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IZA DP No. 15474

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ABSTRACT

Does Performance Pay Influence Hours of Work?*

A large body of research links performance pay to poorer worker health. The exact mechanism generating this link remains in doubt. We examine a common suspect, that performance pay causes employees to work longer hours in pursuit of higher pay. Using representative data for the UK, we demonstrate that performance pay is associated with more work hours and a higher probability of working long hours. Yet approximately two thirds of these differences reflect worker sorting rather than behavioral change. The remaining influence appears too small to generate the differences in health except for blue-collar occupations that we isolate.

JEL Classification: J22, J33

Keywords: performance related pay, working hours

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1. Introduction

A growing research consensus links performance pay and poorer worker health. As we will review, performance pay has been associated with increased risk of serious occupational injuries, a greater number of health-related absences, with both self-reported and laboratory measures of stress, with heightened heart risks and with increased use of both prescribed medication (anti-depressants) and self-medication (alcohol and drug use). However, the behavioral changes that generate these links remain in doubt. We examine a common claim, that performance pay causes employees to work longer hours in pursuit of higher pay (DeVaro 2022; Andelic et al. (2022a); Artz and Heywood 2015).

While the relationship between long hours and poorer health is well established, the link between performance pay and longer hours deserves far more study. As with other aspects of performance pay, one should anticipate both a behavioral response and a sorting response. Thus, Lazear (2000) found that performance pay increased worker productivity but also attracted more productive workers. Similarly, the hours of existing workers may respond to performance pay and workers with specific preferences over hours (vs. earnings) will sort into performance pay.

Critically, there exists no theoretical or empirical agreement on the direction of these two responses to performance pay. While one anticipates the purpose of performance pay is to increase worker effort, work hours remain a poor proxy for this effort. The additional earnings associated with performance pay represents an income effect suggesting fewer work hours. More generally, performance pay often replaces hourly wages that simply reward time on the job. This reduces adverse specialization in work hours ("face time" at an extreme). Also, performance pay that rewards groups is well known to create free-rider issues that likely undermine both effort and working hours. Added to this ambiguity, the very modest empirical

literature which we will review presents both positive and negative associations between performance pay and hours.

We use UK individual panel data to trace the influence of two measures of performance pay on hours of work. These measures imperfectly distinguish between individual and group rewards yet the pattern they present remain remarkably similar. The initial pooled cross-section indicates performance pay is associated with 2.4 additional hours per week for one measure and 1.7 additional hours for the other measure. These rough magnitudes remain robust to the inclusion of personality traits and controls for earnings. Despite extensive controls, we examine the role of worker heterogeneity and the associated sorting. The worker fixed-effect estimates continue to reveal statistically significant increased hours associated with the measures of performance pay. They become 0.7 and 0.8 additional hours for the two measures. This pattern of fixed effect estimates being much smaller carries over to examinations of the probability of working long hours, for example, more than 50 hours per week.

The fixed effect estimates show that performance pay may lead employees to work more hours or long hours. Yet, the sorting influence appears far larger. Those inherently likely to work longer hours are sorted into performance pay jobs. This sorting seems unlikely to generate the health deterioration associated with performance pay. These workers would work longer hours in any event, and performance pay perhaps merely allows them to receive a (more direct) return on this. While the worker fixed effect estimates remain highly significant statistically, they appear too small to fully explain the observed link between performance pay and poorer worker health. They may play a contributing role, but for most workers it would seem to be added to other causes such as working harder, taking fewer breaks, taking greater risks on the job as well as facing uncertainty over performance and earnings. Blue-collar laborers provide a counter case in which the increase in long hours is substantial and may be primary cause of poorer worker health. We draw out these points in both our presentation and conclusion.

2. Setting the Stage

Building from Adam Smith's concern that workers on piece rates would be incentivized to ruin their health, a large literature examines the influence of performance pay on worker health. This literature stands beside the survey and experimental evidence that performance pay increases productivity by aligning the interests of workers and firms.[1] Thus, case studies indicate that the transition to piece rates is associated with higher accident rates among Swedish loggers (Sundstroem-Frisk 1984) and heart attacks among tree cutters in Canada (Toupin et al. 2007). Similarly, industrial accidents are more common for piece rate workers than time rate workers in India's fertilizer industry (Saha et al. 2004). US truck drivers paid by the mile have proportionally more accidents than those paid by the hour (Monaco and Williams 2000). A German steel plant experienced increased sickness absence when it introduced production bonuses (Frick et al. 2013). Four studies of more than 1400 sales workers confirm that the greater the performance pay component in compensation, the greater the sales workers' stress, emotional exhaustion, and sick days (Habel et al. 2021).

