
Issues in the measurement of low pay: 2010

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Abstract

The UK uses two major surveys as sources of earnings information to estimate the numbers on low pay. The methods for producing these figures are well established, but there are differences between employer and employee responses. These differences are accepted as a consequence of the different survey methods and purposes. Ormerod and Ritchie (2007) reviewed these explanations, and argued that all the results reflect, to a greater or lesser degree, behavioural response by both employers and survey respondents. In particular, the absolute and relative level of the minimum wage affected decisions made by employers and by the way that information is gathered. They also noted that the timing of data collection can affect the measurement.

This paper updates that work with information up to 2009. The additional three years of data support and expand upon the earlier conclusions of that paper. In addition, some minor changes were made to the surveys to address measurement issue. This work notes that these changes had less effect than expected, implying that some of the measurement issues are more deep-seated than expected. As before, this paper supports the current methods for generating low pay estimates but suggests that "the number of low paid" can be a misleading construct without an awareness of these background issues.

Disclaimer

This is a research paper. The opinions expressed in this paper are those of the authors and do not necessarily represent the views of the Office for National Statistics.

1. Introduction

The National Minimum Wage (NMW) was introduced in the UK in 1999 by the government as a direct response to the perceived growth in inequality in wages throughout the 1980s and 1990s. This was the first time the UK had had a minimum wage since the effective abolition of most Wages Councils in 1980, and the introduction of a floor to wages in a competitive labour market was predicted to lead to a variety of outcomes. The Low Pay Commission (LPC) was established to advise the government on an appropriate level for the NMW. The LPC is supported by a secretariat with a remit to carry out and commission research.

The UK Office for National Statistics (ONS) produces National Statistics (aggregate statistics produced to a defined quality standard) on the number of “low paid”. These figures relate to those earning at or below the NMW, and are broken down by a variety of personal and employer characteristics. These are taken as the most accurate statement on the condition of the low paid. Changes in the ONS aggregates are seized upon as evidence that the NMW is or is not having an impact on jobs, wages, profits, and so on.

The survey data used by the ONS for the National Statistics is also made available to researchers as de-identified microdata. The use of microdata allows relationships between characteristics and over time to be explored; for example, to separate out multiple causes of low pay in different occupations, industries, or ethnic groups.

Evidence of differential impacts in the economy can lead directly to policy recommendations, as well as having political repercussions. Hence, low pay figures, whether calculated from microdata or aggregate statistics, are highly visible and small changes are often highlighted in the press.

The annual Low Pay Commission Reports (LPC, 2005 to 2010) give an idea of the range of work carried out on the NMW. Some of this research is funded directly by the LPC, and some derives from external sources. Whilst the LPC research programme includes qualitative studies, case reviews and expert opinion, much of the research is based upon the ONS aggregate statistics and source microdata.

The ONS survey methodologies and collection practices are well-established, follow international best practice, and are produced with standard confidence intervals. Nevertheless, relatively little work has been carried out, either by ONS or by external researchers, on how robust some of these figures are when put under the spotlight that is possible by combining and contrasting the survey microdata at the most detailed level.

Low pay estimates will be influenced by a number of issues. For instance, a number of pay measures could be derived from the data; and the data itself may come from employers or employees, which affects the distribution of information. The period under review may also have an impact: estimates at the time of the NMW uprating may be more susceptible to errors from lags in data collection. This analysis will highlight and investigate potential measurement issues arising from both these sources.

There are a number of further assumptions made when reporting low pay statistics. It is assumed that the wage itself is measured accurately, and that errors in measurement lead to proportional

impacts on statistics. Finally, it is often assumed that differences in official statistics are the result of irreconcilable differences in the data sources.

When working with most official statistics, it is reasonable to assume that small variations in data collection 'cancel out' (some wages be under-reported, some over-reported) and the overall picture is accurate. However, when dealing with low pay, these need to be treated more cautiously. Because the concept of "low pay" is an on-off measure, small deviations in methods or circumstances can lead to large changes in results. For example, symmetrical inaccuracies in survey responses for those being paid at the NMW will lead to overestimation of the low paid. Given the policy importance of low pay, there is an important discussion to be had around the sensitivity of results

The next section describes how the official statistics on low pay are collected and published, and relates how the accuracy of low pay statistics is commonly perceived. We compare estimates based on the ASHE, the survey used to produce the National Statistic on low paid, and show results are sensitive to the methodology. We also compare rates based on LFS measures, the survey which provides the auxiliary estimates of low paid, and which is widely used by academic researchers for microeconomic research. Long-standing concerns over the accuracy of the LFS have been difficult to resolve because there is no supplementary information in the LFS to verify responses. However, the 2005 adult NMW of £5.05, and the LFS' questionnaire design, provides a natural experiment in how survey respondents approximate answers. The results are somewhat surprising, but also reassuring. However, they also point up the fact that the level of the NMW itself is a potential source of measurement error.

We then consider the effect that source has upon low pay estimates, by comparing measures from the ASHE and LFS. Specifically, we examine the tendency for rounding in the two data sources. We demonstrate that this is particularly common in the LFS. Similarly, the paper considers the tendency for wages to be set at focus points. This is observed in both ASHE and LFS. We are unable to say whether these issues are as a result of respondent rounding and hence a measurement issue, or whether this is due to employer setting of actual wage rates. The implications of this being partially as a result of employers preferring to set wage rates at round values (as found by Lam et al. 2006) is that the rate the NMW is set could be particularly important in influencing company wage setting policies. This is an issue we do not explore in great depth here, but an area to be explored in future research.

Third, the paper summarises and discusses the work of Ormerod and Ritchie (2007) on the timing of the surveys. The question of 'how many low-paid are there?' has a time dimension as well as a statistical dimension.

The final section draws together these results to ask what can be learnt from these in-depth studies. Overall, the paper supports the current methods for generating low pay estimates but suggests that "the number of low paid" can be a misleading construct without an awareness of these background issues; and that real-world effects can be identified by exploiting differences in surveys.

All results in the paper are based on the authors' own calculations from ASHE and the LFS unless otherwise identified.

2. Description of Low Pay Estimate Sources

The Annual Survey of Hours and Earnings (ASHE) is a one percent sample of employees using information provided by employers. It has been the main source of information on earnings in the UK since 2004. ASHE is used to generate the official estimates of the low paid, the percentage of jobs paid below the NMW; see Milton (2004) for a description of the ASHE estimate and its forerunners.

However, ASHE is not the only source for official low pay statistics. The household-based Labour Force Survey (LFS) also includes information on hours and earnings, as well as much more personal data. As ASHE has very limited information on the individual, LFS estimates are required to support the ASHE estimates where breakdowns by personal characteristics are required (for example, skill, ethnicity and disability). LFS surveys around 60,000 households every three months; households are surveyed for no more than five waves, and they are asked to supply earnings information on the first and fifth wave. The LFS estimate is based on information on first and second jobs. An improved methodology was developed by the ONS in 2005 to use improved information on second jobs (Ormerod (2005)).

Until 2004, ONS placed equal weight on the low pay estimates of LFS and the New Earnings Survey (NES), ASHE's predecessor. This was an acknowledgement that neither survey gave a definite answer on the number of low paid. ASHE was developed to remedy this uncertainty, and is considered to be the most reliable estimate; hence, the National Statistic for the number of low paid is simply the ASHE figure. However, the nature of low pay analysis is to try to understand which groups of individuals are more affected by the NMW. The LFS is vital to this analysis because ASHE has very limited personal data. ASHE and LFS estimates are therefore examined together by the Low Pay Commission (LPC) and others to assess the impact of the NMW on earnings and other related subjects.

The main difference between the two estimates has always been attributed to the different sources of the information. The ASHE is collected from the employer and as such the earnings information is thought to be more reliable as it is mainly provided with reference to company records. The LFS is provided by the individual and it is subject to recall error, which is compounded when the information is provided by proxy response. These differences are described in detail in Ormerod (2005). Ormerod and Ritchie (2007a) do provide some evidence that the LFS is an unbiased estimator of ASHE earnings data (if not hours), but this is over the whole dataset. Due to the binary nature of low pay estimates, measurement errors, even if unbiased, lead to over-estimates of the number of low paid. We return to this issue in a later section.

3. Effect of methodology on low pay estimates

3.1 Which hourly rates are comparable¹?

Estimates of low pay are generated by comparing individuals' hourly earnings with the appropriate NMW rate. The National Statistics on low pay are calculated from ASHE. For ASHE the *derived*

¹ This section is derived from Ormerod and Ritchie (2007)

rate - earnings for the period divided by hours worked - is believed to be the best measure of hourly pay because it is extracted from pay records and based on actual earnings and hours.

