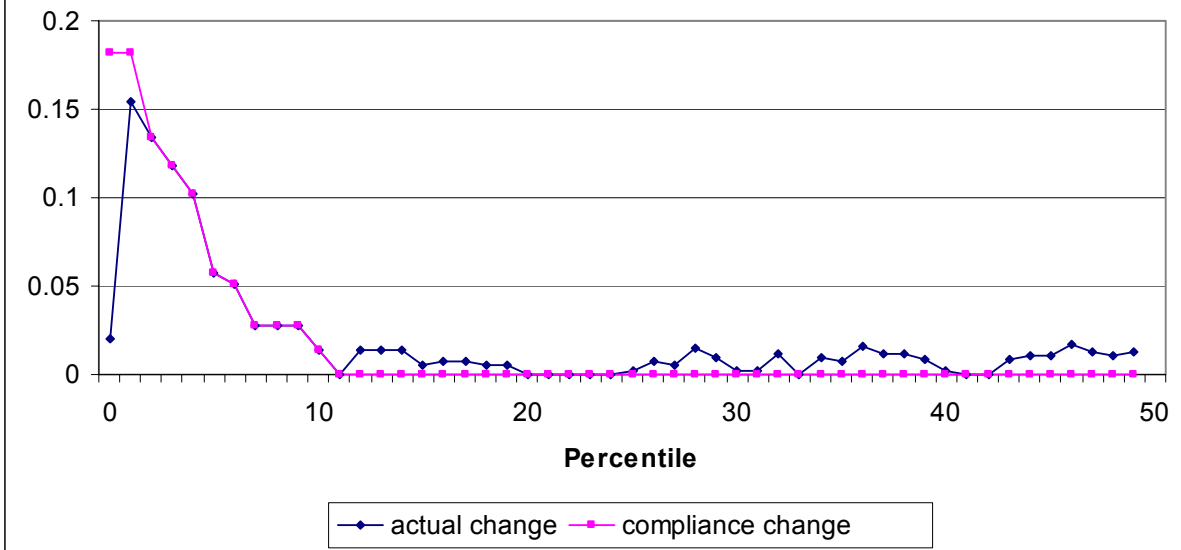
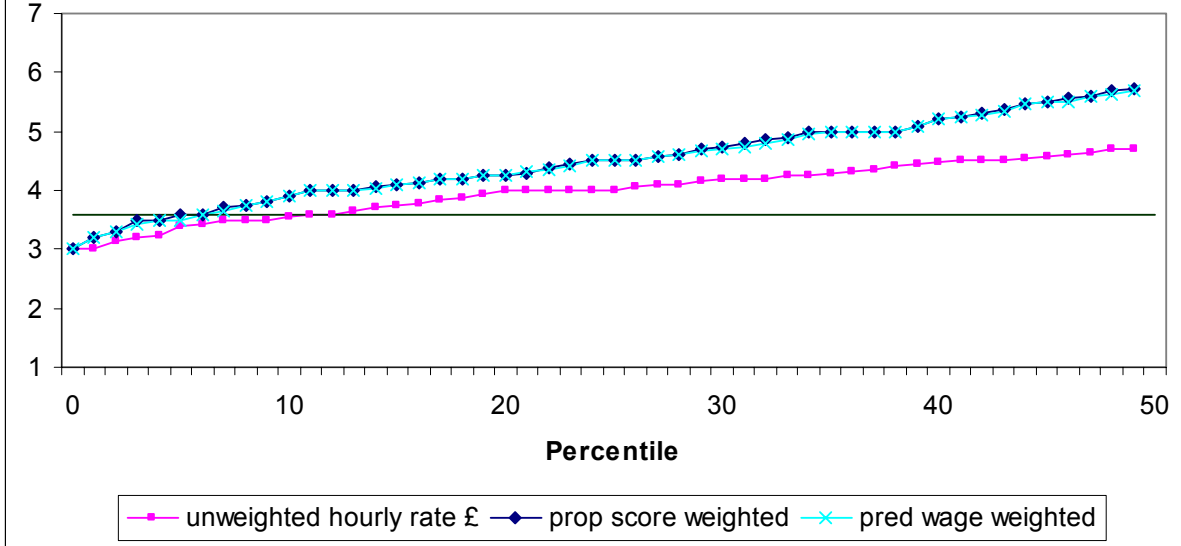
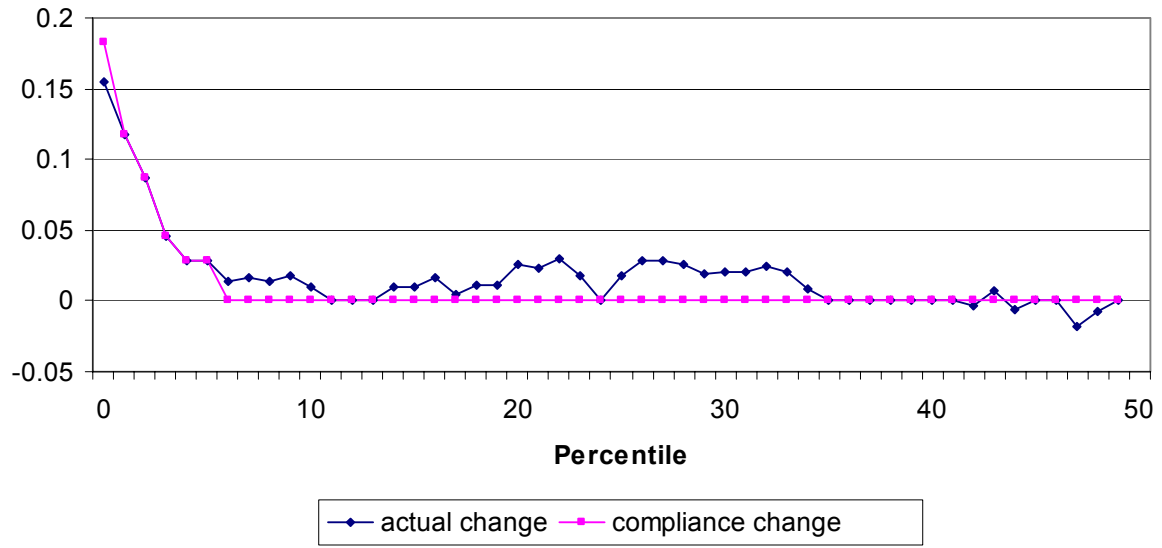


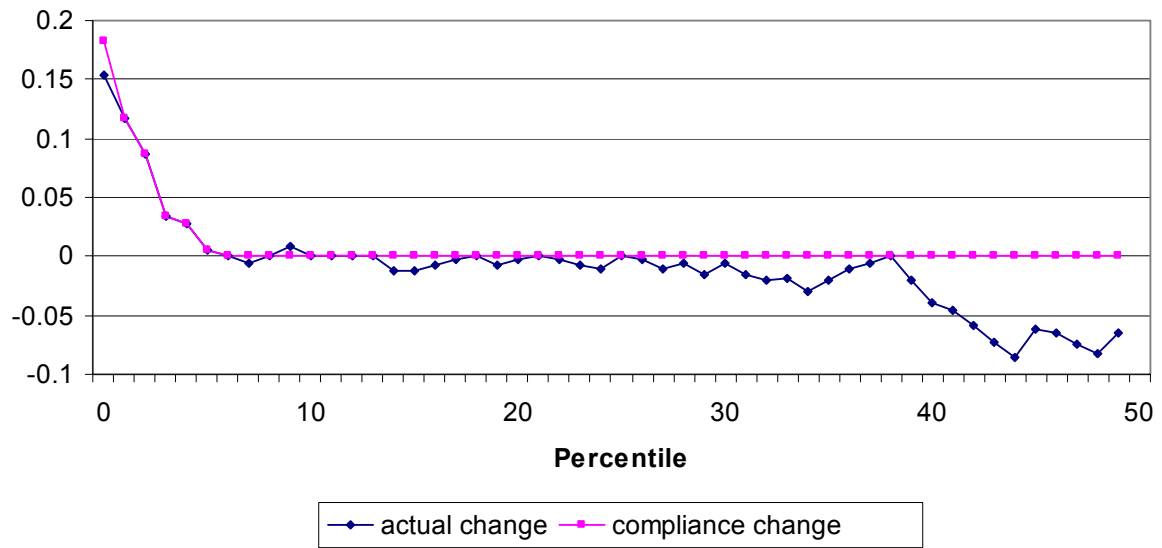
Figure 5: The distributions of weighted and unweighted hourly rate compared, March 1999



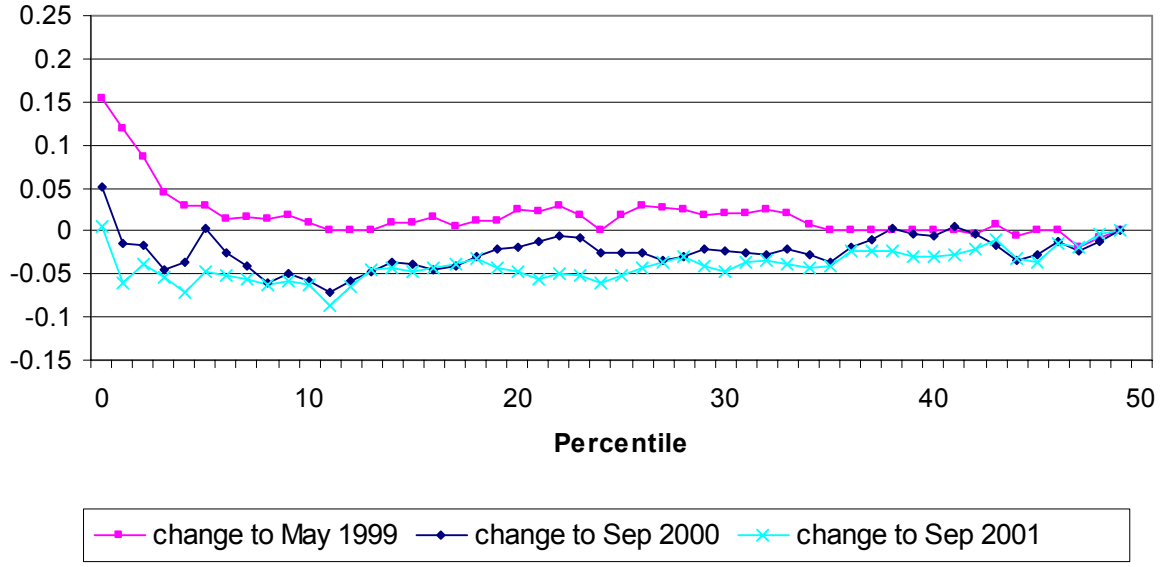
**Figure 6: The change in the distribution of predicted wage weighted hourly rate, March-May 1999**



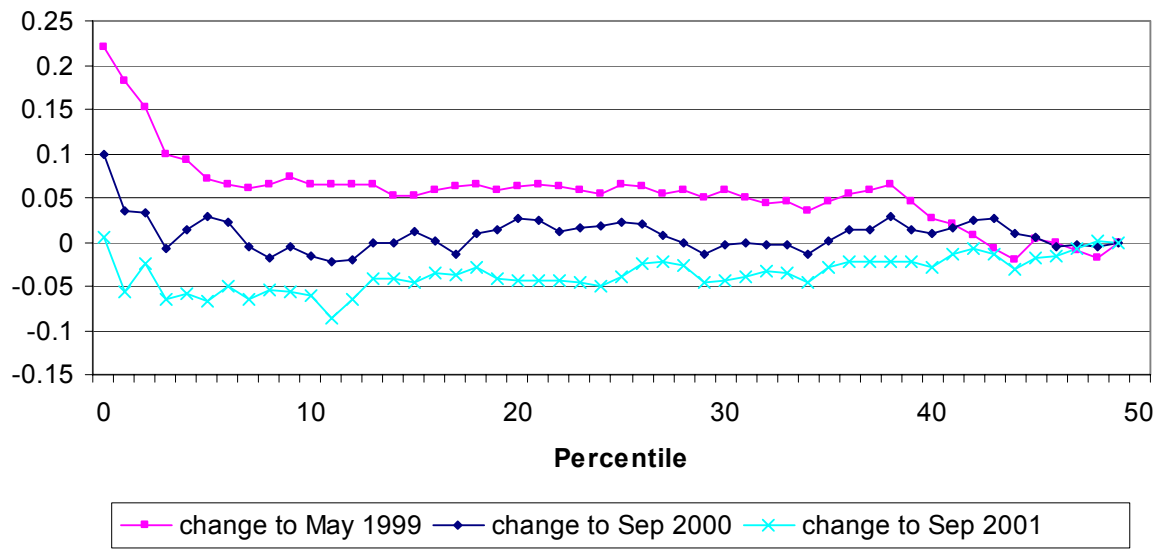
**Figure 7: The change in the distribution of propensity score weighted hourly rate, March-May 1999**