Survey evidence supplements these occupational studies. Bockerman et al. (2012) examine high-performance work practices in Finland that include performance pay and fail to find a relationship between such practices and accidents. On the other hand, using European data, Bender et al. demonstrate that piece rates increase the risk of workplace injury. Artz and Heywood (2015) confirm that among blue-collar workers in the US paid output-based pay (piece rates or bonuses) have higher injury risk. This persists despite worker fixed effects. DeVaro and Heywood (2017) demonstrate greater sickness absence and health ailments among

[1]Survey and experimental evidence support the claim that productivity increases (Banker et al. 1996, Lazear 2000 , Bandiera et al. 2005, Gielen et al. 2010, Heywood et al. 2011) and that the more productive are attracted to peformance pay (Lazear 2000, Cadsby et al. 2007, Dohmen and Falk 2011 and Shaw 2015).

UK workers at establishments using performance pay. These links persist despite accounting for establishment fixed effects.

The literature studies more than absence and injury. Foster and Rosenzweig (1994) show that piece rate agricultural workers put forth enough extra effort that their basic physical health is measurably worse. In her examination of Vietnamese clothing manufactures, Davis controls for each factory's occupational safety and health compliance. Yet, she reports that piece rate workers have both lower physical and emotional health. Indeed, piece rates stand as the most important variable in determining emotional health. Bender and Theodossiou (2014) show a larger hazard of falling out of good self-reported health for UK workers receiving a broad measure of performance pay (including bonuses, commissions and other more common white-collar performance pay). Andelic et al. (2022a) examine specific indicators of health. While not all indicators show worse health, self-reported mental health is worse for UK workers receiving performance pay. Medical test also demonstrate significantly higher blood pressure and higher inflammation markers in the blood for workers receiving performance pay.[2] Using German data, Baktash et al. (2022a) shows that workers receiving a broad measure of performance pay report greater stress. This influence is far smaller for worker who are risk tolerant or have an internal locus of control.

Confirming survey data, Cadsby et al. (2016) use laboratory experiments to show that performance pay increases self-reported stress among risk averse individuals. Allan et al. (2021) eliminate issues of self-reporting with alternative classroom experimental evidence. Those earning performance pay suffer objectively higher stress as measured by cortisol hormone levels. This confirms field experiments on manufacturing workers randomly assigned

[2] After correcting for sample selection, performance pay was associated with a 16-point increase in systolic blood pressure, enough to move from "normal" through "elevated" to "hypertension stage one."

to either piece rates or hourly wages (Timio and Gentili, 1976). Piece rate workers had routinely greater stress measured by hormone levels.

Dahl and Pierce (2020) focus on performance pay and prescription drug use in the Netherlands. The adoption of performance pay increases anti-anxiety drug and anti-depressant use by four to six percent. They argue that performance pay induces stress and anxiety which harms mental health increasing the associated prescriptions. Self-medication emerges as at least as important. When workers switch to performance pay, the use of alcohol and drugs increases by large percentages and so does the intensity of use (see Artz et al. 2021, for evidence from the US and Baktash et al. 2022b, for evidence from Germany).

While this review suggests that worker health may be reduced by performance pay, it does not explain why. A common claim is that performance pay incentivizes working longer hours potentially to the point of physical and/or mental exhaustion harming health (DeVaro and Heywood 2017). Pencavel (2015) made a similar point when describing the long hours of piece rate munition workers during World War I Britain. He makes clear that "employees at work for a long time may experience fatigue or stress that not only reduces his or her productivity but also increases the probability of errors, accidents, and sickness that impose costs on the employer (p. 2073)."

Epidemiological evidence makes clear that long hours are unhealthy. The World Health Organization reports that 745,000 deaths from stroke and heart disease in 2016 resulted from long hours. This represents an almost 30 percent increase since 2000. Indeed, they identify long work hours as the single largest risk factor accounting for over 1/3 of the occupation disease burden (Pega et al. 2021). Moreover, long hours are not risky simply because they are concentrated in inherently dangerous occupations and industries or because long hours workers spend more time at risk. Instead, long hours increase worker's underlying risk of illness per hour worked (Dembe et al 2005). In a meta-analysis of the epidemiological evidence (drawing

on studies in industrial democracies including the UK) Wong et al. (2019) make three critical points. First, long working hours remain ubiquitous across countries and studies. Second, long working hours routinely links to poorer health *outcomes* (cardiovascular diseases; chronic fatigue, stress; depression state, anxiety, hyper-tension, and all-cause mortality among others). Third, long working hours routinely line with worse health *behaviors* including lack of sleep, smoking, drinking and drug use.