However, ASHE records several components of income: basic, incentives, shift premia etc, and it is possible to derive a rate based on several combinations of components. The LPC recommends that earnings included in the hourly rate used to calculate low pay estimates should be basic, incentive and other payments, but excluding any shift premium.

ASHE also has a *stated* rate of earnings, given by the employer. A stated rate is more likely to be based on basic pay only, but it is difficult to ensure that the respondent has included the desired components in the basic rate. Although validation against the derived rate can help, guidance is not clear in LFS and not explicit in ASHE. (ref Catrin/Carwyn's paper?) The stated rate is available for about one-third of respondents, but the proportion is much higher for those on hourly pay; these are generally lower earners. ONS currently uses this hourly rate for the validation of the derived rate but it is not used in reporting.

For the LFS a stated hourly rate appears to be a more accurate measure for pay per hour than the derived hourly rate calculated by dividing weekly earnings by hours worked. For individuals providing both derived and hourly rate information in the LFS it has been shown that the distribution of the derived rate is much wider than the stated rate and in some cases implausible. This is likely to be because respondents do not provide hours information that exactly matches the earnings information for the period and this results in an inaccuracy in the derived hourly rate. LFS estimates are therefore based on the hourly rate where this is provided.

However, hourly rates are only applicable for certain types of jobs whilst total earnings and hours are provided by most respondents; around half of the dataset has a value for the stated rate. Individuals who provided stated rate information are generally low paid and as estimates of the low paid focus on this part of the earnings distribution this is not seen as a major issue. Where a respondent does not provide hourly rate information this is imputed using a 'nearest neighbour' model where the derived rate has the most influence.

There is thus a basic difference between the methodologies used to create the ASHE and LFS low pay estimates; the ASHE estimate is based on the derived rate whilst the LFS estimate is based on the stated rate. ASHE has an hourly rate, comparable to the LFS hourly rate; but issues with the LFS derived rate make it difficult to produce a credible LFS estimate on the ASHE basis (Ormerod, 2005). Table 1 describes the various hourly pay measures that are examined in this paper.

Table 1 **Hourly Pay Measures from ASHE and LFS**

Measure	Description
ASHE Derived	Derived rate that includes incentive and other payments. This is not comparable to the ASHE stated rate. This measure is used to compile the National Statistic.
ASHE Basic Derived	Derived rate based on basic pay only. This is comparable to the stated rate which is also based on basic pay.
ASHE Stated	The hourly rate stated by the respondent. Only applicable for certain individuals and so approximately only half of respondents will have this variable.
ASHE Combined	The stated rate if present; if not the basic derived rate is used. This is comparable to the LFS hourly rate measure used to estimate low pay.
LFS Stated	The basic hourly rate as stated by the respondent. This is the preferred LFS pay measure.
LFS Derived	Average gross hourly pay; a derived rate that is based on basic pay only.

In summary, the stated rate in the household survey is felt to be less affected by the need to match up hours and earnings, but there is some concern over whether the stated rate measures the current wage rate. Individuals who are paid around the NMW are less likely to receive payments on top of their basic pay, so this may not be as important an issue for low pay estimates. In ASHE on the other hand, derived pay is felt to be the better estimate of actual pay, and the derived rate can be broken down into its subcomponents to compare with a stated rate, where this exists.

3.2 Comparable ASHE and LFS low pay estimates

Table 2 presents low pay estimates for 2006 to 2009 using the various ASHE measures. The LFS estimates are included for comparison purposes. Figure 1 illustrates the pattern for individuals aged 18 and over.

Using the basic-derived hourly rate of pay we estimate a greater number of low paid workers than when we use the derived rate. The basic derived rate of pay is by definition lower as it excludes other and incentive payments. This therefore results in a greater estimate of the low paid.

Estimates presented here that are based on the ASHE derived measure do differ from official statistics. This is partly due to ASHE reweighting, and also because estimates presented here refer to Great Britain rather than the UK. The proportion of workers aged over 22 we estimate to be paid below the NMW however, are very similar to the official figures. Those presented here are slightly lower, but differ by no more than 0.1%. This implies that a slightly greater than proportional number of workers are low paid in Northern Ireland compared to the rest of the UK. This is consistent with evidence presented in LPC (2005) that median gross hourly pay is lower in Northern Ireland compared with England, Scotland and Wales.

Comparing the various hourly pay measures between sources, the ASHE derived rates appear to be closest to the LFS measure. In an earlier version of this paper that examined the measures from 2004–2006 (Ormerod and Ritchie 2007), the ASHE combined measure was felt to be the most comparable to the rate calculated using the LFS. Whereas this is the case for 2004, the year ASHE

was introduced and subject to a number of problems, expanding the period under investigation has revealed that this is not consistently the case.

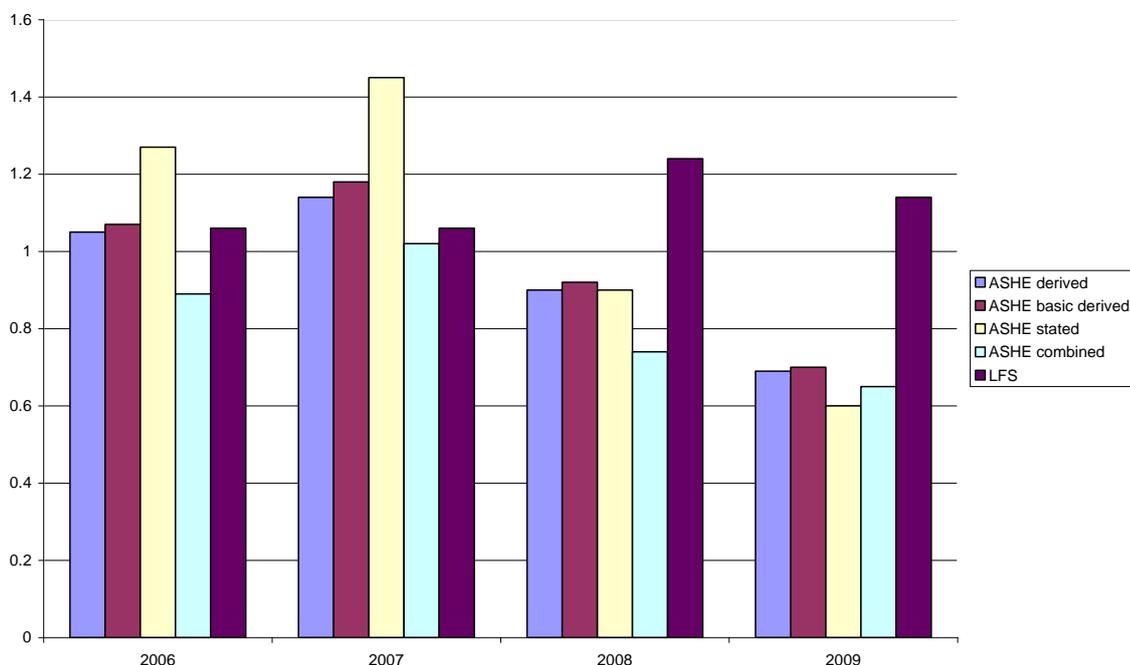
Table 2 Estimates of the number of jobs paid below the NMW using various hourly pay measures, 2006-2009

	16+	16+	16+	18+	18+	18+
	<i>Jobs</i>	<i>Jobs below NMW</i>	<i>Jobs below NMW</i>	<i>Jobs</i>	<i>Jobs below NMW</i>	<i>Jobs below NMW</i>
	<i>Thousands</i>	<i>Thousands</i>	<i>%</i>	<i>Thousands</i>	<i>Thousands</i>	<i>%</i>
2006						
ASHE Derived	24,575	268	1.09	24,221	254	1.05
ASHE Basic-derived	24,575	274	1.11	24,221	260	1.07
ASHE Stated ¹	10,257	133	1.29	9,971	127	1.27
ASHE Combined ¹	24,575	230	0.94	24,221	217	0.89
LFS ²	24,872	262	1.06	24,356	257	1.06
2007						
ASHE Derived	25,195	298	1.18	24,804	283	1.14
ASHE Basic-derived	25,195	308	1.32	24,804	293	1.18
ASHE Stated ¹	10,552	157	1.49	10,241	149	1.45
ASHE Combined ¹	25,195	268	1.06	24,804	253	1.02
LFS ²	24,870	274	1.10	24,387	260	1.06
2008						
ASHE Derived	25,454	241	0.94	25,042	224	0.90
ASHE Basic-derived	25,454	246	0.97	25,042	230	0.92
ASHE Stated ¹	10,765	101	0.94	10,427	94	0.90
ASHE Combined ¹	25,454	200	0.78	25,042	185	0.74
LFS ²	25,239	318	1.26	24,753	307	1.24
2009						
ASHE Derived	24,975	211	0.85	24,641	198	0.80
ASHE Basic-derived	24,975	213	0.85	24,641	200	0.81
ASHE Stated ¹	10,525	82	0.78	10,255	76	0.74
ASHE Combined ¹	24,975	202	0.81	24,641	188	0.76
LFS ²	24,984	288	1.15	24,558	283	1.15

Notes

1. Some basic validation carried out on stated rate
2. Revised LFS methodology devised in 2005 based on calendar quarters

Figure 1 Estimates of the percentage of jobs paid below the NMW using various hourly pay measures for individuals aged 18 and over, 2006-2009



Ormerod and Ritchie (2007) supported the use of the derived rate of pay in the ASHE as the most accurate measure of pay per hour. However when the information on total hours and total earnings comes from household surveys the derived rate is inaccurate. In this case the stated rate should be used. It is therefore necessary for ASHE and LFS low pay estimates to be based on different measures of hourly pay.