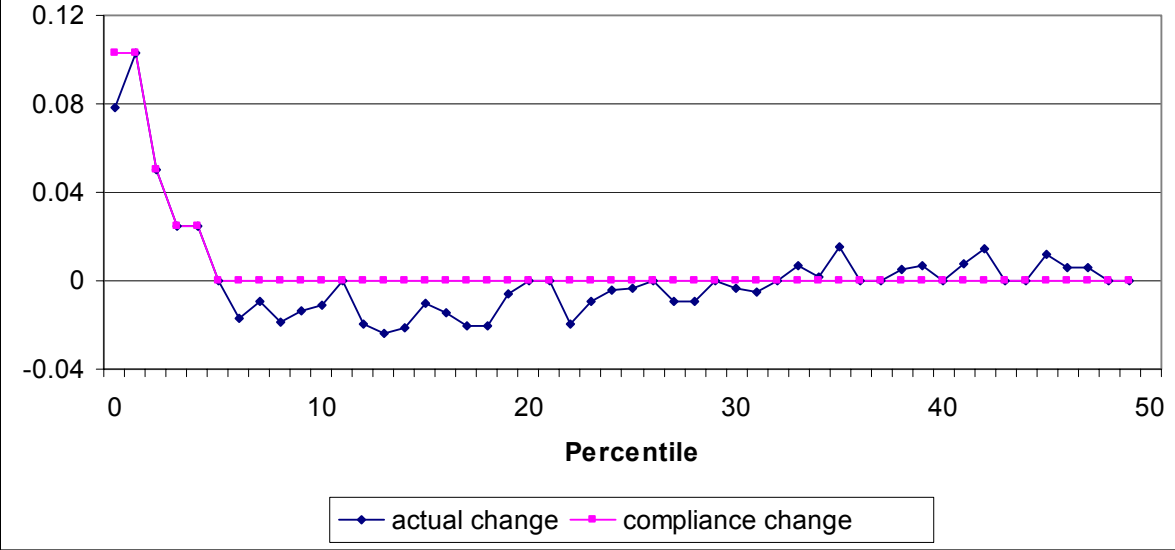
**Figure 8: Longer run changes in the distribution of predicted wage weighted hourly rate**



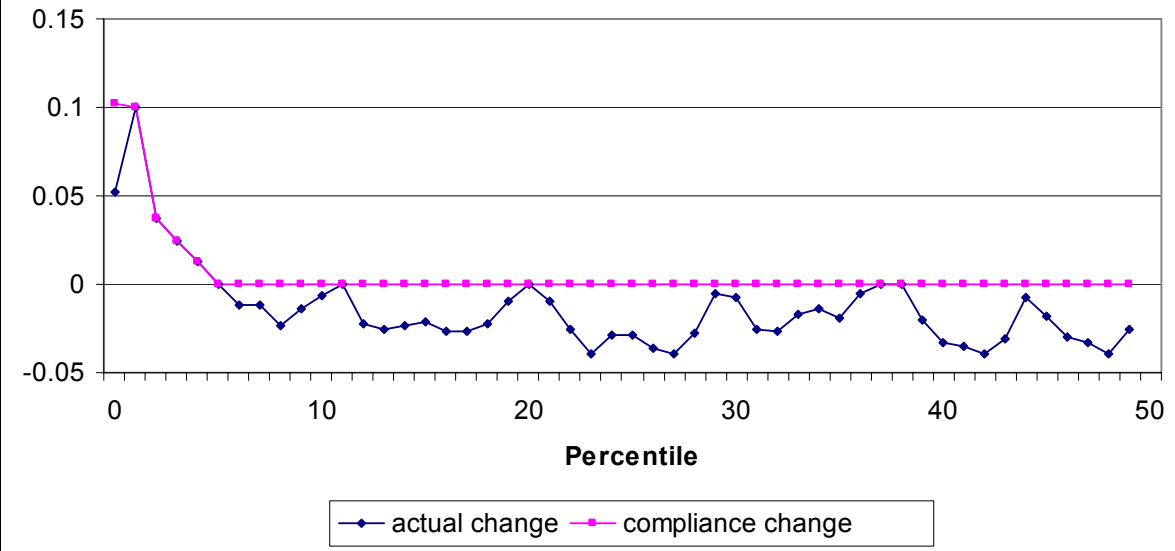
**Figure 9: Longer run changes in the distribution of propensity score weighted hourly rate**



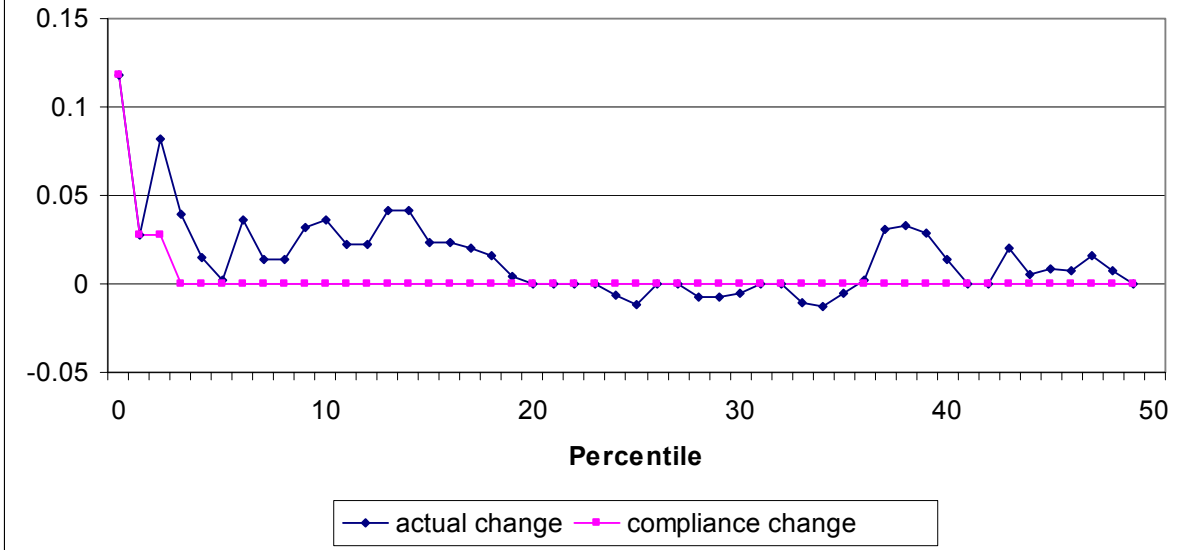
**Figure 10: The change in the distribution of predicted wage weighted hourly rate, Sep-Nov 2001**



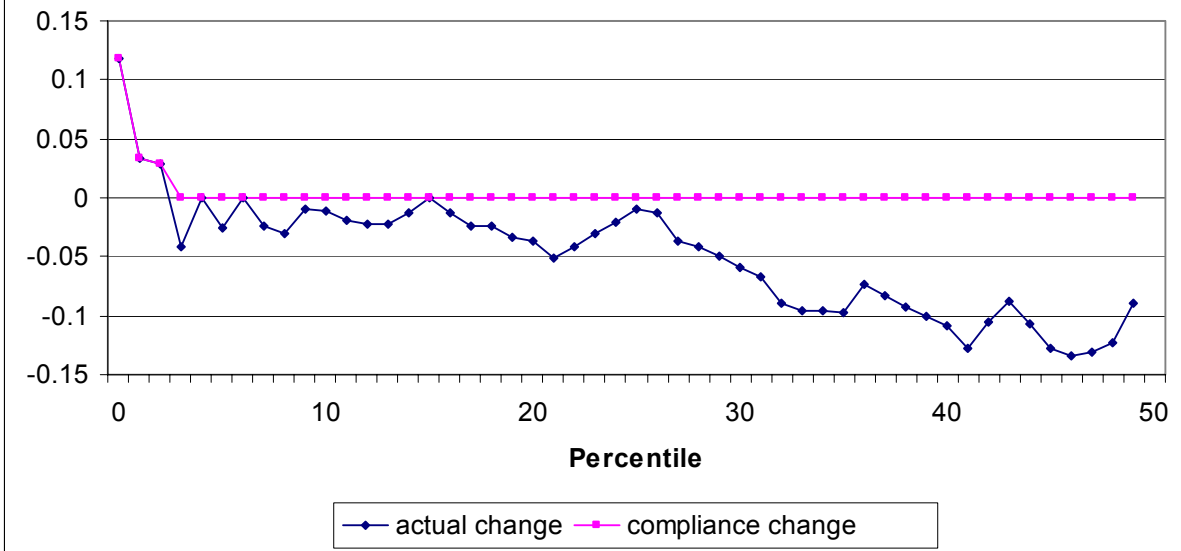
**Figure 11: The change in the distribution of propensity score weighted hourly rate, Sep - Nov 2001**



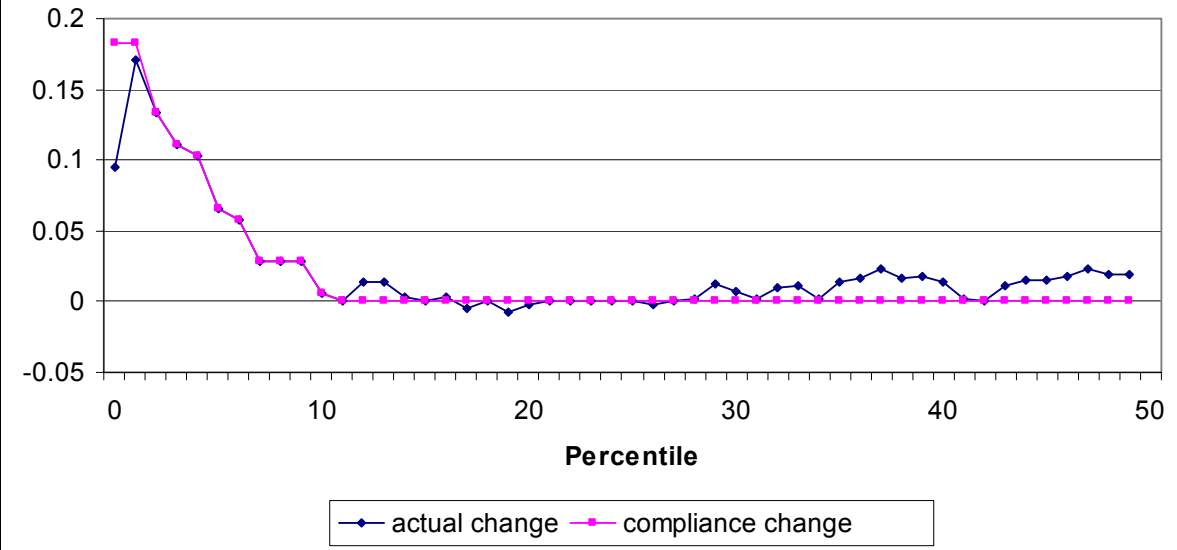
**Figure 12: The change in the distribution of predicted wage weighted hourly rate, March-May 1999, Men**