These health associations make clear the popularity of the hypothesis that performance generates poor health through incentivizing longer hours. Yet, the evidence on this point is not persuasive. Jones (2013) examined working hours under performance pay for US schoolteachers. In 49 states, teachers responded to performance pay by working fewer hours per week. Jones takes this to be free riding as much of the performance pay was at the school or team level. Florida allows only individual level performance pay and their teachers responded by working more hours per week. Pay-for-performance contracts were introduced in 2004 for general practice medicine in the UK. Gemmell et al (2009) use time diaries and employment records to show that the response of practices was not to increase hours but to increase staff size. Piece rates were Adam Smith's concern but Bilikopf and Norton (1992) and Bilikopf (1995) show that farmworkers trimming California vineyard worked fewer hours per acre when paid piece rates. Their hourly wage and productivity were higher, but their total hours remained roughly the same but showed more variability. They appeared to work "faster and smarter" but not longer.

Pekkarinen and Riddell (2004) use linked employee-employer panel data from the Finnish metal industry to isolate the influence or performance pay. They find that the average piece rate worker works slightly fewer hours than the average worker on hourly wages. Yet, this those moving from hourly to piece rate payment increase their hours during this transition. This supports the view that the workers that transition to piece rates come from the lower end

of the hours distribution among hourly workers and respond to piece rates by working more. This supports with the incentive effects that interest the authors (Pekkarinen and Riddell 2008) but gives no suggestion that the influence of piece rates on hours is sufficient to drive health consequences.

DeVaro (2022) uses linked employer-employee data to tie together performance pay, working hours and sickness absence. As part of this he provides modest evidence of a link between long hours within establishments and performance pay. Specifically, performance pay tends to increase the share of long hours if the cut-off is modest (35 to 39) but does not increase the share of long hours for cutoffs of 40 or more hours but does for smaller cut-offs of 35 to 39 hours. In echoes of the Finnish study, performance pay may move workers up to full time but not move them to the very long hours needed to harm health.

Andelic et al. (2022b) examine the influence of performance pay on time use. While not examining work hours, they confirm the type of time reallocations suggested by Becker (1965). Performance pay workers attend fewer leisure events and also exercise and sleep less. They do, nonetheless, eat and drink out more frequently. These reallocations would be anticipated if performance pay increased both work hours and earnings.

3. Data and Empirical Approach

Our data combines the British Household Panel Survey (BHPS; 1991-2008) with the Understanding Society (USoc) data set (2009-2018) (University of Essex, 2020). The BHPS is a random sample of approximately 10,000 individuals in 5,500 households, which was increased to 16,000 individuals in 9,000 households in 1999. USoc is the follow-on to the BHPS starting in 2009 and covers approximately 100,000 individuals in 40,000 households. The BHPS households comprise a subset of the USoc sample and can be followed in the latter, except for the first USoc wave where the BHPS households were not interviewed. We initially

use the full sample of respondents from the BHPS and USoc. However, some of the key variables are only available in certain waves of the BHPS/USoc. In particular, the questions on performance and bonus pay are only available from 1998 on, and in every second USoc wave. As such, some analyses cover different periods in the data, as we will highlight in the text. Reflecting our focus on workers, we exclude those not in employment, and retain individuals aged from 18 to 65.

The BHPS /USoc contains information on performance-related pay (see for instance Green and Heywood 2008, and Bryan and Bryson, 2016), although the format of the questions has changed over time. Initially in 1991-1997 there was one catch-all performance-pay question. We drop all observations for this earlier period. From 1998-2008, respondents were asked two separate questions: "Does your pay include performance-related pay?"; and "In the last 12 months have you received any bonuses such as a Christmas or quarterly bonus, profit-related pay or profit-sharing bonus, or an occasional commission? [excludes overtime payments]". These questions only appear in every second wave of USoc. However, each wave of USoc takes 24 months in total to conduct and the waves overlap with each other such that some individuals are, for example, being surveyed for wave 3 at the same time as individuals for wave 4. This means that we observe both performance pay receipt and bonuses for all of 1998 to 2018 inclusive. These questions produce binary indicators of the receipt of performance related pay (PRP) and bonus/profit share receipt respectively. We cannot rule out that the former indicator, PRP, could potentially capture some elements of group payment. However, the latter question and resultant indicator clearly captures two prominent forms of group-based payment, profit-related pay and profit shares, that fit with our main interest.[3]

[3] Consequently, existing literature has often interpreted this question as capturing group and profit share payment (see for instance Gielen, 2011, and Green and Heywood, 2010 and 2011).