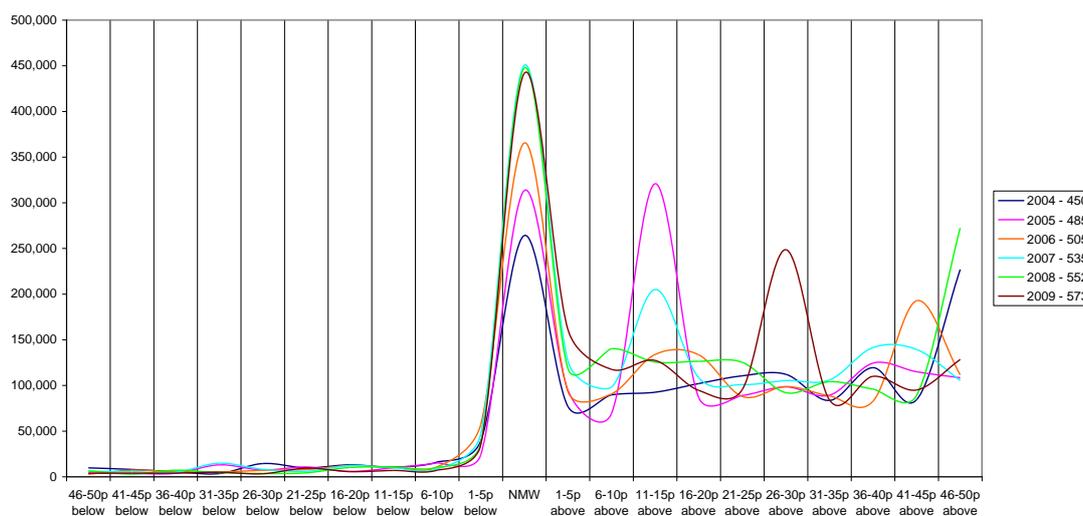
In summary, the estimates cannot be reconciled on the basis of the methodology used, partly driven by the nature of the source data. It is worth noting that the LFS estimates seem to be more variable than, and even contradict, the ASHE estimates. We now turn to the question of how accurate the source data is.

4. Effect of Source on Low Pay Estimates

This section focuses on a further reason for the differences in low pay estimates; the source of the information. ASHE estimates should be provided by employers from actual pay records (and follow-up checks confirm that this is overwhelmingly the case).

Figure 2 illustrates frequency rates using ASHE derived over time for those estimated to be paid the NMW and at various bands above and below this rate. As expected, for each year there is a large peak at the NMW, with no particular cluster at bands below this rate. In contrast, above the NMW there are peaks at round values, most notably at £5.00 (2004, 2005) and £6.00 (2008, 2009).

Figure 2 Distribution over time around NMW using ASHE Derived



LFS responses are recalled by the respondents, often without reference to documentation. In around 30 per cent of cases the respondent is not available when the survey is carried out, and a “proxy response” is provided by another member of the household. The potential for recall error in the LFS poses a particular problem for low pay estimates as it changes the distribution of observed earnings. Because low pay estimates are concerned with numbers below a limit, then a different distribution will lead to a biased estimate of the number of low paid, even if the estimate of the earnings distribution remains unbiased.

Figures 3 and 4 present frequency distribution around the NMW over time, using the LFS stated and derived measures. By comparing these to figure 2, we are able to see how the source used to measure low pay can have a large impact upon estimates. The distribution using LFS stated is not dissimilar to that using ASHE derived; there is a large peak at the NMW, and there are no large peaks below the NMW. Unlike that observed using the ASHE measure however, here there are small peaks below the NMW.

Interestingly, small peaks using LFS stated occur at the previous year’s NMW. For instance in 2008 there is a small peak at £5.35 and in 2007 at £5.05. The fact that this is not observed using the ASHE rate which comes from employer reports, suggests it is the differences in the source of the data that have led to this variation. The reliance the LFS measure places on respondent recall appears to have led some to state the previous year’s rate. Conversely, employers, the subject of ASHE data, will have a greater incentive to ensure they do not report rates that are below the current years NMW due to the possibility of prosecution.

The equivalent distribution for the LFS derived rate is quite different to that presented for ASHE and LFS stated. With the exception of 2004, there is no peak at the NMW. In 2004 however, the NMW was set at a round number (£4.50). In other years, where the NMW has not been set at similar focus points, the most common derived rates have been at round numbers, such as £5.00. The observation in 2004 therefore, can likely be explained by the fact that the NMW was set at such a rate.

Figure 3 Distribution over time around NMW using LFS Stated

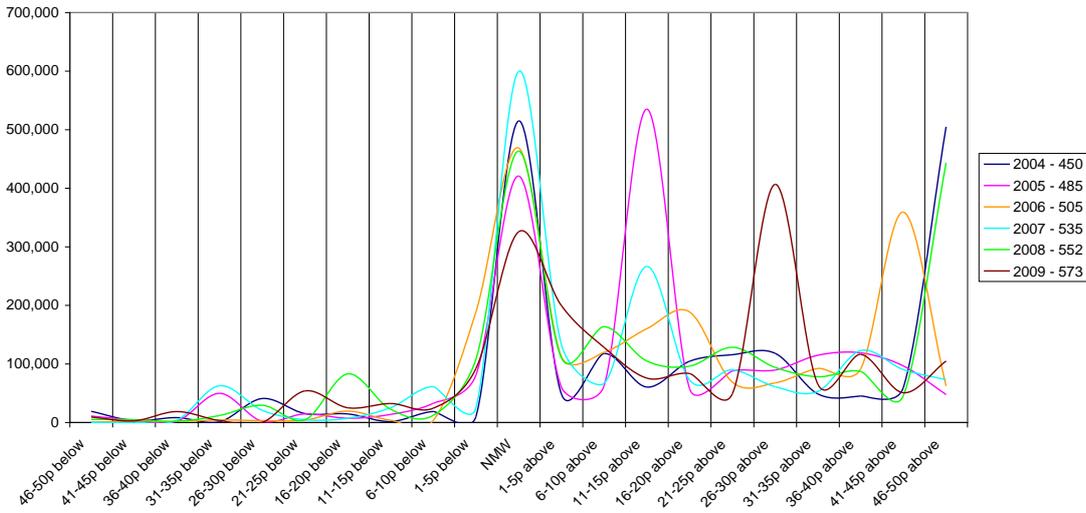
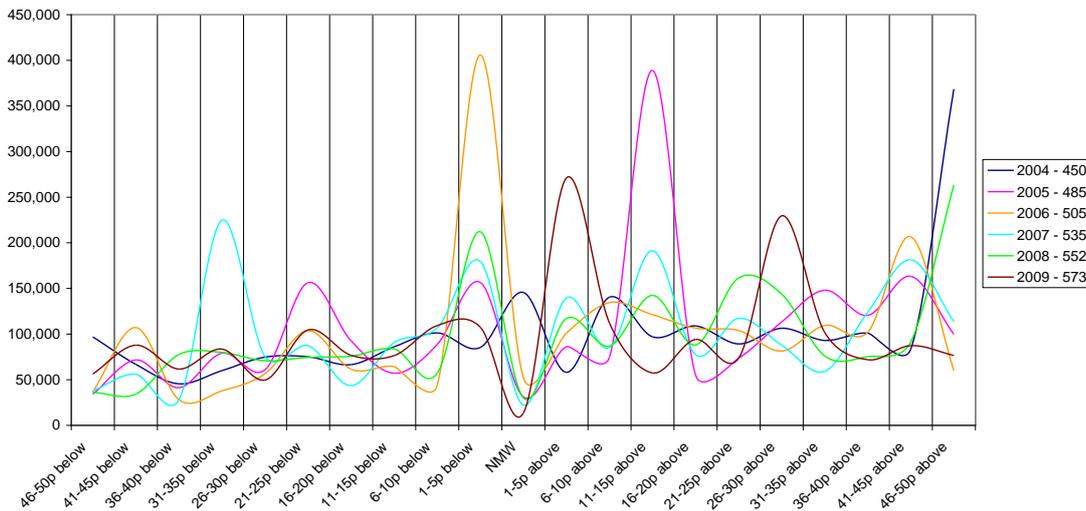


Figure 4 Distribution over time around NMW using LFS Derived



This therefore supports the conclusions of previous research; the ASHE appears to provide the most reliable measure of low pay, whilst the stated rate is the more accurate LFS measure. We examine each measure in turn in greater depth in the following section.