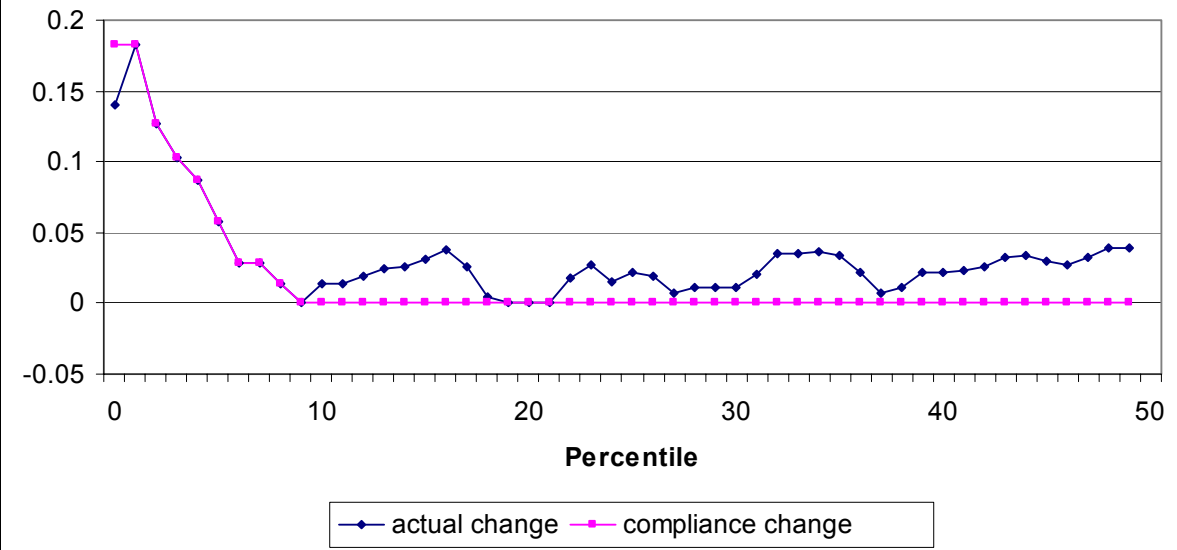
**Figure 13: The change in the distribution of propensity score weighted hourly rate, March-May 1999, Men**



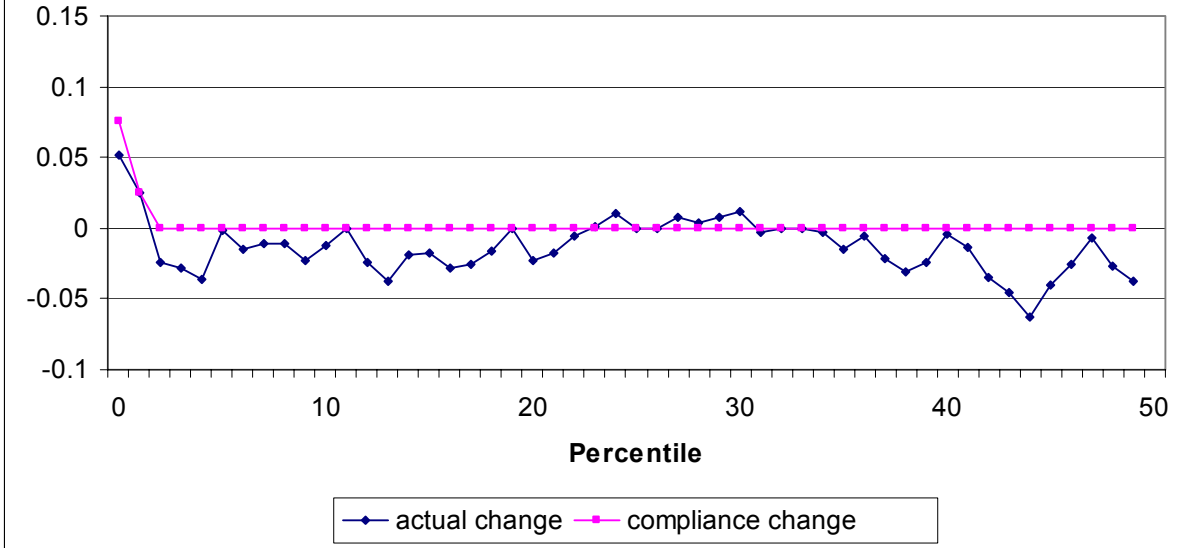
**Figure 14: The change in the distribution of predicted wage weighted hourly rate, March-May 1999, Women**



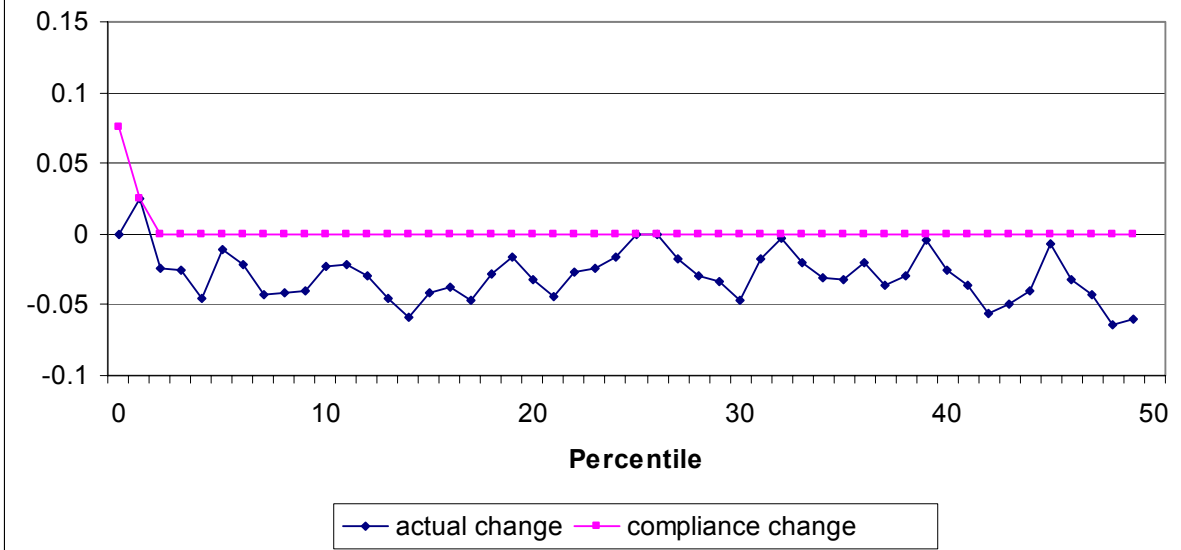
**Figure 15: The change in the distribution of propensity score weighted hourly rate, March-May 1999, Women**



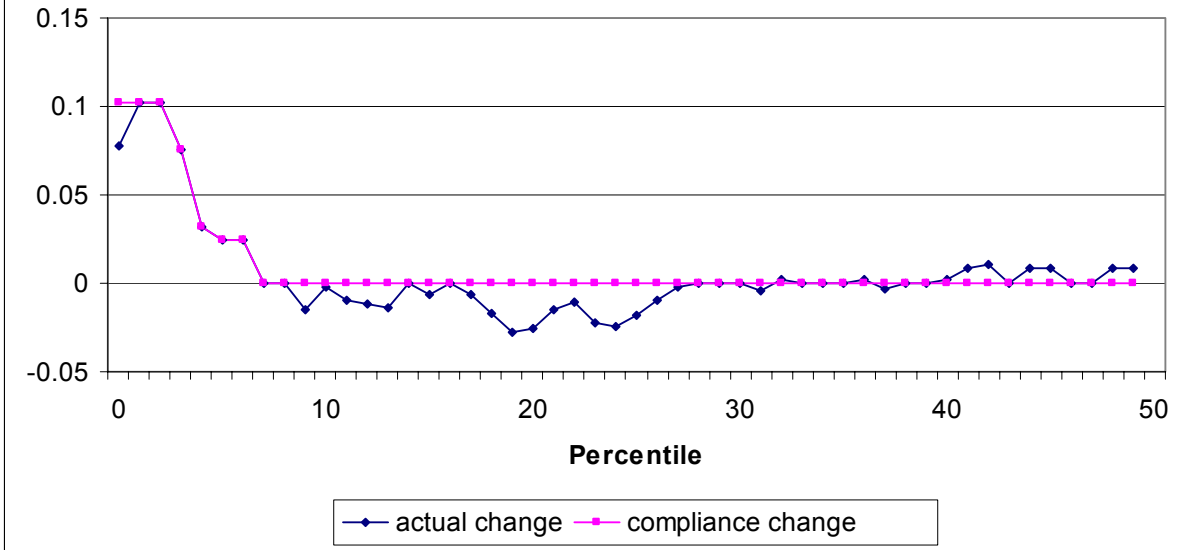
**Figure 16: The change in the distribution of predicted wage weighted hourly rate, Sep-Nov 2001, Men**



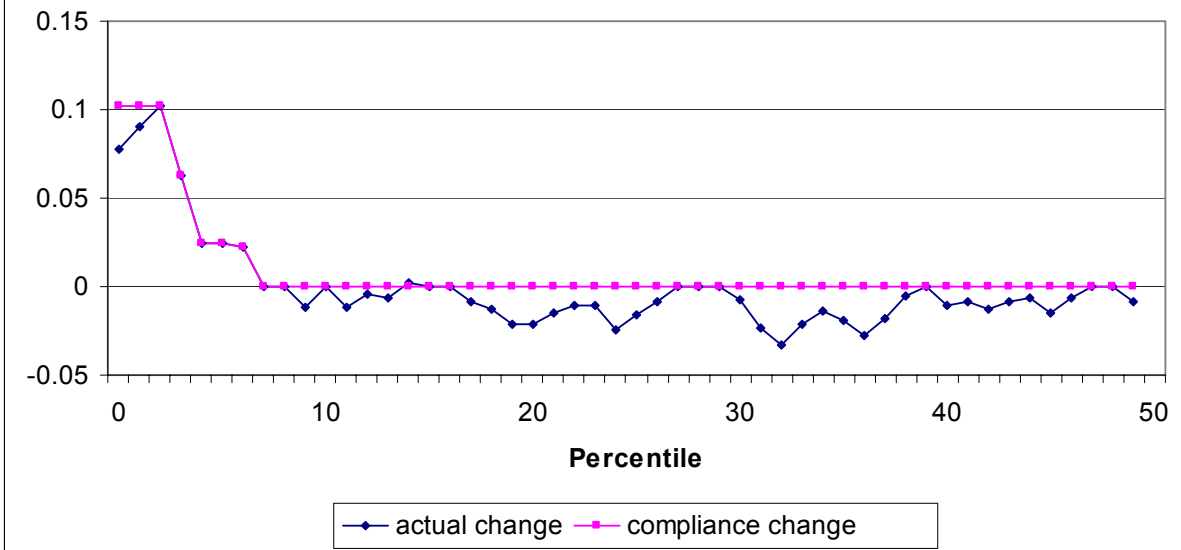
**Figure 17: The change in the distribution of propensity score weighted hourly rate, Sep - Nov 2001, Men**



**Figure 18: The change in the distribution of predicted wage weighted hourly rate, Sep-Nov 2001, Women**



**Figure 19: The change in the distribution of propensity score weighted hourly rate, Sep - Nov 2001, Women**



**Table 1: Distribution of hourpay for by whether or not an report hourly rate  
Mar-99**

	<b>For those who report an hourly rate - £</b>	<b>For those who don't report an hourly rate - £</b>	<b>Hourly Rate - £</b>
<b>5th percentile</b>	<b>3.00</b>	<b>3.51</b>	<b>3.28</b>
<b>10th percentile</b>	<b>3.35</b>	<b>4.18</b>	<b>3.50</b>
<b>25th percentile</b>	<b>4.00</b>	<b>5.63</b>	<b>4.00</b>
<b>50th percentile</b>	<b>5.00</b>	<b>7.83</b>	<b>4.71</b>
<b>75th percentile</b>	<b>6.74</b>	<b>11.43</b>	<b>6.00</b>
<b>90th percentile</b>	<b>9.21</b>	<b>15.59</b>	<b>7.93</b>
<b>95th percentile</b>	<b>11.26</b>	<b>19.23</b>	<b>9.28</b>
<b>Number of Observations</b>	<b>1263</b>	<b>3149</b>	<b>1263</b>

**Table 2**  
**Evidence on Rounding in HRRATE**

**Percentage whose Hourly Rate ends in a '10'**

<b>Method of Pay Verification</b>	<b>Personal Response</b>	<b>Proxy Response</b>	<b>Number of Observations</b>
<b>Pay Slip Seen</b>	42.3	47.3	18698
<b>Bank Account Seen</b>	55.7	63.6	170
<b>Nothing Seen/Other</b>	55.1	73.5	47803

**Percentage whose Hourly Rate ends in a '50'**

<b>Method of Pay Verification</b>	<b>Personal Response</b>	<b>Proxy Response</b>	<b>Number of Observations</b>
<b>Pay Slip Seen</b>	21.8	27.3	18698
<b>Bank Account Seen</b>	36.5	47.7	170
<b>Nothing Seen/Other</b>	33.6	47.0	47803

**Percentage whose Hourly Rate ends in a '100'**

<b>Method of Pay Verification</b>	<b>Personal Response</b>	<b>Proxy Response</b>	<b>Number of Observations</b>
<b>Pay Slip Seen</b>	14.4	18.1	18698
<b>Bank Account Seen</b>	24.6	38.6	170
<b>Nothing Seen/Other</b>	23.0	32.7	47803