Table A1 provides summary statistics for the whole sample, those in receipt of PRP, and those in receipt of bonuses or profits shares. Workers on both PRP and Bonus/Shares work longer hours than average workers in terms of regular hours and overtime. They are also younger and more likely to be male. The patterns with respect to education are a little less clear. PRP is received by, on average, more highly educated workers but the opposite is true for those in receipt of bonuses or profit shares.

To further explore distributional differences in hours worked, Figure 1 provides kernel density estimates of differences in total hours worked according to contract type. While all share a mass around full-time hours, there is a higher density of hours worked beyond this amount for PRP and bonus/profit share workers. A concern is that the tendency to report a 40-hour week makes it more difficult to observe differences in hours worked. Figure 2 provides estimates excluding 40 hours, this provides a slightly more pronounced view of PRP and bonus/profit share workers as being more likely to work more than 40 hours. We explore this point further later in the paper.

Our main estimating equations take the form:

$$Hours_{it} = \alpha_1 PerfPay_{it} + \gamma_1 Bonus/Profit_{it} + \beta' \boldsymbol{X}_{it} + \boldsymbol{y}_t + \boldsymbol{m}_t + \varepsilon_{it} \qquad (1)$$

Where hours is an indicator of hours worked (normal hours, overtime, total hours), $\boldsymbol{X}$ is a vector of controls, including age, occupation, industry, gender, highest educational level and marital status. We also include a set of controls for year of interview ($\boldsymbol{y}$) and calendar month ($\boldsymbol{m}$). Our parameters of interest are α_1 and γ_1. We estimate variants of (1) without and with worker fixed effects. The estimates with worker fixed effects provide the change in working hours when a given worker changes their contract type. Comparing these estimates to those without worker fixed effects measure the role of sorting in generating differences in hours worked across

contract types. Naturally, changes in contract type may also reflect other time-varying changes that may influence working hours. While we cannot be exhaustive on this front, we later explore event study estimates variants of (1) which aim to examine whether there is evidence of selection into contractual type in terms of time-variation of hours worked and (2) the time-profile of hours worked changes (if any) following changes in contractual type.

A second variant of (1) uses as a dependent variable a dichotomous indictor of long hours. These include whether the worker has worked more than 40 hours, more than 45 hour and more than 50 hours on average in a week. Using a linear probability model, these estimates indicate the extent to which perform pay increases the likelihood of harm inducing long hours. Again, cross-sectional, and fixed-effect estimates will be contrasted.

4. Initial Results

In what follows, we first examine the link between performance pay and hours of work. We follow this by an examination of performance pay and working long hours.

4.1 Hours of Work

Table 1 presents initial estimates of the relationship between performance pay receipt and hours worked. We present estimates for standard hours worked, over time, and finally total hours worked. This is done in three increasing complex specifications. The first presents the more parsimonious estimates and demonstrates large differences in average hours worked by workers on performance pay. PRP is associated with 2.4 more hours per week, of which around 1/3 of this increase is in reported overtime hours. The estimate of 2.4 hours on an average of 37 hours is reminiscent of the US and Finnish findings that performance pay increases average hours to approximately full time at or near 40 hours. The results for bonus/profit share move

in the same direction thus giving no indication of the free-riding thought to associated with profit sharing. The increase in hours is smaller than that for PRP with increase of 1.6 hours.

The right-hand side of Table 1includes include a range of controls for both occupation and industry at a one-digit level. The fundamental pattern of increased hours remains suggesting that the differences in hours worked does not simply reflect differences in the occupational and industry mix of workers in and out of PRP.[4] The fundamental pattern also remains if we include the big five personality traits that have been thought to influence both sorting into performance pay and effort levels (Heywood et al., 2017).[5]

The final set of results introduce worker fixed effects retaining the industry and occupation controls. These are within worker comparisons of PRP on hours and so have the advantage of removing the influence from sorting on (time-invariant) unobservable characteristics. These could include otherwise unmeasured attitudes toward work and working hours inherent in individual workers. The estimate is thus more nearly the behavioral response to performance pay and are substantially smaller. The total PRP influence is only 0.61 of an hour, less than two percent of the mean number of hours. The total bonus/profit share influence shrinks also but now is larger than that for PRP at 0.74 of an hour. In both estimates the share contributed by increased overtime is larger than in estimates without the fixed effects.

