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Understanding the Gender Pay Gap: What's Competition Got to Do with It?

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Abstract
A number of papers have recently argued that men and women have different attitudes and behavioural responses to competition. Laboratory experiments suggest that these gender differences are very large but it is important to be able to map these findings into real world differences. In this paper, we use performance pay as an indicator of competition in the workplace and compare the gender gap in incidence of performance pay and earnings and work effort under these contracts. Women are less likely to found in performance pay contracts but the gender gap is small. Furthermore, the effect of performance pay on earnings is modest and does not differ markedly by gender. Consequently the ability of these theories to explain the gender pay gap seems very limited.

Keywords: Gender Pay gap, Performance Pay
JEL Classifications: J31, J33

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Introduction

Economists have long struggled to offer a complete explanation of the gender pay gap – although factors like differences in labour market experience do have considerable explanatory power, a sizeable gap typically remains after the best attempts to explain it (see Altonji and Blank, 1999, or Blau and Kahn, 2006). Recently, a new class of explanations have been proposed – that, by the time they enter the labour market, women and men differ in psychological attitudes that affect the type of employment contracts they favour and their performance therein[1]. For example, Gneezy et al (2003) find that women perform less well than men in tournaments, particularly mixed-sex tournaments. Also, Dohmen and Falk (2006) and Niederle and Vesterlund (2007) find that women seek to avoid variable pay schemes (that tend to raise productivity) and tournaments. All of these studies use evidence from laboratory experiments, but their conclusions chime with other research, e.g. Babcock and Laschever (2003) who argue that women's attitudes not their productivity per se accounts, at least partially, for their lower earnings. The gender gaps found in these experiments are often very large. For example, Dohmen and Falk (2006) show that, even after controlling for productivity, women are about 15% less likely to enter a variable pay scheme than men. And in Gneezy et al (2003) the gender gap in performance in mixed-sex tournaments is 33%.

This paper is an attempt to do evaluate the importance of these ideas in practice for our understanding of the gender pay gap. We use data from the 1998 and 2004 British Workplace Employees Relations Survey (WERS) that contains information on the

[1] There is a debate which we will not discuss in detail here about whether these effects are nature or nurture – the evidence in Gneezy, Leonard and List (2008) and Booth and Nolen (2008) suggest some role for nurture as the first paper finds women are more competitive than men in a matriarchal society and the second finds no gender differences for those who went to single-sex schools.

nature of the pay schemes individuals work under. We use the presence of a performance pay contract as an indicator of a more competitive environment in the workplace.

One should acknowledge at the outset that we do not have an experimental design, nor do we know exactly the nature of the incentives workers face in the performance pay contracts we study, so that one potential criticism of our conclusion is that we are not capturing in our variables the measures the laboratory studies have found to be important. To allay such fears we provide various upper bounds on the part of the gender pay gap that can be explained by the competition hypothesis.

The plan of the paper is as follows: In the next section, we describe the data. The second section then considers selection of men and women into performance pay contracts. In the third section, the effects on earnings are presented. The fourth section discusses some potential limitations of our results, and the fifth section concludes.

1. Data

The Workplace Employees Relations Survey (WERS) is an establishment-based survey that collects detailed information on many aspects of employment relations in Great Britain. In one form or other it has been conducted 5 times since 1980 though we only use the two most recent surveys – in 1998 and 2004 – as only these contain information on the earnings of individuals. In each of these surveys, managers are interviewed and provide a very wide range of information on human resource practices within the establishment, including the pay system – the present focus of interest. There is then a sample of workers who answer questions about themselves (collecting information on most of the usual demographics) including their earnings.

WERS contains information on the use of a number of different types of variable pay schemes – profit-sharing, employee share-ownership and performance pay. In this paper, we focus exclusively on the impact of performance pay schemes as these seem to have the largest effects on behaviour and are the focus of interest in the experimental literature discussed in the introduction. In WERS, information on the use of performance pay is collected for 9 broad occupational groups (essentially the 1-digit level) from the management respondent, so we do have some within-plant variation in the use of performance pay as some plants use performance pay for some occupations and not for others.

The category of 'performance pay' encompasses a wide range of incentive schemes from piece-rates in which individual pay is related to an objective measure of individual output to merit pay based on subjective assessments of managers. WERS does contain information on the type of performance pay contract in use (whether it is payment-by-results or merit pay), the level at which performance is assessed (whether it is the individual, group or workplace) and the method of assessment of performance (e.g. piece-rates or subjective assessment). However, this information is not disaggregated by occupation – we only have information on whether these types of performance pay contracts are used for any workers within the plant – this means that the types of performance pay contracts are not mutually exclusive and managers can report the use of multiple types. Because one cannot link the type of performance pay contract to workers in particular occupations, our main analysis uses the presence of performance pay as an indicator of a more competitive environment within the plant. But we do experiment at various points with dividing performance pay contracts into different types.

It is important to consider the relationship between the ‘performance pay’ variable that is the focus of interest in this paper and the ‘competitive’ versus ‘non-competitive’ pay schemes that have been the focus of the experimental literature. That literature has typically compared ‘piece-rates’ and ‘tournaments’, with the former interpreted as a non-competitive pay scheme and the latter as a competitive one (though Dohmen and Falk, 2006, also consider a fixed-pay scheme). In our classification, we interpret all performance pay schemes (including piece-rates) as a more competitive environment than fixed-pay schemes, though we do make some attempt to classify performance pay schemes into different types (described below). There are a number of reasons why we think that piece-rates are more competitive pay schemes than assumed in the experimental literature. First, in real-world work environments, people generally do not work in isolation and the differences in pay that result from piece-rates will typically be quite visible and there will be seen to be ‘winners’ and ‘losers’. Secondly, in the real world, earnings under piece-rates are not independent. If some workers produce a lot under piece-rates, the piece-rate will typically be adjusted downwards as employers seek to set total earnings to match what could be obtained on the outside labour market. In the folklore of the working class ‘rate-busters’ were disliked because their greater output resulted in lower earnings for others as the piece-rate was adjusted downwards.