**Table 3  
Evidence of Rounding in HOURPAY**

<b>Gross Pay Ends in a '10'</b>			
<b>Pay Period</b>	<b>Weekly</b>	<b>Monthly</b>	<b>Annual</b>
<b>No pay slip seen - proxy response</b>	0.53	0.69	0.79
<b>No pay slip seen- personal response</b>	0.48	0.71	0.89
<b>Pay slip seen- proxy response</b>	0.28	0.32	0.84
<b>Pay slip seen- personal response</b>	0.24	0.27	0.81
<b>Gross Pay Ends in a '100'</b>			
<b>Pay Period</b>	<b>Weekly</b>	<b>Monthly</b>	<b>Annual</b>
<b>No pay slip seen - proxy response</b>	0.13	0.52	0.78
<b>No pay slip seen- personal response</b>	0.10	0.49	0.85
<b>Pay slip seen- proxy response</b>	0.06	0.17	0.80
<b>Pay slip seen- personal response</b>	0.04	0.13	0.75
<b>Gross Pay Ends in a '1000'</b>			
<b>Pay Period</b>	<b>Weekly</b>	<b>Monthly</b>	<b>Annual</b>
<b>No pay slip seen - proxy response</b>	0.00	0.11	0.63
<b>No pay slip seen- personal response</b>	0.00	0.08	0.58
<b>Pay slip seen- proxy response</b>	0.00	0.03	0.63
<b>Pay slip seen- personal response</b>	0.00	0.02	0.49

**Table 4**  
**Evidence on Extent of Measurement Error in HOURPAY and HRRATE**

Type of regression	Mean	Mean	Mean	Mean	Mean	Mean	Median	Median
<b>Log(HOURPAY)</b>	0.362 [0.002]		0.323 [0.002]		0.325 [0.002]		0.193 [0.002]	
<b>Log(HRRATE)</b>		-0.125 [0.003]		-0.074 [0.003]		-0.075 [0.003]		0.000 [0.001]
<b>Constant</b>	-0.623 [0.004]	0.240 [0.005]	-0.551 [0.004]	0.153 [0.005]	-0.553 [0.004]	0.158 [0.005]	-0.313 [0.003]	0.000 [0.001]
<b>Type of trimming</b>	None	None	<b>HOURPAY only</b>	<b>HRRATE only</b>	<b>HOURPAY and HRRATE</b>	<b>HOURPAY and HRRATE</b>	<b>HOURPAY and HRRATE</b>	<b>HOURPAY and HRRATE</b>
<b>Observations</b>	66758	66758	66646	66726	66615	66615	66615	66615
<b>R-squared</b>	0.29	0.03	0.25	0.01	0.28	0.01	-	-

Notes.

1. The dependent variable is the log of HOURPAY minus the log of HRRATE. Standard errors are in brackets.
2. When there is trimming of the data, observations above £100 per hour and below £1 per hour are excluded.

**Table 5**  
**Quantile Regressions for Difference Between Log Hourly Pay and Log Hourly Rate**  
**Dependent Variable: Log(HOURPAY/HRRATE)**

	Percentile									
	10 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	90 <sup>th</sup>	10 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	90 <sup>th</sup>
<b>Proxy response</b>	-0.025	-0.007	-0.002	-0.002	-0.002	-0.026	-0.009	-0.003	-0.003	-0.003
	[0.004]	[0.002]	[0.001]	[0.002]	[0.005]	[0.004]	[0.002]	[0.001]	[0.003]	[0.005]
<b>Payslip seen</b>	0.03	0.015	0.011	0.028	0.038	0.035	0.02	0.015	0.03	0.043
	[0.003]	[0.001]	[0.001]	[0.002]	[0.005]	[0.004]	[0.002]	[0.001]	[0.002]	[0.004]
<b>Gross pay ends in 10</b>	-0.01	-0.005	0.002	0.023	0.031	-0.004	-0.002	0.006	0.025	0.027
	[0.004]	[0.002]	[0.001]	[0.002]	[0.005]	[0.004]	[0.002]	[0.001]	[0.002]	[0.005]
<b>Gross pay ends in 100</b>	0.01	0.01	0.01	0.024	0.043	0.023	0.014	0.014	0.027	0.051
	[0.005]	[0.002]	[0.001]	[0.003]	[0.006]	[0.005]	[0.002]	[0.001]	[0.003]	[0.006]
<b>Gross pay ends in 1000</b>	0.008	0.006	0.016	0.022	0.04	0.018	0.009	0.02	0.025	0.045
	[0.007]	[0.003]	[0.002]	[0.004]	[0.009]	[0.007]	[0.003]	[0.002]	[0.005]	[0.009]
<b>Overtime Hours/Total Hours</b>	-0.817	-0.826	-0.55	-0.351	-0.342	-0.81	-0.81	-0.554	-0.355	-0.344
	[0.017]	[0.007]	[0.004]	[0.010]	[0.023]	[0.017]	[0.007]	[0.005]	[0.011]	[0.023]
<b>Overtime Hours/Total Hours if overtime at higher rate</b>	-0.543	-0.341	-0.129	-0.117	-0.187	-0.519	-0.339	-0.134	-0.116	-0.164
	[0.029]	[0.012]	[0.007]	[0.018]	[0.040]	[0.029]	[0.012]	[0.008]	[0.020]	[0.040]
<b>Bonus in last pay</b>	0.09	0.074	0.097	0.131	0.16	0.096	0.079	0.099	0.131	0.157
	[0.004]	[0.002]	[0.001]	[0.002]	[0.005]	[0.004]	[0.002]	[0.001]	[0.002]	[0.005]
<b>Last pay usual</b>	0.066	-0.003	-0.044	-0.11	-0.174	0.06	-0.003	-0.046	-0.108	-0.173
	[0.004]	[0.002]	[0.001]	[0.002]	[0.005]	[0.004]	[0.002]	[0.001]	[0.002]	[0.005]
<b>Pay band reported</b>	0.013	-0.023	-0.029	-0.029	-0.048	0.018	-0.018	-0.026	-0.03	-0.058
	[0.007]	[0.003]	[0.002]	[0.004]	[0.010]	[0.007]	[0.003]	[0.002]	[0.005]	[0.009]
<b>Expected pay reported</b>	-0.001	-0.006	-0.042	-0.114	-0.166	-0.005	-0.009	-0.042	-0.11	-0.155
	[0.018]	[0.008]	[0.005]	[0.011]	[0.025]	[0.019]	[0.008]	[0.005]	[0.012]	[0.024]
<b>Pay period monthly</b>	-0.072	-0.051	-0.02	-0.017	-0.051	-0.059	-0.044	-0.017	-0.013	-0.04
	[0.003]	[0.001]	[0.001]	[0.002]	[0.005]	[0.004]	[0.002]	[0.001]	[0.002]	[0.005]
<b>Pay period annual</b>	-0.06	-0.055	-0.04	-0.054	-0.108	-0.053	-0.046	-0.037	-0.047	-0.088
	[0.006]	[0.003]	[0.002]	[0.004]	[0.009]	[0.006]	[0.003]	[0.002]	[0.004]	[0.009]
<b>Actual Hours=Normal Hours</b>	0.027	0.013	0.006	0.005	-0.004	0.035	0.015	0.008	0.01	0.007
	[0.005]	[0.002]	[0.001]	[0.003]	[0.007]	[0.005]	[0.002]	[0.002]	[0.004]	[0.007]
<b>Log(HRRATE)</b>						-0.139	-0.068	-0.048	-0.086	-0.159
						[0.006]	[0.002]	[0.001]	[0.003]	[0.007]
<b>Observations</b>	65998	65998	65998	65998	65998	65998	65998	65998	65998	65998

Notes.

1. The sample is restricted to those for whom both HOURPAY and HRRATE are between £1 and £100 per hour.
2. The results are from quantile regressions, the particular quantile estimated being reported in the first row. Standard errors are in brackets.
3. Other variables included in the regressions are sex, a quadratic in age and job tenure, education, whether black, whether asian, region and month

Table 6: Estimates of the percentage of workers affected by the NMW Mar - May 1999

	Predicted wage re-weighting				
	Actual distribution	Basic specification	plus industry and occupation dummies	plus proxy measure	plus hourly pay
<b>Mar-99</b>					
% < £3.59	11.5	7.1	6.9	7.0	6.7
% £3.59-£3.61	1.9	1.2	1.1	1.1	1.0
% £3.61-£3.69	1.0	0.8	0.8	0.9	0.6
% £3.69-£3.71	0.9	0.5	0.5	0.5	0.4
% £3.71-£4.09	11.9	9.0	8.5	8.3	6.9
% £4.09-£4.11	1.3	0.9	0.9	0.9	0.7
% > £4.11	71.6	80.5	81.3	81.3	83.7
<b>May-99</b>					
% < £3.59	2.2	1.4	1.4	1.4	1.2
% £3.59-£3.61	9.9	6.3	5.7	5.7	5.3
% £3.61-£3.69	1.6	1.1	0.8	0.8	0.8
% £3.69-£3.71	0.6	0.4	0.3	0.3	0.3
% £3.71-£4.09	12.2	8.8	7.5	7.4	7.5
% £4.09-£4.11	0.7	0.6	0.4	0.4	0.4
% > £4.11	72.8	81.5	83.8	83.9	84.6

Table 7: Estimates of the percentage of workers affected by the NMW Mar - May 1999

	Inverse propensity score weighting				
	Actual distribution	Basic specification	plus industry and occupation dummies	plus proxy measure	plus hourly pay
<b>Mar-99</b>					
% < £3.59	11.5	8.5	7.3	6.9	6.2
% £3.59-£3.61	1.9	1.4	1.1	1.0	0.9
% £3.61-£3.69	1.0	0.8	0.8	0.8	0.7
% £3.69-£3.71	0.9	0.5	0.4	0.4	0.4
% £3.71-£4.09	11.9	8.3	7.0	7.4	7.0
% £4.09-£4.11	1.3	1.0	2.0	1.7	1.1
% > £4.11	71.6	79.5	81.5	81.8	83.6
<b>May-99</b>					
% < £3.59	2.2	1.7	1.4	1.5	1.4
% £3.59-£3.61	9.9	6.4	6.0	6.2	5.8
% £3.61-£3.69	1.6	0.9	0.8	0.8	0.8
% £3.69-£3.71	0.6	0.4	0.4	0.3	0.3
% £3.71-£4.09	12.2	9.1	8.0	8.1	8.0
% £4.09-£4.11	0.7	0.6	0.4	0.4	0.4
% > £4.11	72.8	80.9	82.9	82.6	83.3

**Table 8: Estimates of the percentage of workers affected by the NMW Sep - Nov 2000**

	Predicted wage re-weighting				
	Actual distribution	Basic specification	plus industry and occupation dummies	plus proxy measure	plus hourly pay
<b>Sep-00</b>					
% < £3.59	0.6	0.5	0.5	0.5	0.5
% £3.59-£3.61	3.7	2.4	2.3	2.3	2.2
% £3.61-£3.69	0.3	0.2	0.2	0.2	0.2
% £3.69-£3.71	0.8	0.6	0.6	0.6	0.5
% £3.71-£4.09	9.6	6.8	6.2	6.3	6.0
% £4.09-£4.11	0.9	0.7	0.6	0.7	0.6
% > £4.11	84.1	88.9	89.6	89.5	90.1
<b>Nov-00</b>					
% < £3.59	0.8	0.7	0.6	0.7	0.7
% £3.59-£3.61	0.9	0.6	0.6	0.6	0.5
% £3.61-£3.69	0.3	0.2	0.2	0.2	0.2
% £3.69-£3.71	4.0	2.5	2.3	2.3	2.0
% £3.71-£4.09	9.5	6.3	5.7	5.8	5.1
% £4.09-£4.11	0.8	0.5	0.5	0.5	0.4
% > £4.11	83.7	89.1	90.2	90.0	91.2