5. Focus points and rounding

Lam et al (2006) showed that employers like to pay employees wage rates at 'round' values, such as £4.50, £5.00 and to a lesser extent £5.75, £6.25. It is likely that household members paid at these wage rates would accurately recall rates, total wages and total hours. However, the actual wages paid in survey weeks often do not correspond to round values, and the concern here is that LFS respondents who do not refer to pay records carry out the rounding themselves: £4.95 being reported as £5.00, and so on. Total hours and earnings may also be rounded. The LFS shows a large number of employees being paid £5.00 per hour prior to 2006, with this being especially true of the LFS derived measure. We are also observing a greater number of respondents being paid

£6.00 as the NMW approaches this following annual upratings. Whether these are true figures or rounded is impossible to determine. However, this is also observed in ASHE, suggesting employers prefer to pay at round numbers.

The April 2006 National Minimum Wage (NMW) of £5.05 provides a natural experiment to test rounding by comparing stated and derived rates surrounding the £5.05 mark. Individuals rounding wages are likely to round down to £5.00; rounding wages up to £5.10 does not seem a likely alternative to using the actual wage. Observing large numbers of employees paid at £5.00 rather than £5.05 would imply significant rounding. This conclusion can be tested by comparing the ASHE records, which are compiled from documentation and are less likely to be subject to rounding error. The findings can also be tested by comparing the data with other years.

As well as rounding on the wage rate, household respondents may be rounding on total hours and earnings too. This is also likely to lead to more observations at £5.00 on the derived wage. This then leads to a further source of supporting information. If the derived and stated wage rates differ, the two can be investigated for evidence of rounding.

We also compare wage rates that are based on stated and derived responses from ASHE and LFS between 2004 and 2009. With upratings of the NMW observed every year over this period, we have a long time horizon over which to test our rounding hypothesis.

Table 3 presents our expectations for the ASHE and LFS estimates around the NMW following the annual increases. In 2004, the NMW was set at £4.50. This is one of the ‘focal points’ (Lam et al (2006)) where employers tended to fix wages; it is also a relatively straightforward number to use in calculations.

Table 3 Rounding Expectations by Year in ASHE and LFS

Year	NMW (over 22)	Employer Survey (ASHE) Expectation	Employee Survey (LFS) Expectation
2004	£4.50	No rounding	No rounding
2005	£4.85	No rounding	No rounding
2006	£5.05	Some rounding down	Significant rounding down
2007	£5.35	No rounding	No rounding
2008	£5.52	Some rounding down	Significant rounding down
2009	£5.73	Some rounding up	Rounding up

In contrast, in 2006 for example, with the NMW being set at £5.05, we would expect to see rounding down to the focus point of £5.00. This could be as a result of measurement problems, with LFS respondents rounding down to this focus point, or because employers’ prefer to set wages at round numbers. In the latter case, we may expect to observe similar rounding in the ASHE data. This is unlikely to be as significant however, as employer respondents will be wary of paying below the NMW. If indeed we do not observe as much rounding in ASHE compared to LFS, it would be fair to conclude that a significant element of rounding in the LFS rates is due to measurement and

not because of non-compliance with the NMW legislation. We may expect to observe similar rounding down in 2008 from the NMW of £5.52 to £5.50. As the NMW now approaches £6.00, we may begin to see an increase in the incidence of rounding to this value.

5.1 Earnings around the NMW

Figure 5 shows the distribution of earnings around the NMW using ASHE derived (5a), LFS stated (5b) and LFS derived (5c) for individuals aged 22 and over. Using the ASHE derived and LFS stated measures, peaks at the NMW can be seen clearly for 2004 at £4.50, at £4.85 in 2005, at £5.05 in 2006, £5.35 in 2007, £5.52 in 2008 and £5.73 in 2009.

In 2005 the peak at £5.00 is particularly high using both these measures, confirming earlier expectations that when the minimum wage is close to a round number, many employers chose to pay the next round number up. It is worth noting that employees are much more likely to report a stated rate of £5.00 than the £4.85, even though the employer data suggests that the NMW is the commoner wage.

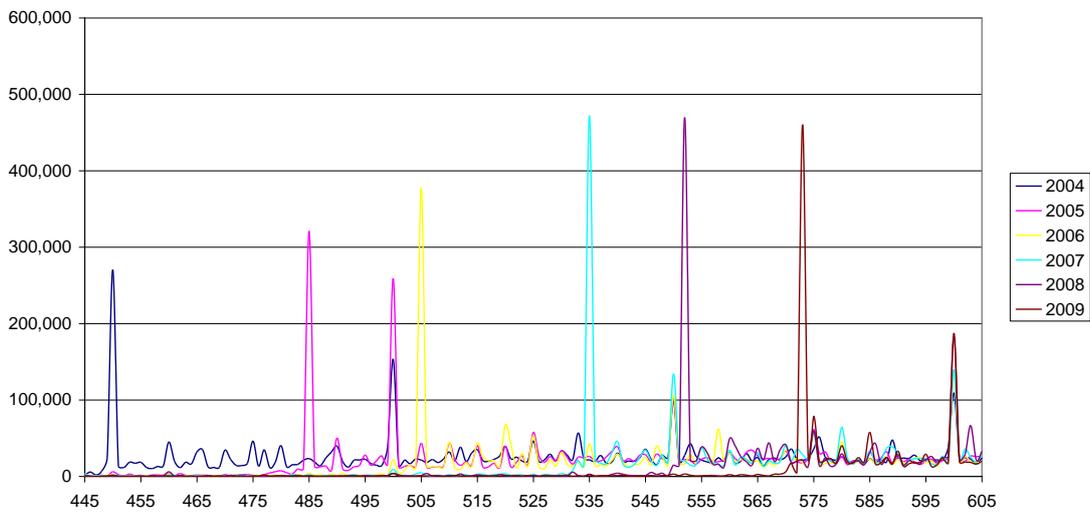
This is not the case in 2006 with the minimum wage at £5.05. Rounding to the next focus point at £5.50 may be too much of an increase from the NMW (it would have been a 13.4 per cent increase in hourly rate compared with the 4.1 per cent in the NMW itself) and there is therefore a higher peak at the NMW in 2006 than observed in previous years. Again as hypothesised, as the NMW approaches closer to £6.00, we observe an increasing number of workers paid this rate. This can be seen clearly from the LFS stated data (5b) in 2009. Whether this rounding is mainly due to measurement or employer wage setting policies is unclear, but it highlights how the level of the NMW can potentially impact upon both of these elements. The change in the percentage of jobs below the NMW is also related to the size of the uprating (see Lam et al, 2006) but the position relative to a focus point also appears to be important.

Employers are aware that they can not round down and are unlikely to round-up by a large amount. It therefore appears that the NMW, depending on its position relative to a focus point, can encourage some employers to take their earnings higher than the NMW if this is set close to a focal point. Ormerod and Ritchie (2007) suggested that many employers could use £5.50 as their lowest wage following the uprate in October 2006 to £5.35; the 2007 series illustrates that this is indeed the case, although a particularly high peak is observed at the NMW, suggesting the 15p increase is still too large to result in significant rounding, consistent with our expectations outlined in Table 3. Following the increase to £5.52 in October 2007, again with employers aware they cannot round down, we observe a particularly high peak at the minimum wage in the 2008 series. Although some rounding up does occur, most commonly at £6.00, this is not widespread.