Nonetheless, it could be argued that some forms of performance pay contracts are more competitive than piece-rates and can come closer to the tournaments considered in the experimental literature. For example, the most common form of merit pay is a system where the employer decides on a pot of money to be used for merit pay and then the allocation across individuals is decided – in this case, there is an effective tournament as a pound extra for one worker is a pound less for everyone else. Of course these tournaments are nowhere near as extreme as the 'winner-take-all' approach in many of the experimental studies but it is important to study incentive schemes that are actually used. In what follows we do investigate whether the impact of piece-rates and merit pay is different.

2. Do Women Shy Away From Competition?

In this section, we discuss the incidence of performance pay schemes and consider whether women are under-represented in jobs which have those schemes. Table 1 presents the incidence of performance pay schemes in the WERS data. Panel A uses data from the employee profile questionnaire completed by management together with the weights required to reproduce the British working population, i.e. this should be an estimate of the proportion of workers in Britain as a whole on performance pay contracts. In the 1998 sample 16.3% of workers were in jobs which used performance pay, and this rose to 32% in 2004. Although there is little surprise that the use of performance pay is rising over this period, the magnitude of the rise does seem large. However, a direct question in the 2004 survey reveals that 12% of establishments report that they have introduced performance related pay in the last 2 years, so the increases reported in Table 1 may not be implausible. This table also reports the prevalence of performance pay for men and women, a first indication of whether women are under-represented in performance pay contracts. In 1998 men are 4 percentage points more likely than women to have performance pay, and this gap rose to 8 percentage points in 2004. Panel B of Table 1 shows the incidence of performance pay among the individuals in the workers sample of WERS – the sample we will use for analysis. The proportions in Panel B are very similar to those derived using the basic workforce information reported in Panel A. These raw gender differences in the incidence of performance pay are much smaller than those typically reported in the experimental literature.

Is there any evidence that women shy away from particular types of performance pay contracts? Table 2 shows the proportion of men and women with performance pay who are in plants with either or both of merit pay and payment-by-results. There is no indication here of women avoiding the merit pay schemes that might be thought to be more competitive – if anything, women are more likely to be on such schemes, though the gender gap is small. There may also be a difference in the level at which performance in assessed, e.g. very competitive individuals might prefer individual-based schemes while others might prefer team or workplace-based schemes. Table 3 shows that the most common form of performance pay contracts are individual-based but that there is little raw difference between men and women in the level of the measures used to evaluate performance.

Tables 1-3 do not control for any other relevant factors, and we next consider their importance. When we control for additional characteristics, the gender differential remains small and often insignificant. Table 4 estimates probit models of whether an individual is in a performance pay contract, with gender on the right-hand side and different sets of covariates. The first row includes only a dummy for gender, the next row personal demographics, the third row establishment characteristics, the fourth row occupation dummies. The fifth column estimates a linear-probability model with establishment fixed effects. In all of these estimates, the extent to which women seem to shy away from performance-related pay is much smaller than the gaps reported in the experimental literature and the inclusion of some regressors can fully explain the gap. In particular, the inclusion of job dummies turns a gap of 4-5 percentage points into something close to 0.5 percentage point. We do not find strong support for the finding of Gneezy and Rustichini (2006) that the differences within occupations are smaller than the raw differential – the inclusion of occupation in the fourth row actually raises the gender gap slightly.

It is not immediately obvious which specification is the best to use as an estimate of the gender difference in performance pay contracts. If it is the case that women seek to avoid competitive situations, this may show up in the choice of occupation, industry, public or private sector or unionization. In this case the best evidence would be the specification that controls only for personal characteristics. However, there may be other reasons why women end up in different sectors from men, and factors apart from gender differences in the attitude to competition that explain the variation in the use of performance pay across sectors. It would then be wrong to assign all of the raw gender gap in the incidence of performance pay contracts to different attitudes to competition among men and women. As this paper argues that the overall explanatory power of the 'competition' hypothesis is small, we err on the side of generosity and use estimates that include only personal and not job characteristics as our main specification. However, we do report estimates in some tables with different sets of controls to give some idea of the sensitivity of results to specification – these other specifications generally suggest performance pay is even less important in explaining the gender pay gap.

As discussed previously, one might argue that the measure of a performance pay contract used here is not a perfect measure of 'competition' that is used in the experimental literature. There are a number of ways in which we might investigate that hypothesis. We argued above that merit pay schemes are more likely to be 'tournaments' than piece-rate schemes. The sixth and seventh rows of Table 4 restrict the sample to those on performance pay contracts and estimate probit models for having merit pay and payments-by-results. Gender gaps are small and insignificantly different from zero but, if anything, women are more likely to be in merit pay systems. It might also be the case that women's greater aversion to competition leads them to end up in fewer jobs with individual-based performance pay (as opposed to group-based performance pay). The eighth row of Table 4 shows that this does not seem to be the case – women and men on performance pay schemes are equally likely to be in schemes using individual measures of performance.

The estimates in Table 4 can be thought of as an average across all jobs – but perhaps it is only women in some sorts of jobs who shy away from competition. To investigate this, Table 5 estimates separate probit models for the 9 1-digit occupations reporting estimates both with and without controls for job characteristics. None of the gender gaps are particularly large, but not all of them are negative and there does not seem to be any very noticeable pattern to the coefficients.

In conclusion, although women are less likely than men to be found in performance pay contracts, the difference is much smaller than the size of effect reported in the experimental literature. However, we need to be able to say something about the effect of performance pay on earnings before we can say anything about the size of the contribution to the gender pay gap – this is the topic of the next section.