**Table 9: Estimates of the percentage of workers affected by the NMW Sep - Nov 2000**

	Inverse propensity score weighting				
	Actual distribution	Basic specification	plus industry and occupation dummies	plus proxy measure	plus hourly pay
<b>Sep-00</b>					
% < £3.59	0.6	0.5	0.5	0.5	0.5
% £3.59-£3.61	3.7	2.6	2.5	2.5	2.3
% £3.61-£3.69	0.3	0.2	0.2	0.2	0.2
% £3.69-£3.71	0.8	0.7	0.8	0.7	0.6
% £3.71-£4.09	9.6	7.2	6.4	6.7	6.3
% £4.09-£4.11	0.9	0.7	0.7	0.7	0.6
% > £4.11	84.1	88.1	89.0	88.7	89.5
<b>Nov-00</b>					
% < £3.59	0.8	1.1	0.7	0.7	0.7
% £3.59-£3.61	0.9	0.7	0.8	0.9	0.7
% £3.61-£3.69	0.3	0.3	0.2	0.2	0.2
% £3.69-£3.71	4.0	2.7	2.5	2.5	2.3
% £3.71-£4.09	9.5	6.7	6.2	6.2	5.8
% £4.09-£4.11	0.8	0.5	0.5	0.5	0.5
% > £4.11	83.7	88.0	89.2	89.1	89.9

Table 10: Estimates of the percentage of workers affected by the NMW Sep - Nov 2001

	Predicted wage re-weighting				
	Actual distribution	Basic specification	plus industry and occupation dummies	plus proxy measure	plus hourly pay
<b>Sep-01</b>					
% < £3.59	0.4	0.3	0.2	0.2	0.2
% £3.59-£3.61	0.2	0.1	0.1	0.1	0.1
% £3.61-£3.69	0.2	0.1	0.1	0.1	0.1
% £3.69-£3.71	3.1	2.0	1.7	1.7	1.7
% £3.71-£4.09	5.6	3.5	3.1	3.1	3.1
% £4.09-£4.11	2.0	1.3	1.1	1.1	1.1
% > £4.11	88.6	92.7	93.7	93.7	93.8
<b>Nov-01</b>					
% < £3.59	0.4	0.3	0.3	0.3	0.3
% £3.59-£3.61	0.0	0.0	0.0	0.0	0.0
% £3.61-£3.69	0.0	0.0	0.0	0.0	0.0
% £3.69-£3.71	0.4	0.3	0.2	0.2	0.2
% £3.71-£4.09	1.9	1.2	1.1	1.1	1.0
% £4.09-£4.11	8.4	5.4	4.8	4.7	5.2
% > £4.11	88.9	92.9	93.6	93.7	93.3

**Table 11: Estimates of the percentage of workers affected by the NMW Sep - Nov 2001**

	Inverse propensity score weighting				
	Actual distribution	Basic specification	plus industry and occupation dummies	plus proxy measure	plus hourly pay
<b>Sep-01</b>					
% < £3.59	0.4	0.2	0.2	0.2	0.2
% £3.59-£3.61	0.2	0.1	0.1	0.1	0.1
% £3.61-£3.69	0.2	0.1	0.1	0.1	0.1
% £3.69-£3.71	3.1	2.0	1.7	1.7	1.7
% £3.71-£4.09	5.6	3.8	3.1	3.1	3.0
% £4.09-£4.11	2.0	1.4	1.2	1.2	1.1
% > £4.11	88.6	92.3	93.6	93.6	93.9
<b>Nov-01</b>					
% < £3.59	0.4	0.4	0.3	0.3	0.3
% £3.59-£3.61	0.0	0.0	0.0	0.0	0.0
% £3.61-£3.69	0.0	0.0	0.0	0.0	0.0
% £3.69-£3.71	0.4	0.7	0.8	0.7	0.6
% £3.71-£4.09	1.9	1.3	1.0	1.1	1.1
% £4.09-£4.11	8.4	5.8	5.0	4.9	4.8
% > £4.11	88.9	91.8	92.9	93.0	93.4

**Table 12**

**Estimates of the Fraction Paid the Minimum Wage Using the Alternative Identification Strategy**

	<b>Fraction of Workers with Observed HRRATE Paid the Minimum Wage</b>	<b>Fraction of Workers without Observed HRRATE Estimated to be Paid the Minimum Wage</b>	<b>Fraction of Workers with Observed HRRATE</b>	<b>Fraction of Workers Paid the Minimum Wage</b>
<b>No Covariates</b>				
May1999-July 1999 (NMW=£3.60)	0.103	0.014	0.256	0.037
Oct 2000-Dec 2000 (NMW=£3.70)	0.041	0.008	0.39	0.021
Oct 2001-Dec 2001 (NMW=£4.10)	0.072	0.015	0.369	0.036
<b>With Covariates</b>				
May1999-July 1999 (NMW=£3.60)	0.103	0.015	0.256	0.038
Oct 2000-Dec 2000 (NMW=£3.70)	0.041	0.011	0.39	0.023
Oct 2001-Dec 2001 (NMW=£4.10)	0.072	0.011	0.369	0.034

Notes.

1. The covariates included are age, sex, education and job tenure.

**Table 13: Estimates of the percentage of workers affected by the NMW  
Youths**

**Predicted wage re-weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>April - June 1999</b>					
% < £2.99	1.1	1.0	0.9	1.0	0.7
% £2.99-£3.01 <sup>y</sup>	6.6	5.9	5.7	5.7	6.2
% £3.01-£3.59	13.5	12.3	12.1	12.4	11.7
% £3.59-£3.61 <sup>a</sup>	10.2	9.6	9.4	10.0	10.0
% > £3.61	68.6	71.2	72.0	71.0	71.4
<b>June - August 2000</b>					
% < £3.19	3.3	3.2	3.0	2.9	3.1
% £3.19-£3.21 <sup>y</sup>	4.5	4.5	4.5	4.5	4.0
% £3.21-£3.59	5.5	4.9	5.4	5.3	5.0
% £3.59-£3.61 <sup>a</sup>	8.4	7.7	7.4	7.3	7.7
% > £3.61	78.3	79.7	79.8	80.0	80.3
<b>October - December 2000</b>					
% < £3.19	3.3	3.0	2.7	2.8	2.9
% £3.19-£3.21 <sup>y</sup>	2.5	2.2	2.7	2.5	2.0
% £3.21-£3.59	4.1	3.5	3.5	3.5	3.4
% £3.59-£3.61	4.3	3.8	4.1	3.9	3.8
% £3.61-£3.69	0.5	0.5	0.5	0.5	0.4
% £3.69-£3.71 <sup>a</sup>	5.4	4.6	4.5	4.6	4.9
% > £3.71	79.9	82.4	82.1	82.3	82.7
<b>October - December 2001</b>					
% < £3.49	2.9	2.8	2.9	2.8	2.7
% £3.49-£3.51 <sup>y</sup>	3.4	3.0	2.6	2.7	2.9
% £3.51-£3.59	0.2	0.2	0.2	0.2	0.1
% £3.59-£3.61	1.4	1.2	1.2	1.2	1.6
% £3.61-£3.69	0.0	0.0	0.0	0.0	0.0
% £3.69-£3.71	2.2	2.0	2.2	2.2	2.0
% £3.71-£4.09	10.9	10.2	9.8	9.7	9.7
% £4.09-£4.11 <sup>a</sup>	8.6	8.4	8.1	7.9	7.4
% > £4.11	70.4	72.3	73.0	73.3	73.5

a - adult rate, y - youth rate

Table 14: Estimates of the percentage of workers affected by the NMW  
Youths

Inverse propensity score weighting

	Actual distribution	Basic specification	plus industry and occupation dummies	plus proxy measure	plus hourly pay
<b>April - June 1999</b>					
% < £2.99	1.1	0.8	0.8	0.8	0.8
% £2.99-£3.01 <sup>y</sup>	6.6	7.0	7.2	7.5	7.5
% £3.01-£3.59	13.5	11.7	12.3	12.5	12.5
% £3.59-£3.61 <sup>a</sup>	10.2	8.6	8.1	8.0	8.0
% > £3.61	68.6	72.0	71.6	71.1	71.2
<b>June - August 2000</b>					
% < £3.19	3.3	3.9	3.7	3.6	3.6
% £3.19-£3.21 <sup>y</sup>	4.5	4.7	4.7	4.6	4.6
% £3.21-£3.59	5.5	5.3	5.3	5.1	5.1
% £3.59-£3.61 <sup>a</sup>	8.4	7.5	7.7	8.2	8.2
% > £3.61	78.3	78.5	78.6	78.6	78.6
<b>October - December 2000</b>					
% < £3.19	3.3	3.1	2.9	3.0	3.0
% £3.19-£3.21 <sup>y</sup>	2.5	2.8	3.1	2.8	2.8
% £3.21-£3.59	4.1	3.5	3.6	3.6	3.6
% £3.59-£3.61	4.3	4.0	4.0	4.3	4.3
% £3.61-£3.69	0.5	0.4	0.4	0.4	0.4
% £3.69-£3.71 <sup>a</sup>	5.4	4.6	4.4	4.4	4.4
% > £3.71	79.9	81.7	81.6	81.4	81.5
<b>October - December 2001</b>					
% < £3.49	2.9	3.0	3.2	3.4	3.3
% £3.49-£3.51 <sup>y</sup>	3.4	3.3	3.2	3.1	3.1
% £3.51-£3.59	0.2	0.2	0.2	0.2	0.2
% £3.59-£3.61	1.4	1.2	1.6	1.6	1.6
% £3.61-£3.69	0.0	0.0	0.0	0.0	0.0
% £3.69-£3.71	2.2	2.1	2.6	2.9	2.9
% £3.71-£4.09	10.9	10.4	10.5	10.4	10.4
% £4.09-£4.11 <sup>a</sup>	8.6	7.6	7.5	7.8	7.8
% > £4.11	70.4	72.1	71.3	70.8	70.8

a - adult rate, y - youth rate

**Table 15: Estimates of the percentage of workers affected by the NMW Mar - May 1999**  
**Men**

**Predicted wage re-weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Mar-99</b>					
% < £3.59	6.5	3.7	3.6	3.7	3.5
% £3.59-£3.61	0.5	0.3	0.2	0.2	0.2
% £3.61-£3.69	0.3	0.2	0.2	0.2	0.2
% £3.69-£3.71	0.2	0.1	0.1	0.1	0.1
% £3.71-£4.09	6.0	4.7	4.2	4.0	3.3
% £4.09-£4.11	0.5	0.3	0.5	0.5	0.3
% > £4.11	86.1	90.7	91.2	91.3	92.5
<b>May-99</b>					
% < £3.59	1.3	0.8	0.8	0.8	0.5
% £3.59-£3.61	4.2	3.0	2.5	2.5	1.9
% £3.61-£3.69	0.3	0.2	0.2	0.2	0.1
% £3.69-£3.71	0.0	0.0	0.0	0.0	0.0
% £3.71-£4.09	7.3	4.6	4.2	4.1	3.6
% £4.09-£4.11	0.3	0.4	0.2	0.2	0.2
% > £4.11	86.6	91.0	92.2	92.2	93.7

**Table 16: Estimates of the percentage of workers affected by the NMW Mar - May 1999  
Women**

**Predicted wage re-weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Mar-99</b>					
% < £3.59	16.2	11.9	11.3	11.2	11.2
% £3.59-£3.61	3.2	2.5	2.3	2.3	2.1
% £3.61-£3.69	1.7	1.5	1.6	1.6	1.2
% £3.69-£3.71	1.5	1.1	1.1	1.1	1.0
% £3.71-£4.09	17.5	15.0	14.0	13.8	11.9
% £4.09-£4.11	2.0	1.7	1.5	1.6	1.3
% > £4.11	57.9	66.3	68.2	68.5	71.4
<b>May-99</b>					
% < £3.59	3.0	2.2	2.2	2.2	2.1
% £3.59-£3.61	14.8	10.6	9.9	9.9	10.0
% £3.61-£3.69	2.8	2.1	1.7	1.7	1.7
% £3.69-£3.71	1.1	0.9	0.7	0.7	0.6
% £3.71-£4.09	16.4	14.2	11.7	11.7	12.9
% £4.09-£4.11	1.0	0.8	0.7	0.7	0.7
% > £4.11	60.9	69.2	73.2	73.2	71.9