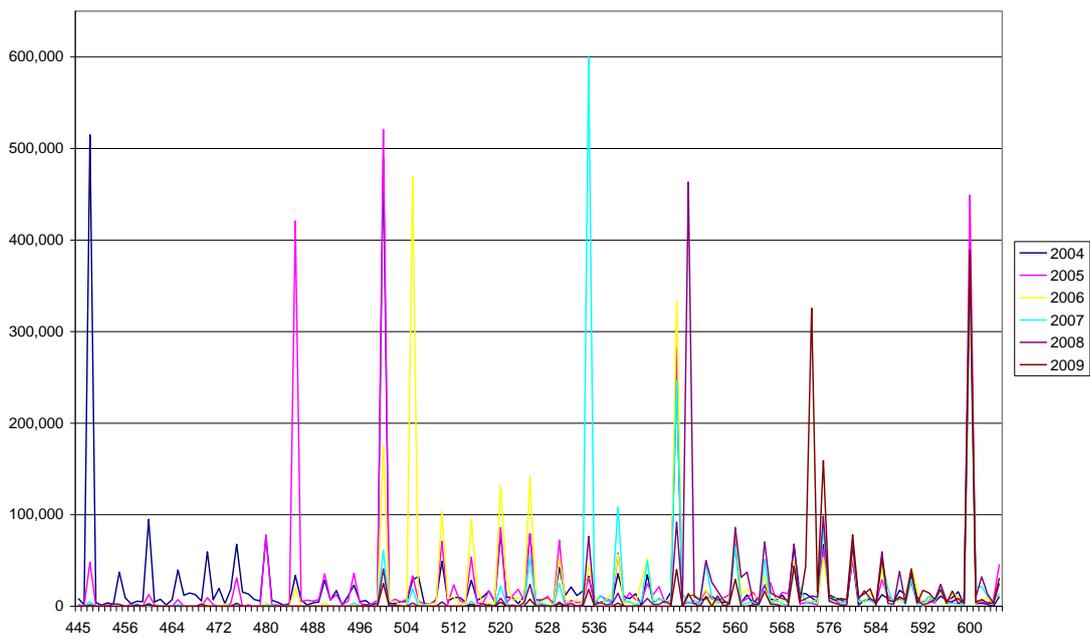
This contrasts with the picture for the LFS derived rate of pay in figure 5c. Here peaks are clearly visible at the focus points but only small peaks appear at the minimum wage values. Respondents on the LFS may not match the hours and earnings for a period; this will give an inaccurate derived hourly rate. Equally respondents may round their hours or earnings resulting in a 'rounded' derived rate. As employers respond to the ASHE they will be eager to provide accurate hours and earnings information as they do not want wages to appear to be below the NMW. LFS respondents do not have the same incentive.

Figure 5 Earnings for Individuals aged 22 and over, 2004-2009

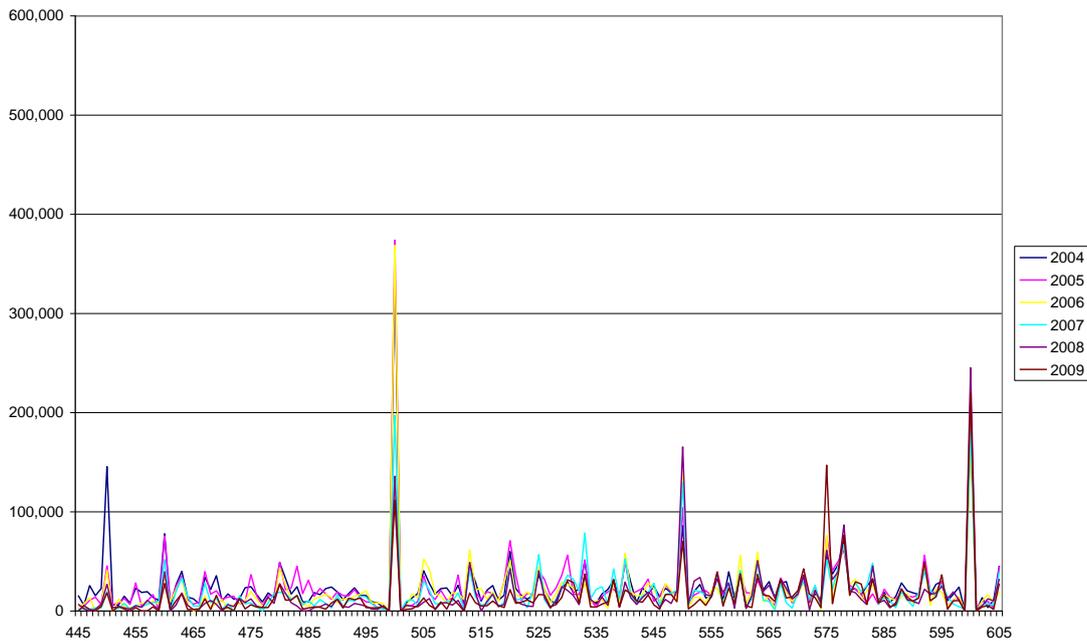
5a ASHE Derived rate of pay



5b LFS Stated rate of pay



5c LFS Derived rate of pay



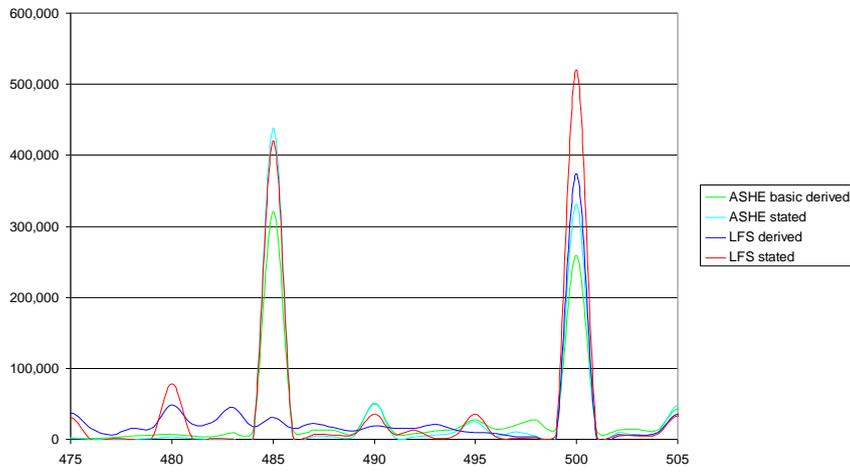
To examine focus points and rounding in greater detail, figure 6 presents the four low pay measures for 2005 through to 2009. With the NMW set at £4.85 in 2005, we observe large peaks at this rate using both ASHE measures and LFS stated. There is significant rounding-up to £5.00 for the LFS stated measure, and also, but to a lesser extent, the ASHE measures. In sharp contrast, the LFS derived measure shows no peak at the NMW, but there is a large peak at £5.00. For the LFS stated rate, earnings are all focussed on 5 pence bands with higher peaks at focus points (for example no respondent reports £4.94, only £4.90 or £4.95 is observed).

In 2008, with the NMW set at £5.52, again we observe large peaks at this rate using the two ASHE measures and LFS stated, but not using LFS derived. Conversely, there is a peak at £5.50 using the LFS derived rate, and also, although much smaller, using LFS stated.

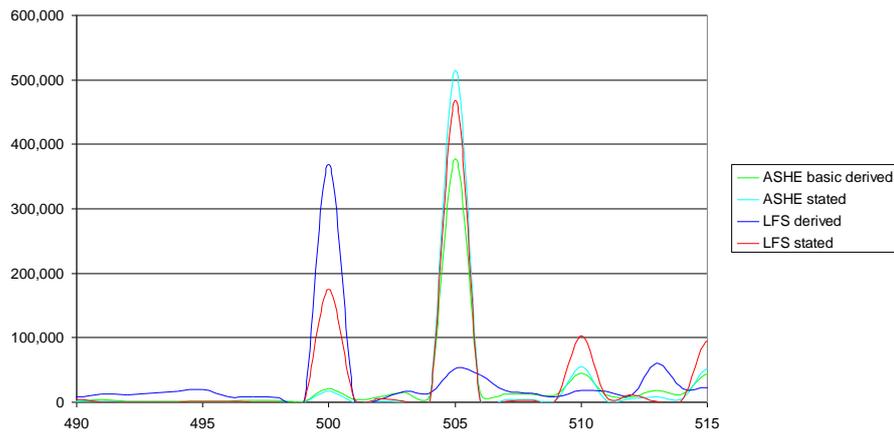
These figures illustrate the likelihood of rounding using LFS compared to ASHE low pay measures. In 2005, we observe significant rounding using measures from both sources, as the nearest focus point of £5.00 was above the NMW. In 2008 however, with the nearest focus point £5.50 and below the NMW, we only observe rounding in the LFS.