3. The Effects of Performance Pay on Earnings

We now turn to the effects on pay. We start by estimating simple earnings functions pooling both men and women with a gender dummy. The earnings data in WERS refers to weekly earnings and is banded. We use a number of estimation models for this data – an interval regression model, with and without allowance for heteroskedasticity, and a model in which we simply use the mid-points of the bands. The first row of Table 6 includes nothing but a gender dummy showing a log hourly pay differential of 23 log points in line with other estimates (Anderson et al, 2001). The next rows show how this changes when one includes personal characteristics, job characteristics (including the gender mix on the job) and occupation. Inclusion of personal characteristics (the second row) reduces the gender pay gap to 21 log points and job characteristics (the third row) to 17 log points and including, in addition, occupation (the fourth row), reduces it further to 14 log points. The fifth row then shows that the estimate from the interval regression model is essentially identical if one allows for heteroskedasticity related to all the covariates and the sixth row shows that one obtains essentially the same estimate if one estimates a linear regression model using mid-points of the pay bands to assign weekly earnings (plus 1.4 times the top band). Because recognising the banded nature of the data makes very little difference to the estimates, the rest of the paper just uses linear regressions. The seventh row includes establishment fixed effects – the reduction in the estimated gender pay gap to 10 log points shows that women are concentrated in lowpaying firms. The eighth row includes fixed effects for the plant-occupation combination – this reduces the gender pay gap still further, though the reduction is only a modest one. Finally, the last two rows report the results of Oaxaca decompositions where the coefficients in male and female earnings equations are estimated separately and the reported results are the pay gaps evaluated at the average man and average woman. All of these results are in line with what others have found when studying the UK gender pay gap using other data sets (see, for example, Anderson et al, 2001).

Table 7 also reports estimates of earnings functions but now including the presence of performance pay as an additional regressor. The estimate in the first row includes no regressors other than gender and performance pay. The gender coefficient is very similar to that reported in the similar specification in Table 6 because, as shown in the previous section, women are not strongly selected out of performance pay schemes. The presence of a performance pay scheme is estimated to raise wages by 17.5 log points. However, as the other rows of Table 7 show, this effect is much reduced if one includes other covariates, reflecting the fact that high-level occupations are more likely to have performance pay. Including personal controls reduces the effect to 12.8 log points, adding job controls reduces the effect to 8.6 log points and inclusion of occupation to 4.6 log points. If plant fixed effects are included, the estimate is only 2.5 log points, though it remains significantly different from zero[2]. These modest estimates of the effects of performance pay schemes on average earnings are in line with what other studies have found (e.g. Lemieux, MacLeod and Parent (2006) though they stand in contrast to the very large effects found in the experimental studies and some studies of specific

[2] We cannot go further and include plant-occupation fixed effects as in Table 8 as performance pay schemes are defined at this level.

performance-related pay schemes (Lazear, 2000, Bandiera, Barankay and Rasul, 2005). A possible reason for this is that most performance pay schemes are not very high-powered while those individual schemes that have been studied are.

The estimates of the gender pay gap in Table 7 are very similar to those found when the performance pay variable was excluded, suggesting that performance pay schemes contribute little to our understanding of the gender pay gap. But the estimates so far have been based on the assumption that male and female earnings functions differ only in the intercept. Table 8 investigates whether relaxing this assumption makes any difference by estimating separate male and female wage equations. The first two columns report the coefficient on performance pay in male and female earnings functions. Contrary to what might be expected from the experimental literature, the returns to a performance pay scheme seem very similar for women and men.

The third and fourth columns of Table 8 investigate whether there is a different effect from having a merit-based or piece-rate pay system. These variables are only available for 2004, so the sample size is smaller here, but there is no evidence of any difference in the effects of these pay schemes. The fifth and sixth columns then investigate one of the findings of Gneezy et al (2003), namely that performance in competition is affected by the gender mix. We have information on the gender mix of the job done by the worker which we divide into mostly male, mixed and mostly female. The fifth column estimates a male earnings function in which the omitted category is the most common – male-dominated. There is a marginally significantly negative effect of being in a female-dominated job with a performance pay scheme – this is different from the finding of Gneezy et al (2003) who find men perform better when competing against women. The seventh column estimates a female earnings function in which the omitted category is a female-dominated job. There is no evidence the gender mix of the job has any effect on the pay impact of a performance pay contract.

All of the estimates presented so far suggest a very modest contribution of competition based pay schemes to the overall gender pay gap. For example, if we assume a return to a performance pay contract of 12.4% (the first two columns of Table 8) and ask how the gender pay gap would be affected if there were no performance pay schemes, the gender pay gap would be reduced by 0.124*(0.238-0.192)=0.0057 as 23.8% of men and 19.2% of women are on performance pay. The estimated contribution is approximately half of one percentage point. The reason for this is simple – the returns to performance pay are modest as is the gender difference in the incidence of performance pay[3].

We make one final attempt to find a large effect of performance pay on earnings. The estimates presented so far assume performance pay affects only the intercept of the earnings function but it might effect other coefficients as well (for example, Lemieux, Parent and MacLeod, 2006, find higher returns to education and lower returns to job tenure with performance pay). To investigate this without being too restrictive about the way in which performance pay affects earnings, we use a re-weighting estimate of the impact of performance pay along the lines first used by diNardo, Fortin and Lemieux (1996). Under the assumption (which we have made throughout this paper) that the presence of a performance pay scheme is exogenous conditional on the included

[3] There is perhaps an echo here of the results of Manning and Swaffield (2008) who investigate the impact of psychological variables on earnings – although they do find these variables affect earnings and that men and women are different, they fail to explain a sizeable effect of the gender pay gap as the differences are not large enough.

covariates, we can estimate a probit model for the presence of performance pay for men and women separately, and then re-weight those observations without performance pay to get an estimate of what the distribution of earnings would have been in the absence of performance pay. One can then take the difference between men and women to get an estimate of what the gender pay gap would have been in the absence of performance pay, and compare this to the gender pay gap with performance pay to get an estimate of the contribution of competition to the gender pay gap. The result of this exercise is a gap of less than one percentage point, reinforcing our conclusion that performance pay explains little of the gender pay gap.

4. Potential Criticisms

We have failed to find any sizeable important role played by performance pay in explaining the gender pay gap, and we have interpreted this as saying that there is little evidence that the differing attitudes and responses to competition of men and women is important in the labour market. But, it is worth reflecting on the possible way in which our conclusions might be misleading and why we get results so different from the experimental evidence. In this section we discuss possible explanations.