**Table 17: Estimates of the percentage of workers affected by the NMW Mar - May 1999**  
**Men**

**Inverse propensity score weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Mar-99</b>					
% < £3.59	6.5	5.3	4.1	4.1	3.5
% £3.59-£3.61	0.5	0.2	0.2	0.2	0.2
% £3.61-£3.69	0.3	0.2	0.2	0.2	0.2
% £3.69-£3.71	0.2	0.1	0.1	0.1	0.1
% £3.71-£4.09	6.0	4.4	3.9	4.2	3.9
% £4.09-£4.11	0.5	0.9	2.8	2.2	1.2
% > £4.11	86.1	89.1	88.7	89.1	91.0
<b>May-99</b>					
% < £3.59	1.3	1.2	1.1	1.2	1.0
% £3.59-£3.61	4.2	2.9	3.3	4.0	3.3
% £3.61-£3.69	0.3	0.3	0.2	0.2	0.2
% £3.69-£3.71	0.0	0.0	0.0	0.0	0.0
% £3.71-£4.09	7.3	5.6	4.6	5.1	4.9
% £4.09-£4.11	0.3	0.5	0.4	0.3	0.3
% > £4.11	86.6	89.5	90.4	89.1	90.3

**Table 18: Estimates of the percentage of workers affected by the NMW Mar - May 1999  
Women**

**Inverse propensity score weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Mar-99</b>					
% < £3.59	16.2	12.8	10.7	10.3	9.7
% £3.59-£3.61	3.2	2.8	2.1	2.0	1.9
% £3.61-£3.69	1.7	1.7	1.5	1.6	1.4
% £3.69-£3.71	1.5	1.0	0.9	0.8	0.9
% £3.71-£4.09	17.5	13.5	10.3	11.0	11.0
% £4.09-£4.11	2.0	1.3	1.0	1.0	1.1
% > £4.11	57.9	66.9	73.5	73.4	74.0
<b>May-99</b>					
% < £3.59	3.0	2.3	1.8	1.8	1.8
% £3.59-£3.61	14.8	10.7	8.7	8.4	8.3
% £3.61-£3.69	2.8	1.8	1.4	1.4	1.4
% £3.69-£3.71	1.1	0.9	0.7	0.7	0.7
% £3.71-£4.09	16.4	13.6	11.5	11.1	11.0
% £4.09-£4.11	1.0	0.7	0.5	0.5	0.5
% > £4.11	60.9	70.1	75.4	76.1	76.3

**Table 19: Estimates of the percentage of workers affected by the NMW Sep - Nov 2000  
Men**

**Predicted wage re-weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Sep-00</b>					
% < £3.59	0.5	0.4	0.4	0.4	0.3
% £3.59-£3.61	1.7	1.0	1.0	1.0	0.9
% £3.61-£3.69	0.3	0.2	0.2	0.2	0.2
% £3.69-£3.71	0.4	0.3	0.3	0.3	0.3
% £3.71-£4.09	4.3	3.0	2.9	2.9	2.5
% £4.09-£4.11	0.4	0.4	0.3	0.3	0.3
% > £4.11	92.4	94.8	95.0	95.0	95.6
<b>Nov-00</b>					
% < £3.59	0.8	1.0	0.9	0.9	1.0
% £3.59-£3.61	0.3	0.2	0.2	0.2	0.1
% £3.61-£3.69	0.4	0.3	0.2	0.2	0.2
% £3.69-£3.71	2.0	1.4	1.2	1.3	1.0
% £3.71-£4.09	3.7	2.5	2.4	2.5	1.8
% £4.09-£4.11	0.4	0.3	0.3	0.2	0.2
% > £4.11	92.5	94.3	94.9	94.7	95.8

**Table 20: Estimates of the percentage of workers affected by the NMW Sep - Nov 2000  
Women**

**Predicted wage re-weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Sep-00</b>					
% < £3.59	0.7	0.6	0.6	0.6	0.6
% £3.59-£3.61	5.1	3.5	3.4	3.4	3.3
% £3.61-£3.69	0.3	0.2	0.2	0.2	0.2
% £3.69-£3.71	1.2	0.9	0.7	0.8	0.8
% £3.71-£4.09	13.4	10.2	9.1	9.2	9.1
% £4.09-£4.11	1.2	1.0	0.9	1.0	0.9
% > £4.11	78.2	83.6	85.2	84.8	85.3
<b>Nov-00</b>					
% < £3.59	0.8	0.5	0.5	0.4	0.5
% £3.59-£3.61	1.4	1.0	0.9	0.9	0.8
% £3.61-£3.69	0.3	0.2	0.2	0.2	0.2
% £3.69-£3.71	5.4	3.5	3.1	3.2	2.9
% £3.71-£4.09	13.5	9.6	8.5	8.6	8.1
% £4.09-£4.11	1.0	0.7	0.6	0.7	0.6
% > £4.11	77.7	84.6	86.2	86.1	87.0

**Table 21: Estimates of the percentage of workers affected by the NMW Sep - Nov 2000**

**Men**

**Inverse propensity score weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Sep-00</b>					
% < £3.59	0.5	0.4	0.4	0.4	0.4
% £3.59-£3.61	1.7	1.2	1.4	1.3	1.1
% £3.61-£3.69	0.3	0.2	0.2	0.1	0.1
% £3.69-£3.71	0.4	0.4	0.3	0.3	0.3
% £3.71-£4.09	4.3	3.7	3.0	3.1	2.7
% £4.09-£4.11	0.4	0.4	0.3	0.4	0.3
% > £4.11	92.4	93.8	94.4	94.4	95.1
<b>Nov-00</b>					
% < £3.59	0.8	1.8	0.9	0.9	0.8
% £3.59-£3.61	0.3	0.3	0.6	0.9	0.5
% £3.61-£3.69	0.4	0.2	0.2	0.2	0.2
% £3.69-£3.71	2.0	1.6	1.4	1.3	1.1
% £3.71-£4.09	3.7	2.6	2.6	2.6	2.3
% £4.09-£4.11	0.4	0.3	0.3	0.3	0.3
% > £4.11	92.5	93.2	94.1	93.9	94.8

**Table 22: Estimates of the percentage of workers affected by the NMW Sep - Nov 2000  
Women**

**Inverse propensity score weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Sep-00</b>					
% < £3.59	0.7	0.5	0.6	0.6	0.5
% £3.59-£3.61	5.1	3.8	3.4	3.4	3.3
% £3.61-£3.69	0.3	0.2	0.2	0.2	0.2
% £3.69-£3.71	1.2	1.0	1.1	1.1	0.8
% £3.71-£4.09	13.4	10.1	9.0	9.5	9.3
% £4.09-£4.11	1.2	1.0	1.0	0.9	0.9
% > £4.11	78.2	83.4	84.9	84.4	85.0
<b>Nov-00</b>					
% < £3.59	0.8	0.5	0.6	0.5	0.5
% £3.59-£3.61	1.4	1.0	0.9	0.9	0.9
% £3.61-£3.69	0.3	0.3	0.2	0.2	0.2
% £3.69-£3.71	5.4	3.7	3.4	3.5	3.3
% £3.71-£4.09	13.5	10.4	9.1	9.2	8.9
% £4.09-£4.11	1.0	0.7	0.6	0.6	0.6
% > £4.11	77.7	83.4	85.2	85.0	85.6

**Table 23: Estimates of the percentage of workers affected by the NMW Sep - Nov 2001**

**Men**

**Predicted wage re-weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Sep-01</b>					
% < £3.59	0.4	0.3	0.3	0.3	0.2
% £3.59-£3.61	0.1	0.1	0.1	0.1	0.1
% £3.61-£3.69	0.1	0.0	0.0	0.0	0.0
% £3.69-£3.71	1.0	0.7	0.6	0.6	0.5
% £3.71-£4.09	3.7	2.3	2.0	2.0	1.9
% £4.09-£4.11	0.6	0.5	0.3	0.3	0.3
% > £4.11	94.2	96.2	96.8	96.8	97.1
<b>Nov-01</b>					
% < £3.59	0.7	0.5	0.4	0.4	0.4
% £3.59-£3.61	0.0	0.0	0.0	0.0	0.0
% £3.61-£3.69	0.0	0.0	0.0	0.0	0.0
% £3.69-£3.71	0.6	0.3	0.3	0.3	0.2
% £3.71-£4.09	1.4	1.0	0.9	0.8	0.8
% £4.09-£4.11	3.6	2.2	1.8	1.8	1.6
% > £4.11	93.7	96.0	96.7	96.7	96.9

**Table 24: Estimates of the percentage of workers affected by the NMW Sep - Nov 2001  
Women**

**Predicted wage re-weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Sep-01</b>					
% < £3.59	0.4	0.2	0.1	0.1	0.2
% £3.59-£3.61	0.3	0.2	0.2	0.1	0.2
% £3.61-£3.69	0.2	0.1	0.2	0.1	0.1
% £3.69-£3.71	4.6	3.1	2.7	2.7	2.8
% £3.71-£4.09	6.8	4.6	4.1	4.1	4.1
% £4.09-£4.11	2.9	2.0	1.8	1.8	1.8
% > £4.11	84.7	89.9	90.9	91.0	90.9
<b>Nov-01</b>					
% < £3.59	0.2	0.2	0.1	0.1	0.1
% £3.59-£3.61	0.0	0.0	0.0	0.0	0.0
% £3.61-£3.69	0.0	0.0	0.0	0.0	0.0
% £3.69-£3.71	0.3	0.2	0.2	0.2	0.2
% £3.71-£4.09	2.2	1.4	1.3	1.3	1.3
% £4.09-£4.11	11.8	8.0	7.3	7.3	8.3
% > £4.11	85.5	90.2	91.1	91.1	90.2

**Table 25: Estimates of the percentage of workers affected by the NMW Sep - Nov 2001**

**Men**

**Inverse propensity score weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Sep-01</b>					
% < £3.59	0.4	0.2	0.2	0.2	0.2
% £3.59-£3.61	0.1	0.1	0.1	0.1	0.1
% £3.61-£3.69	0.1	0.1	0.1	0.1	0.0
% £3.69-£3.71	1.0	0.8	0.6	0.6	0.5
% £3.71-£4.09	3.7	2.4	2.0	2.0	1.8
% £4.09-£4.11	0.6	0.6	0.4	0.3	0.3
% > £4.11	94.2	95.9	96.8	96.8	97.1
<b>Nov-01</b>					
% < £3.59	0.7	0.5	0.4	0.4	0.4
% £3.59-£3.61	0.0	0.0	0.0	0.0	0.0
% £3.61-£3.69	0.0	0.0	0.0	0.0	0.0
% £3.69-£3.71	0.6	0.6	0.7	0.6	0.5
% £3.71-£4.09	1.4	1.0	0.8	0.8	0.8
% £4.09-£4.11	3.6	2.3	1.9	1.9	1.8
% > £4.11	93.7	95.5	96.2	96.2	96.5

**Table 26: Estimates of the percentage of workers affected by the NMW Sep - Nov 2001  
Women**

**Inverse propensity score weighting**

	<b>Actual distribution</b>	<b>Basic specification</b>	<b>plus industry and occupation dummies</b>	<b>plus proxy measure</b>	<b>plus hourly pay</b>
<b>Sep-01</b>					
% < £3.59	0.4	0.2	0.1	0.1	0.1
% £3.59-£3.61	0.3	0.2	0.1	0.1	0.1
% £3.61-£3.69	0.2	0.1	0.1	0.1	0.1
% £3.69-£3.71	4.6	3.0	2.7	2.7	2.7
% £3.71-£4.09	6.8	4.9	4.0	4.1	4.1
% £4.09-£4.11	2.9	2.2	1.8	1.9	1.8
% > £4.11	84.7	89.4	91.0	91.0	91.0
<b>Nov-01</b>					
% < £3.59	0.2	0.3	0.3	0.3	0.2
% £3.59-£3.61	0.0	0.0	0.0	0.0	0.0
% £3.61-£3.69	0.0	0.0	0.0	0.0	0.0
% £3.69-£3.71	0.3	0.8	0.8	0.8	0.6
% £3.71-£4.09	2.2	1.5	1.2	1.2	1.3
% £4.09-£4.11	11.8	8.6	7.5	7.4	7.4
% > £4.11	85.5	88.9	90.2	90.3	90.6

<b>Table 27</b>				
<b>Income distribution of workers affected by NMW - March 1999</b>				
<b>Distribution of affected workers across income deciles</b>				
	<b>By Hourpay for those with Hourly Rate</b>	<b>By Hourly Rate</b>	<b>By Propensity Score Re- weighted Hourly rate</b>	<b>By Wage Re-weighted Hourly rate</b>
Decile 1	34.7	40.0	34.3	40.1
Decile 2	18.4	18.6	25.4	15.8
Decile 3	9.2	8.3	7.9	6.7
Decile 4	9.7	10.3	8.8	9.5
Decile 5	9.2	8.3	8.6	12.4
Decile 6	6.1	5.5	5.6	5.9
Decile 7	6.1	6.2	6.4	7.2
Decile 8	4.1	2.1	2.6	2.1
Decile 9	1.5	0.7	0.5	0.5
Decile 10	1.0	0.0	0.0	0.0