Figure 6 **Earnings for individuals aged 22 and over using various hourly measures**

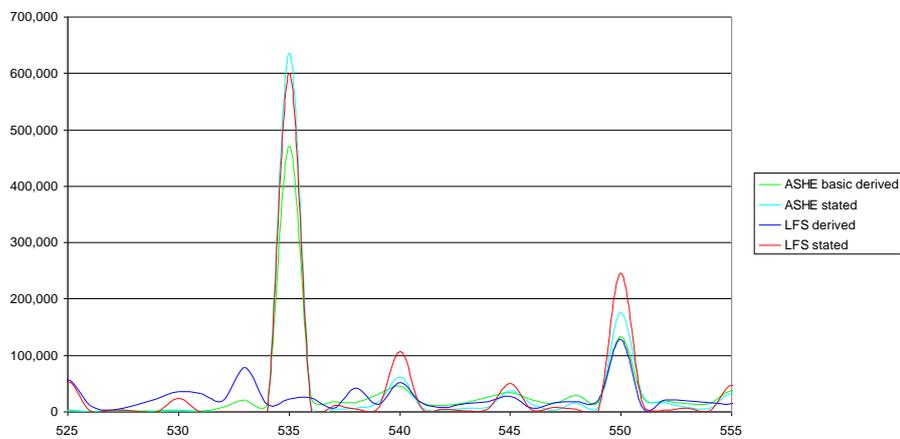
6a **2005**



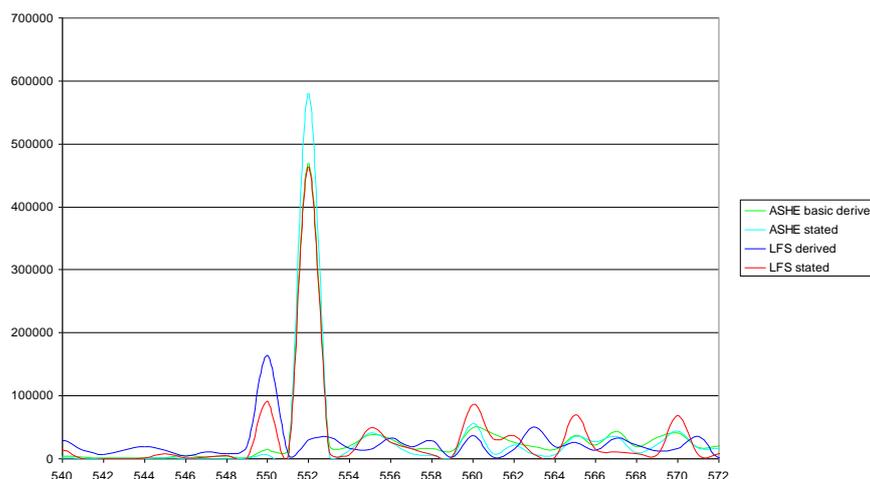
6b **2006**



6c **2007**



6d 2008



6e 2009

Our rounding expectations formulated in table 3 are largely supported. Rounding to the nearest focus point occurs using both ASHE and LFS measures, but the extent of this depends upon the level the NMW is set. The nearer the NMW is to a focus point, the more likely rounding will occur. In ASHE, we do not observe rounding down, which is likely to be due to the source of this data, with employers more wary of both paying and reporting wages below the NMW.

The fact that some rounding is observed in both surveys which come from contrasting sources, suggests that this is likely to be partly due to employers preferring to pay at such rates. However, the fact that rounding is more commonly observed in the LFS rates, suggests that source and hence measurement is an important issue when analysing low pay estimates, with respondents also commonly reporting wages at focus points. We are however, unable to determine precisely which factor is most significant in explaining the rounding.

Overall, the current methodologies for ASHE and LFS are supported by this analysis. The derived rate in ASHE shows peaks at the NMW, suggesting a derived rate based on actual earnings and hours measure hourly rates well.

5.2 Rounding in the LFS Revisited

As illustrated in previous sections, for the LFS there is no concentration around the NMW values for the derived rate, suggesting either rounding or a mismatch in earnings and hours makes the measure unreliable. The stated rate shows clear peaks at the NMW values, suggesting that individuals are aware of their hourly rates and do not round these. The derived rate is used to inform the imputation of the stated rate when a stated rate is not provided (Ormerod, 2006). Comparing responses to the derived and stated rate at this level therefore helps to understand the nature of the LFS low pay estimates.

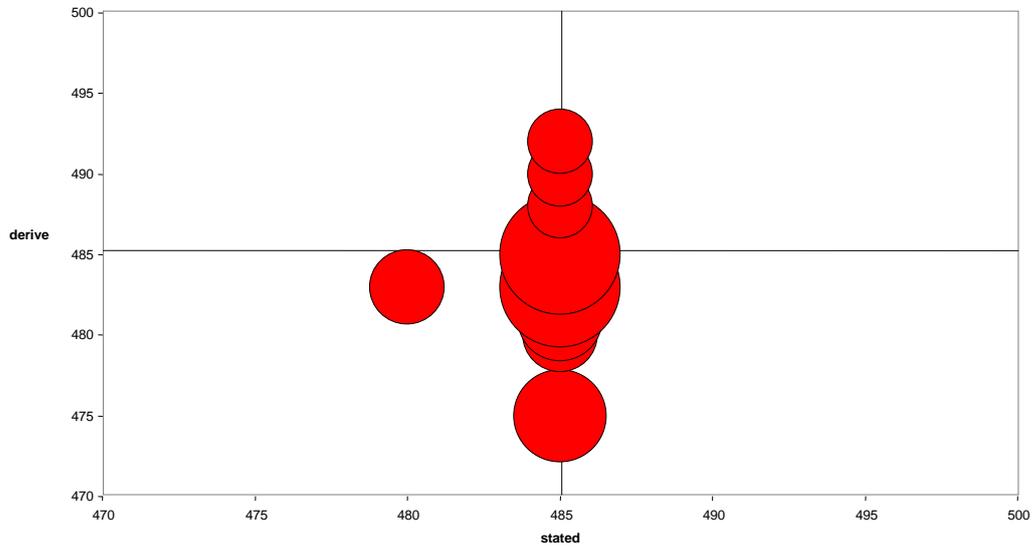
Figure 7 shows the number of respondents with derived and hourly rate values around the NMW in 2005, 2006, 2008 and 2009. The size of the point is related to the number of respondents (note, very small numbers of observations were omitted). For 2005, the stated and derived rates occur

most commonly at the NMW of £4.85. For 2006 however, even though the NMW is £5.05, most respondents have a derived rate of £5.00. Half of these also have a stated rate of £5.00, but the other half have a stated rate of £5.05. For all the respondents with a stated rate of £5.05 a variety of derived rates are provided. This suggests that for individuals having both a stated and derived rate the stated is more accurate. This is based on the assumption that a reported hourly rate of £5.05 is correct; it is unlikely that an individual would report such a value when estimating or rounding. This is further supported by the pattern observed in 2008; most respondents have a derived rate of £5.50 but a stated rate of £5.52. In both these years, respondents have rounded down to the nearest focus point.

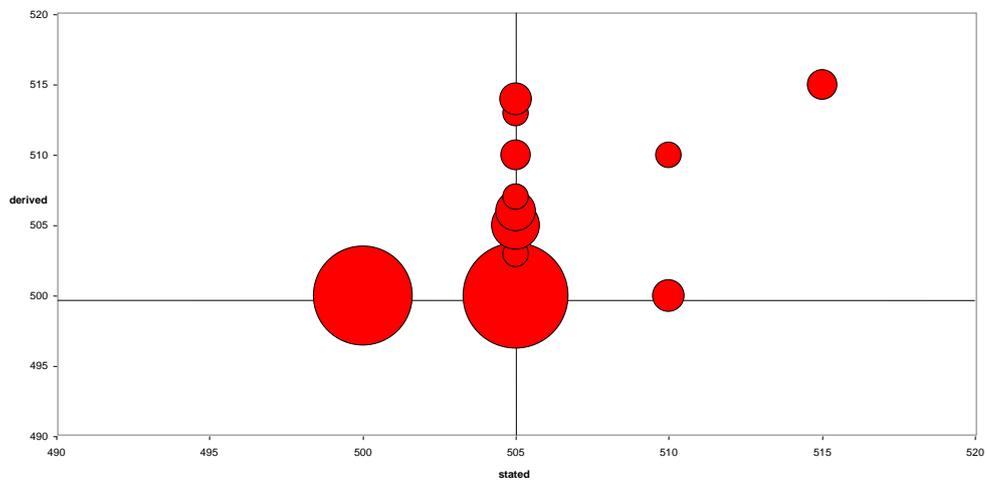
This is intuitively sensible. Employees are likely to know their hourly rate as this does not change from week to week. Weekly hours and earnings can however vary from week to week which makes recalling them more difficult. On examining the data closely the majority of rounding appears to relate to total earnings causing a round hourly rate to be provided.