First, our approach assumes that, conditional on the covariates, having performance pay is exogenous – we do not have a research design with random assignment of performance pay. Existing studies, both experimental (Dohmen and Falk, 2006) and from the field (Lazear, 2000) tend to find it is the more able workers who select into performance pay contracts - in this case, our estimated effects of performance pay, small though they are, are most likely to be over-estimates.

Perhaps more problematic is the argument that the rewards from competition are not in current wages but in something like promotion so that our outcome measure is not the most appropriate one. However, existing British evidence (notably Booth, Francesconi and Frank, 2003) find that women actually have higher promotion rates than men and that women's lower average position in the occupational hierarchy is the result of career interruptions generally associated with having children that are probably not associated with the outcome of competition. But, to investigate this a bit further we use the idea that, whatever the rewards are, the purpose of incentive schemes is to encourage effort. To this end, we use how much workers agree or disagree with the statement 'my job requires that I work very hard' – which is coded from 1 (strongly disagree) to 5 (strongly agree). In Table 9 we use this as the dependent variable and estimate equations similar to the earlier earnings equations. The first column shows that women report working significantly harder than men – the second column shows that this is robust to the inclusion of other controls. When the presence of performance pay is added, the coefficient on female is unaltered but we do find, as expected, that people work harder under incentive schemes. The fourth column estimates an equation only for men and the fifth for women. The estimates do suggest that the gap between effort with and without performance pay is significantly larger for men than for women though the estimates are small in absolute terms. One would have to believe that hard work has a very large material pay-off for this differential to be able to explain much of the gender pay gap.[4] The next two columns then investigate whether the gender mix of the job affects the effort put in. Men's effort response to performance pay is largest in female-dominated

[4] Incidentally, if one includes hard work in an earnings function, it has a coefficient of 0.0038 with a t-statistic of 2. However, it is likely that this coefficient is biased so not too much weight should be put on that.

jobs while women seem to respond less in male-dominated jobs. This is one area where we find an effect in line with the experimental evidence. However, it is unlikely this can explain much of the gender gap in performance as very few men work in female-dominated jobs and very few women in male-dominated jobs. One gets some indication of this in the fourth and fifth columns where the coefficient on performance pay can be thought of as approximately a weighted average of the effects of being in jobs of different gender mixes – here the gender differences, though significant, are small.

A further potential criticism is that the intensity of competition within a job is not well-measured by the presence of a performance pay contract although the evidence presented does suggest that performance pay raises earnings and increases work effort in line with what theory would predict. However, it is likely a degree of misclassification is induced by our equation of performance pay contracts with 'competitive' pay schemes. We will argue that it is hard for any model of misclassification to be able to reconcile our estimates with a sizeable gender difference in the incidence of competitive contracts, a higher return to 'competition' among men (both findings that are emphasized by the experimental literature) and a sizeable true effect of competition on the gender pay gap.

We start first with our measurement of the contribution of 'competition' to the overall gender pay gap – the measure we use is how much the gap would change if there were no competitive pay schemes – this is given by:

$$\overline{C}^*_m \beta^*_m - \overline{C}^*_f \beta^*_f \qquad (1)$$

Where $\overline{C}^*_m$ ($\overline{C}^*_f$) is the true fraction of men (women) in competitive pay schemes and β^*_m (β^*_f) the true returns for men (women) from being in a competitive pay scheme.

Now let us assume that C^* is measured with error. Assume that the probability of being wrongly classified is r_1 if $C^*=1$ and r_0 if $C^*=0$. Denote the observed variable (performance pay in our application) by C. With the assumptions about misclassification we will have that:

$$\bar{C}=\left(1-r_1\right)\bar{C}^*+r_0\left(1-\bar{C}^*\right) \tag{2}$$

This can be re-arranged to give:

$$\left(1-\bar{C}\right)=r_1+\left(1-r_1-r_0\right)\left(1-\bar{C}^*\right) \tag{3}$$

This misclassification will tend to produce attenuation bias in the returns to performance pay. Using the formula in Freeman (1984, equation 8) this is given by:

$$p\lim\hat{\beta}_i=\beta^*_i\left(1-r_1-r_0\right)\frac{\bar{C}^*_i\left(1-\bar{C}^*_i\right)}{\bar{C}_i\left(1-\bar{C}_i\right)},\quad i=m,f \tag{4}$$

Re-arranging this we have that:

$$\beta^*_i\,\bar{C}^*_i=\hat{\beta}_i\frac{\bar{C}_i\left(1-\bar{C}_i\right)}{\left(1-r_1-r_0\right)\left(1-\bar{C}^*_i\right)},\quad i=m,f \tag{5}$$

Where the left-hand side is the contribution of performance pay to the earnings of men and women as defined in (1). Now, using (3), (5) can be written as:

$$\beta^*_i\,\bar{C}^*_i=\hat{\beta}_i\bar{C}_i\frac{\left(1-\bar{C}_i\right)}{\left(1-\bar{C}_i\right)-r_1},\quad i=m,f \tag{6}$$

Note that the term $\hat{\beta}_i\bar{C}_i$ (both elements of which are observable) is the contribution we would use assuming there is no measurement error. The final term on the right-hand side of (6) must be bigger than one showing that measurement error will attenuate the effects. It is interesting to note that the attenuation bias depends only on r_1, the misclassification rate for those who are in competitive pay schemes - r_0, the misclassification rate for those who are not in competitive pay schemes plays no role in (6). One implication of this is that if our classification of competitive pay schemes is incorrect in the sense that all the fixed pay schemes we classify as non-competitive are truly non-competitive but some of the performance pay schemes we classify as competitive are, in reality, non-competitive, our estimates of the contribution of performance pay to the gender pay gap will be correct even though there will be attenuation bias in our estimates of the return to 'competition' – the reason is that, although we are under-estimating the returns to competition we are over-estimating the proportion of workers on competitive pay schemes and these two effects work in opposite directions and exactly cancel each other out.