<b>Table 28</b>				
<b>Income distribution of workers affected by NMW - September 2001</b>				
<b>Distribution of affected workers across income deciles</b>				
	<b>By Hourpay for those with Hourly Rate</b>	<b>By Hourly Rate</b>	<b>By Propensity Score Re- weighted Hourly rate</b>	<b>By Wage Re-weighted Hourly rate</b>
Decile 1	40.7	43.5	40.0	39.6
Decile 2	16.2	20.2	22.2	21.7
Decile 3	15.5	10.9	9.7	10.8
Decile 4	10.8	9.3	9.9	9.1
Decile 5	8.6	6.7	6.7	7.1
Decile 6	2.2	4.2	5.2	5.0
Decile 7	2.2	4.2	4.7	4.7
Decile 8	2.2	0.5	0.7	0.5
Decile 9	1.4	0.5	1.2	1.6
Decile 10	0.4	0.0	0.0	0.0

<b>Table 29</b>				
<b>Income distribution of workers affected by NMW - March 1999</b>				
<b>Distribution of income gains across income deciles</b>				
	<b>By Hourpay for those with Hourly Rate</b>	<b>By Hourly Rate</b>	<b>By Propensity Score Re- weighted Hourly rate</b>	<b>By Wage Re-weighted Hourly rate</b>
Decile 1	21.0	31.4	35.8	36.0
Decile 2	19.9	13.9	11.6	11.7
Decile 3	13.5	8.8	6.5	7.2
Decile 4	12.4	14.8	10.1	13.7
Decile 5	13.3	12.0	14.6	12.2
Decile 6	4.1	6.1	10.5	7.8
Decile 7	8.3	8.3	4.9	8.3
Decile 8	5.1	3.4	4.8	2.4
Decile 9	0.9	1.2	1.1	0.8
Decile 10	1.4	0.0	0.0	0.0

<b>Table 30</b>				
<b>Income distribution of workers affected by NMW - September 2001</b>				
<b>Distribution of income gains across income deciles</b>				
	<b>By Hourpay for those with Hourly Rate</b>	<b>By Hourly Rate</b>	<b>By Propensity Score Re- weighted Hourly rate</b>	<b>By Wage Re-weighted Hourly rate</b>
Decile 1	27.4	27.2	36.2	27.0
Decile 2	20.1	17.7	20.1	19.8
Decile 3	18.3	14.5	14.5	16.3
Decile 4	17.0	11.4	12.9	10.4
Decile 5	9.7	9.3	6.4	8.7
Decile 6	1.3	14.0	6.8	11.0
Decile 7	3.8	4.6	2.4	4.9
Decile 8	0.9	0.8	0.3	1.3
Decile 9	0.6	0.5	0.4	0.6
Decile 10	0.8	0.0	0.0	0.0

**Table A1**  
**Hourly Earnings Distribution - 10 pence bands**  
**Actual Distribution**  
**Cumulative Total %**

<b>Less than</b>	<b>May-99</b>	<b>March - May 2000</b>	<b>March - May 2001</b>	<b>March - May 2002</b>
£2.90	0.6	0.1	0.1	0.1
£3.00	0.6	0.1	0.1	0.1
£3.10	1.0	0.2	0.2	0.1
£3.20	0.0	0.3	0.2	0.1
£3.30	1.1	0.4	0.2	0.1
£3.40	1.2	0.4	0.3	0.1
£3.50	1.5	0.5	0.3	0.1
£3.60	2.2	0.7	0.4	0.2
£3.70	13.8	6.9	0.9	0.3
£3.80	16.1	9.1	5.5	0.4
£3.90	18.1	11.0	7.3	0.5
£4.00	20.0	12.2	8.4	0.6
£4.10	26.6	17.1	12.6	1.4
£4.20	29.8	19.4	14.4	8.8
£4.30	34.9	22.8	17.5	12.0
£4.40	37.1	25.1	19.5	14.4
£4.50	40.1	26.9	20.9	16.3
£4.60	44.9	30.5	25.2	20.1
£4.70	47.1	32.9	27.2	22.2
£4.80	50.3	35.2	29.9	24.9
£4.90	52.8	37.6	31.6	27.2
£5.00	55.3	39.8	33.6	29.1
£5.10	61.6	45.3	39.8	35.3
£5.20	62.8	47.5	41.8	37.5
£5.30	64.7	49.5	45.2	40.2
£5.40	65.6	50.8	46.6	41.8
£5.50	67.0	52.1	47.8	43.5
£5.60	70.1	54.6	51.0	46.9
£5.70	71.2	56.0	52.8	48.6
£5.80	72.3	57.4	54.4	50.6
£5.90	73.0	58.3	55.6	51.9
£6.00	73.9	59.1	56.5	52.7
£6.10	76.9	63.1	60.4	57.3
£6.20	78.0	64.3	61.4	58.8
£6.30	79.1	65.6	62.8	60.5
£6.40	79.9	66.3	63.9	61.3
£6.50	80.3	66.8	64.7	62.4
£6.60	81.6	69.1	67.1	64.6
£6.70	81.9	69.6	67.7	65.4
£6.80	82.5	70.4	68.7	66.6
£6.90	83.0	71.2	69.5	67.3
£7.00	83.4	71.7	70.0	68.0

**Table A2**  
**Hourly Earnings Distribution - 10 pence bands**  
**Inverse Propensity Score Re-Weighting**  
**Cumulative Total %**

<b>Less than</b>	<b>May-99</b>	<b>March - May 2000</b>	<b>March - May 2001</b>	<b>March - May 2002</b>
£2.90	0.3	0.2	0.4	0.0
£3.00	0.3	0.2	0.4	0.0
£3.10	0.7	0.3	0.5	0.1
£3.20	0.7	0.3	0.5	0.1
£3.30	0.8	0.4	0.5	0.1
£3.40	0.8	0.4	0.5	0.1
£3.50	1.0	0.4	0.5	0.1
£3.60	1.4	0.5	0.6	0.1
£3.70	8.0	4.1	0.9	0.2
£3.80	9.3	5.4	3.1	0.3
£3.90	10.5	6.5	4.1	0.3
£4.00	11.7	7.2	4.7	0.3
£4.10	16.3	10.2	6.8	0.9
£4.20	18.1	11.6	7.8	5.1
£4.30	21.9	13.6	9.5	6.9
£4.40	23.3	15.2	10.6	8.3
£4.50	25.7	16.3	11.3	9.4
£4.60	29.0	18.8	13.9	12.0
£4.70	31.2	20.4	15.0	13.2
£4.80	33.7	22.0	16.5	14.9
£4.90	36.0	23.6	17.5	16.3
£5.00	38.2	25.1	18.8	17.5
£5.10	45.3	29.5	23.0	22.1
£5.20	46.2	31.2	24.5	23.7
£5.30	49.6	32.8	27.0	25.5
£5.40	50.3	33.8	27.9	26.6
£5.50	51.5	34.8	28.8	27.8
£5.60	54.6	36.8	31.3	30.5
£5.70	55.4	38.0	32.4	31.7
£5.80	57.0	39.1	33.7	33.2
£5.90	57.8	39.8	34.5	34.3
£6.00	58.8	40.5	35.2	35.0
£6.10	63.5	44.3	38.4	38.8
£6.20	65.3	45.5	39.2	40.0
£6.30	66.5	46.6	40.4	41.8
£6.40	67.6	47.3	41.2	42.5
£6.50	67.9	47.6	41.8	43.3
£6.60	69.2	49.8	43.9	45.3
£6.70	70.2	50.3	44.5	46.0
£6.80	70.7	51.0	45.3	47.1
£6.90	71.1	51.8	46.0	47.7
£7.00	71.3	52.2	46.6	48.2

**Table A3**  
**Hourly Earnings Distribution - 10 pence bands**  
**Predicted Wage Re-Weighting**  
**Cumulative Total %**

<b>Less than</b>	<b>May-99</b>	<b>March - May 2000</b>	<b>March - May 2001</b>	<b>March - May 2002</b>
£2.90	0.3	0.1	0.1	0.0
£3.00	0.3	0.1	0.1	0.0
£3.10	0.6	0.2	0.2	0.1
£3.20	0.6	0.2	0.2	0.1
£3.30	0.6	0.3	0.2	0.1
£3.40	0.7	0.3	0.2	0.1
£3.50	0.8	0.3	0.2	0.1
£3.60	1.2	0.5	0.3	0.1
£3.70	7.3	4.1	0.6	0.2
£3.80	8.9	5.4	3.2	0.2
£3.90	10.1	6.5	4.2	0.3
£4.00	11.3	7.3	4.8	0.3
£4.10	15.1	10.2	7.3	0.8
£4.20	16.8	11.7	8.4	4.9
£4.30	19.8	13.8	10.2	6.8
£4.40	21.2	15.3	11.4	8.1
£4.50	23.1	16.4	12.3	9.3
£4.60	26.1	18.9	15.1	11.5
£4.70	28.0	20.6	16.3	12.9
£4.80	30.5	22.2	18.0	14.5
£4.90	32.6	24.0	19.1	15.9
£5.00	34.6	25.7	20.5	17.1
£5.10	39.9	29.7	24.9	21.1
£5.20	41.0	31.4	26.4	22.6
£5.30	43.2	33.1	28.9	24.4
£5.40	44.0	34.2	30.0	25.6
£5.50	45.5	35.4	31.0	26.8
£5.60	48.8	37.5	33.6	29.2
£5.70	49.8	38.8	35.0	30.4
£5.80	50.7	40.0	36.3	32.0
£5.90	51.4	40.9	37.3	33.1
£6.00	52.7	41.6	38.1	33.8
£6.10	56.3	45.5	41.6	37.5
£6.20	57.5	46.6	42.4	38.7
£6.30	58.7	47.9	43.7	40.2
£6.40	59.7	48.6	44.8	40.9
£6.50	60.1	49.1	45.5	41.9
£6.60	61.5	51.3	47.8	44.1
£6.70	62.2	52.0	48.6	44.7
£6.80	62.8	52.8	49.5	45.9
£6.90	63.2	53.7	50.3	46.6
£7.00	63.7	54.2	50.9	47.2

**Table A4**  
**Hourly Earnings Distribution - 5 pence bands**  
**Actual Distribution**  
**Cumulative Total %**

<b>Less than</b>	<b>May-99</b>	<b>March - May 2000</b>	<b>March - May 2001</b>	<b>March - May 2002</b>
£2.90	0.6	0.1	0.1	0.1
£2.95	0.6	0.1	0.1	0.1
£3.00	0.6	0.1	0.1	0.1
£3.05	1.0	0.2	0.2	0.1
£3.10	1.0	0.3	0.2	0.1
£3.15	1.0	0.3	0.2	0.1
£3.20	1.0	0.3	0.2	0.1
£3.25	1.0	0.4	0.2	0.1
£3.30	1.2	0.4	0.2	0.1
£3.35	1.2	0.4	0.2	0.1
£3.40	1.2	0.4	0.3	0.1
£3.45	1.4	0.5	0.3	0.1
£3.50	1.5	0.5	0.3	0.1
£3.55	2.1	0.7	0.4	0.2
£3.60	12.1	6.0	0.8	0.3
£3.65	12.9	6.2	0.9	0.3
£3.70	13.8	6.9	0.9	0.3
£3.75	14.8	8.0	4.5	0.3
£3.80	16.9	9.9	6.4	0.5
£3.85	17.8	10.5	7.0	0.5
£3.90	18.1	11.0	7.3	0.5
£3.95	19.6	11.8	8.1	0.6
£4.00	20.0	12.2	8.4	0.6
£4.05	26.1	16.5	12.3	1.4
£4.10	27.2	17.7	13.4	7.7
£4.15	28.5	18.3	13.8	8.2
£4.20	31.5	20.3	15.7	10.4
£4.25	32.6	21.2	16.3	10.8
£4.30	34.9	22.8	17.5	12.0
£4.35	36.5	24.4	19.1	13.9
£4.40	37.1	25.1	19.5	14.4
£4.45	39.1	26.3	20.4	15.8
£4.50	40.1	26.9	20.9	16.3
£4.55	44.0	29.9	24.3	19.5
£4.60	45.9	31.2	26.3	21.1
£4.65	46.4	32.2	26.6	21.5
£4.70	47.6	33.5	27.9	23.0
£4.75	48.6	33.9	28.2	23.3
£4.80	50.3	35.2	29.9	24.9
£4.85	52.1	36.9	31.2	26.6
£4.90	52.8	37.6	31.6	27.2
£4.95	54.1	39.3	33.1	28.4