Figure 7 **Number of respondents with stated and derived hourly rate values at NMW and focus points; LFS**

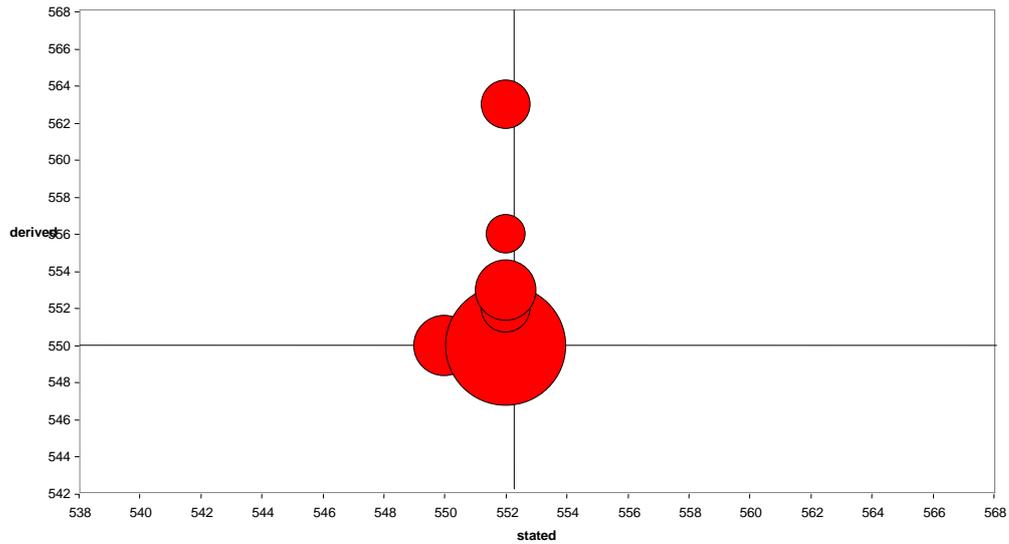
7a **2005**



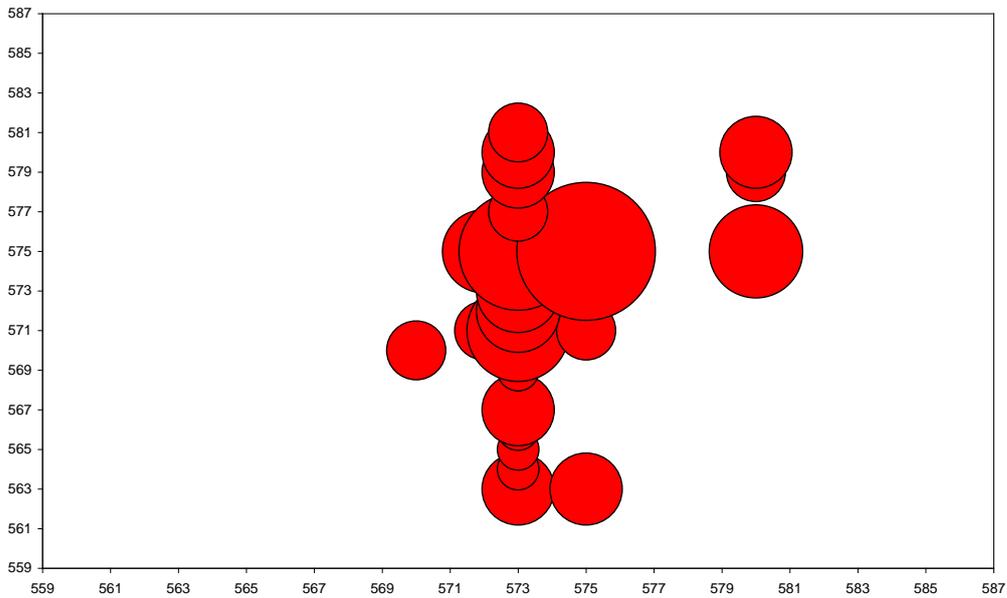
7b **2006**



7c **2008**



7d **2009**



5.3 Bad memory, bad knowledge or bad records?

It was noted above that two of the concerns about the accuracy of the LFS relate to the use of proxy responses and the lack of supporting documentation. A natural question to ask is whether these contribute to the rounding effect, and Ormerod and Ritchie (2007) studied this in relation to the 2006 NMW. Table 2 shows the types of responses and whether documentation was used for hourly rates quoting £5.00 or £5.05.

Table 4 **Percentage of respondents with £5.00 and £5.05 hourly rate measures by proxy response and whether documentation was used, aged 22 and over, March-May 2006.**

Stated	Type of response				Documentation used			
	Derived	Personal	Proxy Brought forward ^a		Payslip	Statement ^b	Other	None
£	£	%	%	%	%	%	%	%
5.00	5.00	46	54	-	7	-	2	92
5.00	5.05	*	*	-	-	-	-	*
5.05	5.00	79	21	-	13	-	-	87
5.05	5.05	90	10	-	30	-	-	70

Notes

- * Frequency suppressed for confidentiality reasons
- Zero or less than 0.5%
- a Information brought forward from previous quarter
- b Bank or building society statement

Source: Ormerod and Ritchie (2007)

Where the stated and derived value are both £5.05 the respondents are more likely to have provided the response themselves and with reference to documentation. Although it is impossible to tell whether the rates have been provided accurately it can be assumed that quoting such a number and obtaining a derived rate exactly equal to it suggests the information is accurate. This is borne out by the fact that 90 per cent of these individuals provided the information themselves, although even in these cases most used no documentation.

Only a small number of cases have a stated rate of £5.00 and a derived of £5.05; hence the numbers are not shown here. Where the stated rate is ‘accurate’ at £5.05 and the derived rate is rounded to £5.00 this is more likely to be a personal response. In all cases proxy responses are more likely to round one or both rates.

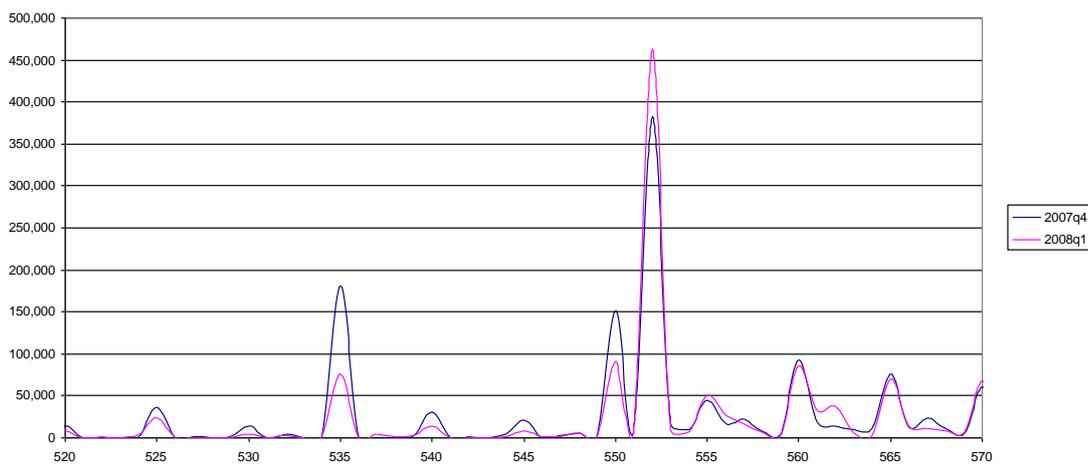
The table supports the idea that documentation is a source of error: correct answers are more likely to be supplied with documentation.

5.4 Is interviewer error a contributory factor?

As a result of the concerns raised in Ormerod and Ritchie (2007), one of the authors spent a day with an LFS interviewer, and drew the conclusion that the need for accuracy of pay rates may not be recognised by interviewers, who are not usually statisticians. Due to concerns that pay rates were being incorrectly reported in the LFS, an interviewer prompt was introduced in 2008 quarter 1 for the NMW of £5.52. This included an explanation of how respondent rounding needed to be avoided due to the implications for the accuracy of the data. At the same time however, the prompt stressed the importance of ensuring cases where the NMW was genuinely being breached were recorded. If the wage given was below the NMW, and the various NMW rates were listed in the

question, interviewers were instructed to query the respondent's answer, asking them to double-check that this was accurate. Figure 8 illustrates the LFS stated rate distribution around the NMW of £5.52. We compare quarter 4 2007 responses with quarter 1 2008; the NMW would have been the same in both periods, with the LFS interviewer prompt only present in quarter 1 2008.

Figure 8 LFS Stated Distribution around NMW; quarter 4 2007, quarter 1 2008



Initial examination appears to show the interviewer prompt had a large impact. In 2007 quarter 4, a large number of respondents reported £5.50, a rate below the NMW. In quarter 1 2008 however, the number reporting this rate declined substantially, with a greater number reporting the actual NMW rate compared to the previous quarter. However, as we examine in the next section, timing can itself be a factor in influencing low pay estimates. We may expect people to be more likely to report the correct NMW the greater the length of time they have been receiving it. For this reason therefore, we compare quarter 1 and 4 estimates for alternative years to see if there are any notable differences.