But, if some of the fixed pay schemes are really competitive we will have $r_1 > 0$ and we will be under-estimating the importance of competition. But, one has to have very large misclassification rates for the bias to be large. For example, suppose we assumed that we observe 25% of men and 20% of women in performance pay contracts (an average across the years observed in Table 1). Furthermore assume that the estimated response of hourly wages to being in a performance pay contract is 0.124 (a generous estimate taken from the first two columns of Table 8). Using these numbers we can compute the 'true' contribution of 'competition' to the gender pay gap for different values of r_1. The results are shown in Panel A of Table 10. The first row is our measured effect with no misclassification – as mentioned earlier this is very small. But what is striking from Panel A is that the misclassification rate has to be very large to produce any much larger effects. For example a misclassification rate of 60% is required for the true contribution of 'competition' to the gender pay gap to be 5 log points, about one-quarter of the total.

Even if the misclassification rate is that high, the 'competition' story runs into other problems. First, a misclassification rate of 60% on 'competitive pay contracts' puts, from a re-arrangement of (2), an upper bound on the misclassification rate for 'non-competitive' pay contracts of 20% given we observe 20% of women in performance pay contracts.

Panel B of Table 10 then takes a misclassification rate of 60% for 'competitive pay contracts' and shows, for different values of r_0, the implied true gender difference in the incidence of 'competitive pay contracts' (from (2)) and the implied true rates of return to being in a competitive contract for men and women (from (4)). Note that if we choose a value of r_0 that implies a gender gap in the true incidence that is close to 20% as the experimental literature suggests, then this implies that women have a higher return to performance pay than men, the opposite of the experimental findings. Our bottom line is that it is very hard to find any pattern of misclassification errors to reconcile all of our findings with the experimental literature even before we start to debate whether such misclassification rates are plausible[5]. Even these computations have been based on what are probably over-estimates of the importance of performance pay – other estimates in the paper would suggest even more modest effects. We would therefore suggest that misclassification of 'competitive' pay schemes cannot explain our results.

Finally, it might be argued that, while differing gender attitudes to competition can explain little of the gender pay gap among the average worker, they can explain more among very senior managers and professionals – indeed, both Gneezy et al (2003) and Niederle and Vesterlund (2007) motivate their papers by the under-representation of

[5] It should be noted that we have assumed misclassification errors to be the same for men and women. Introducing gender differences in error rates introduces enough degrees of freedom to solve the problem we identify here but seems a slim thread on which to hang the theory.

women in very senior jobs. However, although that may be the motivation offered, the actual participants in their experiments (students) and the tasks they undertake are not particularly demanding (though see Gneezy and Rustichini, 2006, for experimental evidence from teachers and executives). Indeed, it is reasonable to think that their experimental evidence is of sizeable gender differences in the attitudes to competition among average workers doing an average job. But, to check these ideas, we do run separate regressions for managers and professionals. The first column of Table 11 shows that the gender pay gap among managers and professionals is lower than the average, not what one might expect if competition is more intense among this group and women fare badly in that. The second column then includes a dummy variable for performance pay – this has a significant positive effect somewhat larger than that estimated for all workers though still fairly modest. Finally, the third and fourth columns estimate separate equations for men and women – if anything, the return to performance pay is higher for women than men. The bottom line is that, even among managers and professionals, there seems to be little evidence of competition being an important aspect of the gender pay gap.

5. Conclusions

Recent evidence from laboratory experiments suggests that men and women have different attitudes to and responses to competition in the workplace. These studies suggest that a sizeable part of the gender pay gap could be explained in this way. However, these results are best thought of as indicating a direction for future research than providing reliable estimates of the gender pay attributable to these factors. In this paper, we have attempted to provide an estimate of the portion of the gender pay gap in the UK that can be attributed to these differing attitudes to competition. We find very modest evidence for differential sorting into performance pay schemes by gender, and small effects of performance pay on hourly wages. Furthermore, and unlike the laboratory studies, we find no significant effect of the gender mix in the job on the responsiveness to performance pay. We do find some evidence for an effect of performance pay on a measure of work effort in line with the experimental evidence but the bottom line is that a very small part of the gender pay gap can be attributed to these factors. Even an attempt to maximize the possible explanatory power of this hypothesis does not lead to very large contributions.

Although we do not have an experimental design, we take some reassurance from the fact that studies with an experimental design from the real world (e.g. Bandiera, Barankay and Rasul, 2005; Paarsch and Shearer, 2007, Paserman, 2007, Lavy, 2008) also fail to find any large gender gaps[6]. These are studies of very particular labour markets and it is not clear how representative they are but our results suggest their conclusions may well be valid for the labour market as a whole.

Why do the experimental findings not show up in the real world literature? We have no definitive answer and can only suggest possibilities. First, the sample sizes in the experimental studies are often not large (sometimes less than 100) so the standard errors will typically be large and one needs to find dramatic effects for them to be significantly different from zero. To obtain interesting results, the experiments may be designed to magnify differences, something the market would not generally do (see

[6] Though see Ors, Palomino and Peyrache (2008) who study gender differences in exams finding greater dispersion among men than women in competitive exams.

Lazear et al, 2004, for a similar point). This may mean that the treatments considered are quite extreme, e.g. the tournaments typically have a ‘winner-take-all’ structure in which those who do not win get nothing (and, in the real world, presumably starve to death) and the piece-rates have a one-for-one incentive that is not seen even in the most high-powered managerial incentive schemes (see, for example, Murphy, 1999). Also, experimental design may have important effects on the results - indeed, the experiments themselves have sometimes differing conclusions about gender differences e.g. there is a significant difference in gender performance in tournaments in Gneezy et al, (2003), but not in Niederle and Vesterlund, (2007). Also the results of Antonovics, Arcidiacano and Walsh (2005, 2008) suggest that the size of stakes may be important. Or it may be that performance pay does have the effects found in the laboratory but that other factors are at work in the real world which act to mitigate or off-set the effect. For example, it may be that it is harder to discriminate against women in performance pay contracts where pay and productivity end up more closely aligned (see Heywood and O’Halloran, 2005, and Fang and Heywood, 2006, for similar ideas applied to racial wage differentials).