**Table A4 continued**  
**Hourly Earnings Distribution - 5 pence bands**  
**Actual Distribution**  
**Cumulative Total %**

<b>Less than</b>	<b>May-99</b>	<b>March - May 2000</b>	<b>March - May 2001</b>	<b>March - May 2002</b>
£5.00	55.3	39.8	33.6	29.1
£5.05	61.3	44.9	39.1	34.9
£5.10	62.1	45.6	40.5	36.1
£5.15	62.4	46.8	40.9	36.7
£5.20	63.7	48.1	42.8	38.6
£5.25	63.9	48.3	43.2	38.9
£5.30	64.7	49.5	45.2	40.2
£5.35	65.4	50.6	46.4	41.5
£5.40	65.6	50.8	46.6	41.8
£5.45	66.5	51.7	47.6	43.1
£5.50	67.0	52.1	47.8	43.5
£5.55	69.8	54.2	50.6	46.6
£5.60	70.8	55.4	51.7	47.6
£5.65	71.0	55.6	52.4	48.0
£5.70	71.5	56.4	53.2	49.1
£5.75	71.7	56.7	53.4	49.6
£5.80	72.3	57.4	54.4	50.6
£5.85	72.8	58.0	55.2	51.7
£5.90	73.0	58.3	55.6	51.9
£5.95	73.7	58.9	56.2	52.5
£6.00	73.9	59.1	56.5	52.7
£6.05	76.7	62.6	60.0	57.0
£6.10	77.1	63.5	60.6	57.6
£6.15	77.5	63.8	60.9	58.2
£6.20	78.3	64.7	61.9	59.4
£6.25	78.6	65.0	62.2	59.6
£6.30	79.1	65.6	62.8	60.5
£6.35	79.7	66.2	63.7	61.1
£6.40	79.9	66.3	63.9	61.3
£6.45	80.2	66.7	64.6	62.1
£6.50	80.3	66.8	64.7	62.4
£6.55	81.4	68.8	66.6	64.4
£6.60	81.7	69.3	67.4	64.8
£6.65	81.9	69.4	67.4	65.1
£6.70	81.9	69.8	68.1	65.8
£6.75	82.0	70.0	68.2	66.0
£6.80	82.5	70.4	68.7	66.6
£6.85	82.9	71.0	69.4	67.1
£6.90	83.0	71.2	69.5	67.3
£6.95	83.4	71.5	69.9	67.8
£7.00	83.4	71.7	70.0	68.0

**Table A5**  
**Hourly Earnings Distribution - 5 pence bands**  
**Inverse Propensity Score Re-Weighting**  
**Cumulative Total %**

<b>Less than</b>	<b>May-99</b>	<b>March - May 2000</b>	<b>March - May 2001</b>	<b>March - May 2002</b>
£2.90	0.3	0.2	0.4	0.0
£2.95	0.3	0.2	0.4	0.0
£3.00	0.3	0.2	0.4	0.0
£3.05	0.7	0.3	0.5	0.0
£3.10	0.7	0.3	0.5	0.0
£3.15	0.7	0.3	0.5	0.0
£3.20	0.7	0.3	0.5	0.0
£3.25	0.7	0.4	0.5	0.1
£3.30	0.8	0.4	0.5	0.1
£3.35	0.8	0.4	0.5	0.1
£3.40	0.8	0.4	0.5	0.1
£3.45	1.0	0.4	0.5	0.1
£3.50	1.0	0.4	0.5	0.1
£3.55	1.3	0.5	0.6	0.1
£3.60	7.2	3.6	0.8	0.2
£3.65	7.5	3.7	0.8	0.2
£3.70	8.0	4.1	0.9	0.2
£3.75	8.6	4.7	2.6	0.2
£3.80	9.7	5.9	3.7	0.3
£3.85	10.3	6.2	3.9	0.3
£3.90	10.5	6.5	4.1	0.3
£3.95	11.4	7.0	4.5	0.3
£4.00	11.7	7.2	4.7	0.3
£4.05	15.9	9.9	6.7	0.9
£4.10	16.7	10.6	7.3	4.4
£4.15	17.4	11.0	7.5	4.7
£4.20	19.6	12.2	8.6	6.0
£4.25	20.2	12.7	8.9	6.2
£4.30	21.9	13.6	9.5	6.9
£4.35	23.0	14.8	10.4	8.0
£4.40	23.3	15.2	10.6	8.3
£4.45	25.1	15.9	11.1	9.2
£4.50	25.7	16.3	11.3	9.4
£4.55	28.3	18.4	13.4	11.4
£4.60	29.6	19.2	14.5	12.6
£4.65	30.4	19.9	14.7	12.8
£4.70	31.6	20.8	15.4	13.8
£4.75	32.4	21.0	15.6	13.9
£4.80	33.7	22.0	16.5	14.9
£4.85	35.5	23.1	17.3	16.0
£4.90	36.0	23.6	17.5	16.3
£4.95	37.5	24.7	18.4	17.1

**Table A5 continued**  
**Hourly Earnings Distribution - 5 pence bands**  
**Inverse Propensity Score Re-Weighting**  
**Cumulative Total %**

<b>Less than</b>	<b>May-99</b>	<b>March - May 2000</b>	<b>March - May 2001</b>	<b>March - May 2002</b>
£5.00	38.2	25.1	18.8	17.5
£5.05	45.1	29.3	22.6	21.8
£5.10	45.6	29.8	23.6	22.7
£5.15	45.8	30.6	23.9	23.1
£5.20	48.4	31.8	25.2	24.4
£5.25	48.5	31.9	25.5	24.6
£5.30	49.6	32.8	27.0	25.5
£5.35	50.1	33.6	27.7	26.4
£5.40	50.3	33.8	27.9	26.6
£5.45	51.1	34.4	28.6	27.6
£5.50	51.5	34.8	28.8	27.8
£5.55	54.3	36.6	31.0	30.2
£5.60	55.0	37.5	31.8	31.1
£5.65	55.1	37.7	32.2	31.3
£5.70	55.8	38.4	32.8	32.1
£5.75	56.0	38.6	32.9	32.5
£5.80	57.0	39.1	33.7	33.2
£5.85	57.6	39.6	34.3	34.1
£5.90	57.8	39.8	34.5	34.3
£5.95	58.7	40.3	35.0	34.8
£6.00	58.8	40.5	35.2	35.0
£6.05	63.4	43.9	38.1	38.5
£6.10	63.8	44.6	38.5	39.1
£6.15	64.8	44.9	38.8	39.6
£6.20	65.6	45.8	39.5	40.8
£6.25	65.9	46.1	39.8	41.1
£6.30	66.5	46.6	40.4	41.8
£6.35	67.5	47.1	41.0	42.3
£6.40	67.6	47.3	41.2	42.5
£6.45	67.8	47.6	41.7	43.1
£6.50	67.9	47.6	41.8	43.3
£6.55	69.2	49.6	43.6	45.1
£6.60	69.8	50.0	44.3	45.5
£6.65	69.9	50.1	44.3	45.7
£6.70	70.2	50.5	44.8	46.4
£6.75	70.2	50.6	44.9	46.6
£6.80	70.7	51.0	45.3	47.1
£6.85	71.0	51.6	45.9	47.6
£6.90	71.1	51.8	46.0	47.7
£6.95	71.3	52.1	46.4	48.0
£7.00	71.3	52.2	46.6	48.2

**Table A6**  
**Hourly Earnings Distribution - 5 pence bands**  
**Predicted Wage Re-Weighting**  
**Cumulative Total %**

<b>Less than</b>	<b>May-99</b>	<b>March - May 2000</b>	<b>March - May 2001</b>	<b>March - May 2002</b>
£2.90	0.3	0.1	0.1	0.0
£2.95	0.3	0.1	0.1	0.0
£3.00	0.3	0.1	0.1	0.0
£3.05	0.5	0.2	0.2	0.1
£3.10	0.6	0.2	0.2	0.1
£3.15	0.6	0.2	0.2	0.1
£3.20	0.6	0.2	0.2	0.1
£3.25	0.6	0.3	0.2	0.1
£3.30	0.7	0.3	0.2	0.1
£3.35	0.7	0.3	0.2	0.1
£3.40	0.7	0.3	0.2	0.1
£3.45	0.8	0.3	0.2	0.1
£3.50	0.8	0.3	0.2	0.1
£3.55	1.1	0.5	0.3	0.1
£3.60	6.5	3.6	0.6	0.2
£3.65	6.8	3.7	0.6	0.2
£3.70	7.3	4.1	0.6	0.2
£3.75	8.3	4.8	2.7	0.2
£3.80	9.4	5.9	3.7	0.3
£3.85	9.9	6.2	4.0	0.3
£3.90	10.1	6.5	4.2	0.3
£3.95	11.1	7.0	4.6	0.3
£4.00	11.3	7.3	4.8	0.3
£4.05	14.8	9.9	7.1	0.8
£4.10	15.4	10.7	7.8	4.3
£4.15	16.0	11.0	8.0	4.6
£4.20	17.8	12.3	9.1	5.9
£4.25	18.3	12.8	9.5	6.0
£4.30	19.8	13.8	10.2	6.8
£4.35	20.8	14.9	11.2	7.9
£4.40	21.2	15.3	11.4	8.1
£4.45	22.5	16.1	12.0	9.0
£4.50	23.1	16.4	12.3	9.3
£4.55	25.4	18.5	14.5	11.0
£4.60	26.8	19.3	15.7	12.1
£4.65	27.3	20.1	15.9	12.4
£4.70	28.4	21.0	16.7	13.4
£4.75	29.2	21.2	17.0	13.5
£4.80	30.5	22.2	18.0	14.5
£4.85	32.1	23.5	18.9	15.5
£4.90	32.6	24.0	19.1	15.9
£4.95	33.7	25.2	20.1	16.7

**Table A6 continued**  
**Hourly Earnings Distribution - 5 pence bands**  
**Predicted Wage Re-Weighting**  
**Cumulative Total %**

<b>Less than</b>	<b>May-99</b>	<b>March - May 2000</b>	<b>March - May 2001</b>	<b>March - May 2002</b>
£5.00	34.6	25.7	20.5	17.1
£5.05	39.6	29.5	24.4	20.8
£5.10	40.1	30.0	25.5	21.6
£5.15	40.4	30.9	25.7	22.0
£5.20	41.9	32.0	27.0	23.4
£5.25	42.0	32.1	27.3	23.5
£5.30	43.2	33.1	28.9	24.4
£5.35	43.9	34.0	29.8	25.3
£5.40	44.0	34.2	30.0	25.6
£5.45	45.1	35.0	30.8	26.5
£5.50	45.5	35.4	31.0	26.8
£5.55	48.5	37.2	33.3	28.9
£5.60	49.4	38.2	34.1	29.7
£5.65	49.5	38.4	34.7	29.9
£5.70	50.0	39.2	35.3	30.8
£5.75	50.2	39.5	35.5	31.3
£5.80	50.7	40.0	36.3	32.0
£5.85	51.3	40.6	36.9	32.9
£5.90	51.4	40.9	37.3	33.1
£5.95	52.4	41.4	37.8	33.6
£6.00	52.7	41.6	38.1	33.8
£6.05	56.1	44.9	41.2	37.2
£6.10	56.5	45.8	41.7	37.7
£6.15	57.0	46.1	41.9	38.2
£6.20	57.8	46.9	42.9	39.2
£6.25	58.1	47.3	43.2	39.4
£6.30	58.7	47.9	43.7	40.2
£6.35	59.4	48.5	44.6	40.7
£6.40	59.7	48.6	44.8	40.9
£6.45	60.0	48.9	45.4	41.7
£6.50	60.1	49.1	45.5	41.9
£6.55	61.4	51.1	47.4	43.8
£6.60	61.9	51.6	48.2	44.3
£6.65	62.1	51.7	48.3	44.5
£6.70	62.2	52.2	48.9	45.2
£6.75	62.2	52.3	49.0	45.4
£6.80	62.8	52.8	49.5	45.9
£6.85	63.1	53.5	50.2	46.5
£6.90	63.2	53.7	50.3	46.6
£6.95	63.7	54.0	50.8	47.0
£7.00	63.7	54.2	50.9	47.2