Figure 9 LFS Stated Distribution around NMW; quarter 4 2006, quarter 1 2007

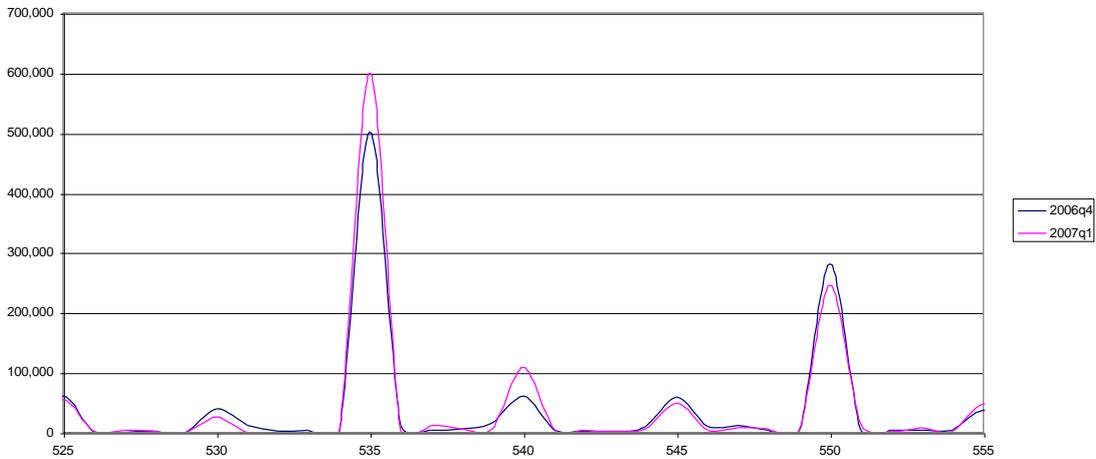
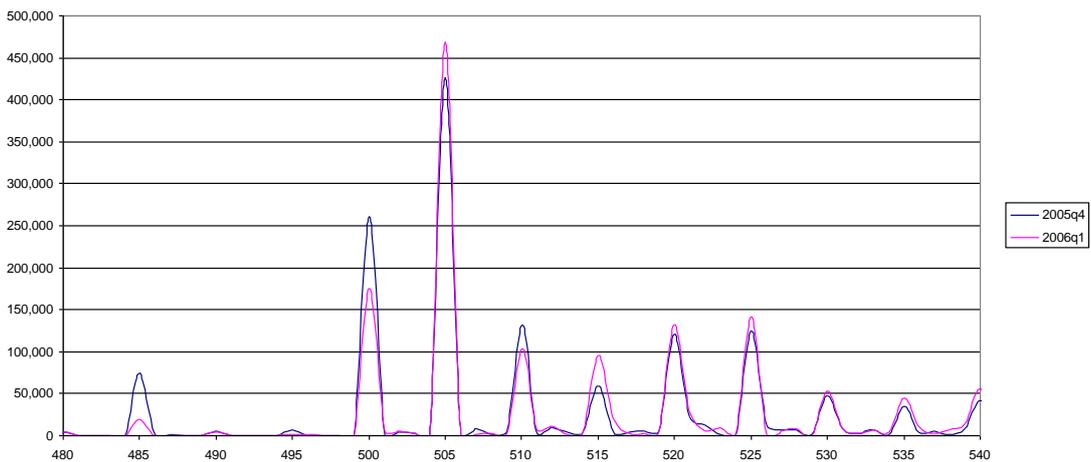


Figure 9 compares quarter 4 2006 with quarter 1 2007. This illustrates that respondents are more likely to report the NMW of £5.35 in the later period. However, as discussed in preceding sections, there is no obvious focus point near to this NMW, and so this is not really comparable to the 2007/8 wage of £5.52 where there is a strong likelihood of rounding down to £5.50. We therefore compare quarter 4 2005 with quarter 1 2006, where there is a clear focus point below the NMW of £5.05 (figure 10).

Figure 10 Stated Distribution around NMW; quarter 4 2005, quarter 1 2006



This demonstrates that a greater number of respondents report the NMW in the later period, and are more likely to report the focus point rate below the NMW in the earlier period. This suggests the addition of an interviewer prompt in the LFS did not appear have an impact in reducing the number

reporting wages below the NMW, as a similar reduction is observed in later quarters before the prompt was introduced. We examine the importance of timing in the following section.

6. The importance of timing

Although Ormerod and Ritchie (2007) did not identify the 'lagged response' effect noted above, they did recognise that the number of low paid tended to fall during the year. The three most obvious reasons for this are (1) a delayed response to the introduction of the NMW, (2) the impact of general pay rises across organisations over time, and (3) the timing of bonuses and back pay. It was argued that large firms were more likely to comply quickly with changes to the NMW, but were also more likely to be affected by delayed payment issues. An econometric analysis, taking account of firm size and other factors, suggested that

- all firms take some time to adjust to changes in the NMW
- there is little evidence to support the view that back pay is a significant factor in the low pay estimates; this could be responsible for the adjustment time for large firms
- small firms are more likely to be paying below the minimum wage throughout the year

Hence this may be the first indirect evidence of non-compliance with the legislation, at least immediately after the uprating. However, Ormerod and Ritchie (2007) also noted that the move from seasonal to calendar quarters affected the estimates containing the October collection period, when the NMW uprating comes into force. Because the LFS asks about earnings in the last pay period, it is legitimate for some people to report earnings below a just-introduced NMW. In addition, none of the surveys can identify non-pay offsets (for example, accommodation). Therefore, the delayed response to the NMW can only be seen as an indication of compliance rates, not a specific value.

7. Conclusion

These linked investigations do support the current methods of estimating low pay using the ASHE and LFS; and they go some way to reconciling the differences between the two sources of low pay estimates; the ASHE and LFS. Nevertheless, they suggest that "the number of low paid" can be a misleading construct without an awareness of these background issues: timing, the choice of measure of hourly earnings, the way people respond to survey questions and so on.

These results also suggest that the level of the NMW has implications beyond simply setting a floor for wages. Lam et al (2006) showed that companies do use some flexibility in setting wages, and the level of the NMW affects this. More recent research (see LPC, 2005-2010) suggests that wage distributions are becoming more compressed. If this is so, then the importance of 'focus points' for employers may be falling. However, there is no reason to suppose that the household respondents will fail to round to memorable focus points. The 2010 and 2011 NMW levels of £5.93 and £6.08 will provide a substantial test of the prediction similar to those in Table 3. If these do show strong focus point effects, this will strengthen the argument that the level of the NMW has a behavioural and statistical impact beyond merely setting a wage floor.

It has not been possible to determine in this paper whether earnings reported at focus points and round values are a true value or as a result of respondent rounding. The fact that rounding and wage setting at focus points is observed to some extent in both ASHE and LFS which are based on different sources however, suggests both elements are a factor. Closer examination of this issue, potentially investigating company wage setting policies in more detail, would make an interesting area for future research.

References

- Griffiths C, Ormerod C and Ritchie F (2006) 'Measuring low pay: Measures and precision'.
<http://www.ons.gov.uk/ons/guide-method/method-quality/specific/labour-market/annual-survey-of-hours-and-earnings/low-pay-estimates/measuring-low-pay---measures-and-precision.pdf>
- Lam K, Ormerod C, Ritchie F and Vaze P (2006) 'Do company pay policies persist in the face of minimum wages?'. *Labour Market Trends*, Volume 114, No. 3, pp 69-81.
<http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-114--no--3/do-company-wage-policies-persist-in-the-face-of-minimum-wages-.pdf>
- LPC (2005), 'National Minimum Wage Low Pay Commission Report 2005', HMSO Norwich
- LPC (2007), 'National Minimum Wage Low Pay Commission Report 2007', HMSO Norwich
- Milton J (2004), 'New methodology for low pay estimates'. <http://www.ons.gov.uk/ons/guide-method/method-quality/specific/labour-market/annual-survey-of-hours-and-earnings/low-pay-estimates/new-methodology-for-low-pay-estimates-in-2004.pdf>
- Ormerod C. (2006), 'LFS low pay estimates: Method of dealing with second jobs', *Labour Market Trends*, July 2006. <http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-114--no--6/labour-force-survey-low-pay-estimates.pdf>
- Ormerod C and Ritchie F (2006a) 'Measuring low pay: Focus points and rounding'.
<http://www.ons.gov.uk/ons/guide-method/method-quality/specific/labour-market/annual-survey-of-hours-and-earnings/low-pay-estimates/measuring-low-pay---focus-points-and-rounding.pdf>
- Ormerod C and Ritchie F (2006b) 'Measuring low pay: The importance of timing'.
<http://www.ons.gov.uk/ons/guide-method/method-quality/specific/labour-market/annual-survey-of-hours-and-earnings/low-pay-estimates/measuring-low-pay---the-importance-of-timing.pdf>
- Ormerod C and Ritchie F (2007) 'Issues in the Measurement of Low Pay', *Economic and Labour Market Review*, Volume 1, No. 6, pp.37-45 <http://www.ons.gov.uk/ons/rel/elmr/economic-and-labour-market-review/no--6--june-2007/issues-in-the-measurement-of-low-pay.pdf>