All of this means it is problematic to map the findings of the laboratory studies into a fraction of the real-world gender pay gap attributable to these explanations – one should perhaps regard them as having indicated an interesting direction for further research rather than a definitive statement of the effect in the labour market. It may be an interesting avenue for future research to explore the gap between laboratory and real world evidence, but the bottom line here seems to be that little of the UK gender wage gap can be explained by gender differences in the incidence of and response to performance-related pay.

Table 1: The Incidence of Performance Pay Contracts

	1998	2004
Panel A: Basic Workforce Information		
All	16.3	32.1
Men	18.6	36.2
Women	14.2	28.3
Panel B: Sample of Employees		
All	16.1	27.6
Men	17.6	31.6
Women	14.6	24.2

Notes.

1. Reported numbers are percentages.
2. The numbers in Panel A use the reported levels of employment by management in each 1-digit occupation plus the establishment weights so should be an estimate of the incidence of performance pay contracts in the British economy as a whole.
3. the numbers in Panel B are an unweighted average of the respondents to the employee survey in WERS.

Table 2: The Nature of Performance Pay Contracts

	All	Men	Women
Merit Pay	35.3	36.1	40.8
Piece-Rates	35.9	37.1	34.5
Both	25.8	26.8	24.6
Sample Size	6069	3221	2848

Notes.

1. these numbers are the percentage of workers in performance pay contracts whose employer reports the use of merit pay, piece-rates or both. Note that the presence of performance pay is defined at the occupation-plant level but the nature of that contract only at the plant level.
2. this data is only available for 2004 so the sample sizes are smaller.

Table 3: The Measures Used to Evaluate Performance

	All	Men	Women
Individual	57.8	57.4	58.2
Team or Group	34.2	35.7	32.4
Workplace	25.4	26.8	23.8
Organization	32.2	32.2	32.2

Notes.

1. these numbers are the percentage of workers in performance pay contracts whose employer reports the use of different measures of performance. Multiple answers are possible so answers sum to more than 100%. Note that the presence of performance pay is defined at the occupation-plant level but the nature of the measure used to evaluate performance only at the plant level.

Table 4: Do Women Select Out of Performance Pay Contracts?

Dependent Variable	Female Coefficient [s.e.]	Personal Characteristics	Job Characteristics	Occupation	Firm Fixed Effects	Sample
Performance Pay	-0.049 [0.007]	No	No	no	No	All
Performance Pay	-0.053 [0.007]	Yes	No	no	No	All
Performance Pay	-0.004 [0.007]	Yes	Yes	no	No	All
Performance Pay	-0.012 [0.006]	Yes	Yes	Yes	No	All
Performance Pay	-0.005 [0.002]	Yes	Yes	Yes	Yes	All
Merit Pay	0.014 [0.020]	Yes	Yes	Yes	No	Performance Pay
Piece-Rates	-0.005 [0.019]	Yes	Yes	Yes	No	Performance Pay
Individual-based performance pay	0.009 [0.017]	Yes	Yes	Yes	No	Performance Pay

Notes.

1. All rows except the fifth report the marginal effects from a probit model – the fifth row is a linear probability model.
2. sample sizes are 47367 for the first 5 rows and 5780 for the last two.
3. all standard errors are robust, and clustered at the establishment-occupation level.
4. personal characteristics are education, race, age, job tenure, marital status, and the presence of dependent children
5. job characteristics are industry, log establishment size, public sector dummy, and union recognition.

Table 5
Do Women Select Out of Performance Pay Contracts?
Disaggregation by Occupation

Dependent Variable: Worker on a Performance Pay Contract

Sample	Coefficient On Female Variable	Standard Error On Female Variable	Coefficient On Female Variable	Standard Error On Female Variable	Sample Size
Managers	-0.0247	[0.0177]	0.011	[0.018]	5244
Professionals	-0.11	[0.0151]	-0.0165	[0.013]	7109
Associate Professionals	-0.0929	[0.0155]	-0.0183	[0.013]	6228
Clerical	-0.0706	[0.0154]	-0.0217	[0.013]	9445
Craft	-0.0654	[0.0326]	-0.0163	[0.036]	3456
Personal Service	0.00145	[0.00837]	0.0112	[0.0048]	3697
Sales	-0.0344	[0.0264]	-0.0247	[0.026]	3416
Operatives	0.0536	[0.0329]	0.0595	[0.031]	3782
Other Occupations	-0.0877	[0.0163]	-0.0292	[0.012]	4923
Controls	Personal Characteristics		Personal + Job Characteristics		

Notes.
1. All rows report the marginal effects from a probit model
2. all standard errors are robust, and clustered at the establishment-occupation level.
3. The personal and job characteristics are those listed in the notes to Table 4.

Table 6: The Gender Pay Gap in WERS

Dependent Variable: Log Hourly Wages

Estimation Method	Female Coefficient [s.e.]	Personal Characteristics	Job Characteristics	Occupation	Fixed Effects	Other Comments
Interval Regression	-0.230 [0.007]	No	No	No	No	
Interval Regression	-0.207 [0.006]	Yes	No	No	No	
Interval Regression	-0.174 [0.006]	Yes	Yes	No	No	
Interval Regression	-0.142 [0.005]	Yes	Yes	Yes	No	
Interval Regression	-0.147 [0.006]	Yes	Yes	Yes	No	Allows for heteroskedasticity
Midpoint Regression	-0.142 [0.005]	Yes	Yes	Yes	No	
Midpoint Regression	-0.105 [0.005]	Yes	Yes	Yes	Firm	
Midpoint Regression	-0.092 [0.005]	Yes	Yes	Yes	Firm* Occupation	
Oaxaca decom-position	-0.208 [0.004]	Yes	No	No	No	Evaluated at average Female characteristics
Oaxaca decom-position	-0.217 [0.004]	Yes	No	No	No	Evaluated at average male characteristics

Notes.

1. The sample size is 45527
2. all standard errors are robust, and clustered at the establishment-occupation level.
3. The personal and job characteristics are those listed in the notes to Table 4.
4. the fifth row allows heteroskedasticity to be related to all variables.
5. the Oaxaca decompositions estimate separate earnings functions for men and women using the midpoint method and then compute earnings gaps for the average woman and man.

Table 7: The Effects of Performance Pay On Earnings

Dependent Variable: Log Hourly Wages

Female Coefficient [s.e.]	Performance Pay Coefficient	Personal Characteristics	Job Characteristics	Occupation	Fixed Effects
-0.228 [0.007]	0.171 [0.012]	No	No	No	No
-0.205 [0.006]	0.128 [0.009]	Yes	No	No	No
-0.175 [0.006]	0.086 [0.009]	Yes	Yes	No	No
-0.142 [0.005]	0.046 [0.007]	Yes	Yes	Yes	No
-0.105 [0.006]	0.025 [0.009]	Yes	Yes	Yes	Yes

Notes.

1. The dependent variable is the midpoint of the log hourly wage. Sample sizes are 45527
2. all standard errors are robust, and clustered at the establishment-occupation level.
3. The personal and job characteristics are those listed in the notes to Table 4.
4. the fourth row allow heteroskedasticity to be related to all variables.

Table 8: The Effects of Performance Pay on Earnings by Gender

Dependent Variable: Log Hourly Wages

	Men	Women	men	women	Men	Women
Performance pay	0.124	0.124	0.0922	0.1	0.109	0.11
	[0.0106]	[0.0113]	[0.0392]	[0.0417]	[0.0133]	[0.0139]
Performance pay* merit pay			0.0753	0.0672		
			[0.0323]	[0.0345]		
Performance pay* piece-rates			-0.0153	-0.0367		
			[0.0314]	[0.0344]		
Performance pay * mixed job					0.0358	-0.0003
					[0.0181]	[0.0180]
Performance pay * male job						0.0443
						[0.0365]
Performance pay * female job					-0.0345	
					[0.0342]	
Personal characteristics	Y	Y	y	y	y	Y
Observations	21937	23548	9463	10854	21314	22776

Notes:

1. As for Table 7. The personal controls are as listed in Table 4.

Table 9: The Effects of Performance Pay on Work Effort

	1	2	3	4	5	6	7
Sample	All	All	All	Men	Women	Men	Women
Female	0.134	0.145	0.147				
	[0.00858]	[0.00857]	[0.00858]				
Performance pay			0.0345	0.0735	0.00937		
			[0.0112]	[0.0152]	[0.0153]		
Performance pay * male job						0.0417	-0.0944
						[0.0193]	[0.0498]
Performance pay * mixed job						0.0976	-0.0107
						[0.0212]	[0.0202]
Performance pay * female job						0.158	0.00572
						[0.0497]	[0.0205]
Personal characteristics	No	yes	yes	yes	yes	Yes	Yes
Observations	46771	46771	46771	22526	24245	21904	23459

Notes:

1. The dependent variable is the response to the question ‘my job requires that I work very hard’ with a 1 representing strongly disagree and 5 strongly agree.
2. The personal characteristics are those listed in the notes to Table 4.

Table 10

The Effects of Misclassification of Pay Contracts

Panel A: The Effect of Misclassifying 'Competitive Contracts' on the Contribution of 'Competition' to the gender pay gap

Misclassification rate for 'competitive pay schemes, r_1	Contribution of 'competition' to the gender pay gap
0	0.006
0.1	0.007
0.2	0.009
0.3	0.012
0.4	0.017
0.5	0.027
0.6	0.056
0.65	0.100
0.7	0.267

Notes: This Table uses the formula in (6), an estimated observed return to performance pay of 0.124 (from Table 8), and an observed incidence of performance pay for men of 25% and women of 20%.

Panel B: The Effect of Misclassifying 'Non-competitive Contracts'

Misclassification rate for 'competitive pay schemes, r_0	True Gender Difference in Incidence of 'Competitive Contracts'	Implied true return to performance pay for women	Implied true return to performance pay for men
0	0.13	0.20	0.25
0.025	0.13	0.21	0.26
0.05	0.14	0.23	0.27
0.075	0.15	0.26	0.29
0.1	0.17	0.30	0.31
0.125	0.18	0.36	0.34
0.15	0.20	0.50	0.39
0.175	0.22	0.89	0.47

Notes: This Table uses the formulae in (2) for the second column and (4) for the last two, an estimated observed return to performance pay of 0.124 (from Table 8), and an observed incidence of performance pay for men of 25% and women of 20%, and a misclassification rate of 0.6 for 'competitive' pay contracts.

Table 11: The Effects of Performance Pay on Earnings in Managerial and Professional Jobs

Dependent Variable: Log Hourly Wages

	1	2	3	4
Sample	All	All	Men	Women
Female	-0.159	-0.146		
	[0.00907]	[0.00890]		
Performance Pay		0.137	0.131	0.144
		[0.0117]	[0.0140]	[0.0172]
Other controls	yes	yes	Yes	Yes
Observations	11796	11796	6882	4914
R-squared	0.32	0.33	0.33	0.31

Notes.

1. This is the same as Table 7 but with the sample restricted to managers and professionals.

Table A1

Descriptive Statistics and Representative Earnings Functions and Performance Pay Equations

	Descriptive Statistics - All	Descriptive Statistics - Men	Descriptive Statistics - Women	Probit for Perfor-mance Pay	Earnings Function
Log hourly wage	2.013	2.131	1.903		
	0.581	0.579	0.560		
Female	0.520	0.000	1.000	-0.012	-0.142
	0.500	0.000	0.000	[0.006]	[0.005]
Performance pay	0.212	0.236	0.190		0.046
	0.409	0.425	0.392		[0.007]
CSE or equivalent	0.100	0.103	0.098	0.000	-0.064
	0.301	0.304	0.297	[0.007]	[0.007]
A level	0.154	0.148	0.159	-0.004	0.058
	0.361	0.355	0.366	[0.006]	[0.006]
Degree or equivalent	0.196	0.212	0.181	0.014	0.182
	0.397	0.409	0.385	[0.007]	[0.007]
Postgraduate	0.068	0.075	0.061	0.048	0.251
	0.251	0.263	0.240	[0.012]	[0.010]
No qualification	0.194	0.210	0.179	-0.009	-0.137
	0.396	0.407	0.384	[0.007]	[0.007]
Other qualification	0.029	0.029	0.029	-0.022	-0.041
	0.168	0.168	0.168	[0.011]	[0.014]
Age 25-29	0.193	0.181	0.204	0.034	0.236
	0.395	0.385	0.403	[0.014]	[0.015]
Age 30-39	0.265	0.274	0.256	0.042	0.377
	0.441	0.446	0.436	[0.015]	[0.015]
Age40-49	0.264	0.261	0.267	0.024	0.402
	0.441	0.439	0.442	[0.015]	[0.016]
Age 50-59	0.201	0.198	0.203	0.020	0.404
	0.400	0.399	0.402	[0.016]	[0.016]
Age 60+	0.041	0.052	0.031	-0.007	0.329
	0.199	0.222	0.175	[0.018]	[0.019]
White	0.933	0.936	0.931	-0.024	0.002
	0.249	0.245	0.253	[0.011]	[0.010]
Kids	0.402	0.428	0.377	-0.007	0.023
	0.490	0.495	0.485	[0.009]	[0.009]
Married	0.687	0.700	0.676	-0.009	0.042
	0.464	0.458	0.468	[0.009]	[0.008]
Married*Kids	0.340	0.316	0.363	0.007	0.012
	0.474	0.465	0.481	[0.010]	[0.010]
Tenure Less than 1 year	0.160	0.153	0.167	-0.006	-0.018
	0.367	0.360	0.373	[0.007]	[0.008]
Tenure 2 to 3 years	0.247	0.233	0.260	0.002	0.043
	0.431	0.423	0.439	[0.007]	[0.007]
Tenure 5 to 10 yrs	0.205	0.199	0.211	-0.012	0.069
	0.404	0.400	0.408	[0.007]	[0.007]
Tenure 10+ years	0.262	0.295	0.230	-0.012	0.121
	0.439	0.456	0.421	[0.008]	[0.008]
Log plant size	4.791	4.924	4.667	0.031	0.027
	1.395	1.332	1.439	[0.003]	[0.002]

manufacturing	0.145	0.220	0.076	-0.042	-0.124
	0.352	0.414	0.265	[0.022]	[0.014]
construction	0.048	0.078	0.019	-0.033	-0.081
	0.213	0.268	0.137	[0.026]	[0.016]
wholesale and retail	0.114	0.102	0.125	-0.001	-0.244
	0.318	0.303	0.331	[0.027]	[0.016]
hotels and restaurants	0.034	0.028	0.040	-0.067	-0.375
	0.182	0.166	0.195	[0.024]	[0.019]
transport and communication	0.063	0.097	0.031	-0.055	-0.097
	0.242	0.296	0.174	[0.024]	[0.018]
financial services	0.059	0.049	0.069	0.160	-0.027
	0.236	0.215	0.254	[0.041]	[0.017]
other business services	0.101	0.105	0.097	-0.002	-0.097
	0.301	0.307	0.296	[0.026]	[0.017]
public administration	0.093	0.099	0.088	-0.030	-0.102
	0.291	0.299	0.283	[0.029]	[0.018]
Education	0.123	0.068	0.173	-0.173	-0.286
	0.328	0.253	0.378	[0.013]	[0.016]
Health	0.138	0.054	0.214	-0.163	-0.229
	0.345	0.227	0.410	[0.014]	[0.016]
other community services	0.052	0.052	0.051	-0.055	-0.203
	0.221	0.223	0.220	[0.024]	[0.020]
Year (1=2004)	0.442	0.427	0.454	0.135	0.302
	0.497	0.495	0.498	[0.010]	[0.006]
Union recognition	0.483	0.479	0.487	0.062	0.008
	0.500	0.500	0.500	[0.011]	[0.007]
Public Sector	0.334	0.264	0.399	-0.008	0.046
	0.472	0.441	0.490	[0.017]	[0.009]
Managers	0.110	0.150	0.074	0.156	0.401
	0.313	0.357	0.261	[0.025]	[0.013]
Professionals	0.148	0.161	0.136	0.045	0.364
	0.355	0.367	0.343	[0.022]	[0.013]
Associate Professionals	0.131	0.131	0.131	-0.007	0.210
	0.337	0.337	0.337	[0.020]	[0.013]
Clerical	0.199	0.082	0.306	0.047	0.023
	0.399	0.275	0.461	[0.021]	[0.012]
Personal Services	0.080	0.051	0.107	-0.098	-0.067
	0.271	0.220	0.309	[0.019]	[0.017]
Sales	0.072	0.043	0.099	0.049	-0.140
	0.258	0.202	0.299	[0.028]	[0.016]
Operatives	0.081	0.133	0.033	-0.031	-0.155
	0.273	0.340	0.178	[0.021]	[0.015]
Elementary	0.106	0.112	0.100	-0.050	-0.260
	0.308	0.316	0.300	[0.019]	[0.013]
Job done only by men	0.123	0.253	0.002		
	0.328	0.435	0.049		
Job done mainly by men	0.189	0.344	0.046		
	0.392	0.475	0.209		
Job done by men+women	0.354	0.351	0.357		
	0.478	0.477	0.479		
Job done mainly by women	0.267	0.052	0.467		
	0.442	0.221	0.499		
Job done only by women	0.067	0.001	0.128		
	0.250	0.031	0.334		

Observations	47367.000	45485.000
R-squared		0.510

Notes.

1. the first 3 columns show means and standard deviations of the variables used for both genders together and for men and women.
2. the fourth column shows the coefficients and standard errors of a probit regression where the dependent variable is having a performance pay contract – marginal effects are reported.
3. the fifth column shows the coefficients and standard errors of an earnings function where the dependent variable is log hourly wages.

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