Several points deserve emphasis as they will be repeated in robustness results. First, the role of sorting is fundamental. The decline from over two additional hours to only six-tenths of an hour indicates that most of the original influence of PRP and bonus/ profit shares on hours reflects sorting of those more likely to work greater hours in any event. Again, this is important

[4] In unreported estimates we also included industry controls at a 4 digit-level and occupational controls at a 3 digit-level (occupations are more difficult to match over the entire time period). The resultant estimates of PRP effects were slight smaller than in the estimates reported in Table 3 (1.75 more total hours for PRP and 1.43 for Bonus/Profit Shares). This suggests that our results do not simply reflect across occupation and industry differences in working hours and the prevalence of PRP.

[5] These results are presented in Appendix Table A2. Note that we observe personality traits only once for each worker in our data so following from Cobb-Clark and Schurer (2012, 2013), we take them as given and reasonably stable over time.

as the hours associated with sorting would be worked even without PRP and so do not influence health. Second, while the results that reflect sorting suggest a much large influence for PRP than bonus/profit share, the actual behavioral response suggests the second influence is as large or larger.

INSERT TABLE 1

Another natural concern recognizes that performance pay increases earnings. Thus, whatever influence it has in increasing incentives to work longer at the margin, it also brings with it an income effect that might work in the opposite direction. As a short cut, we examine this by including hourly wages into our main equations. The results are in Table 2. Focusing on the worker fixed effect estimates, the relationship between our PRP measures and hours worked are largely unchanged. The final estimate suggests a fixed effect influence of .5 an hour for PRP and 0.6 an hour for bonuses.[6]

INSERT TABLE 2

We further explore the influence of performance pay on (total) hours worked through event study estimation. This makes two contributions. First, the event study can incorporate time-varying factors that may explain individual hours worked, and selection into performance pay. For example, changes in home-production responsibilities may lead to changes in an both the willingness to work longer hours and the willingness to receive performance pay. Second, the event study allows us to examine the pattern of adjustment underlying the initial estimates in Table 1. The increase in hours worked may happen immediately with new performance pay arrangements, or it may be much more gradual and be spread out over time.

[6] In otherwise identical estimates in which we estimate the log of hours, we find that PRP and bonuses each result in an 0.02 increase in the log of hours. These are available upon request and also show that including wages does not dramatically change the results.

Figure 3 presents event study estimates of the influence of entry into PRP (panel A) and into bonus/profit shares (Panel B) for individuals who are initially receive neither. The estimates are analogous to those reported in Table 1 that include individual fixed effects. First, in neither case is there any evidence of 'off-trend' variation in hours worked prior to contractual change. This suggests a lack of time-varying selection in terms of workers' propensity to work long hours. Second, for both contract type changes there is an immediate increase in hours worked upon contractual change. The absence of gradual adjustment emphasizes the immediacy of the response to performance pay.

INSERT FIGURE 3

Most importantly, the event analysis confirms both the significant increase in hours associated with performance pay and the fact that the increase is very small, far less than 1 hour per week. The latter remains inconsistent with the average hours increase generating a large deterioration in worker health.

4.2 Working Long Hours

While the overall increases in hours are modest and those in the fixed effect estimates (including the event study) smaller still, the important issue may not be what is happening on average. The negative influence of working time on health is likely to be concentrated in generating long hours. Indeed, Figure 1 suggests that the influence of performance pay on hours of work may be concentrated in the upper right tail. Thus, the role that PRP and bonus/ profit shares play in moving workers into the long hours may be critical. To examine this, Table 3 reports a range of estimates of the probability of working more than a given threshold of hours (greater than 40 hours, greater than 45 hours, and greater than 50 hours).

These confirm that performance related pay receipt is associated with a higher probability of working long hours. For instance, PRP receipt is associated with a near 7 percentage point higher chance of working more than 40 hours in the week. Bonus/profit-shares is associated with a 6 percentage point higher chance of working more than 40 hours a week. These decrease in magnitude as we move to more extreme hours worked. Yet, there remain sizeable influences relative to the underlying rate of working these hours for all workers. Thus, in the estimate of working more than 50 hours, PRP has a 3 percentage point influence and bonus/profit share has a 1 percentage point influence. These are on a base of only 9 percent of employees working more than 50 hours.

INSERT TABLE 3

As before, a large proportion of the effects described above appear to result from sorting. The fixed effect estimates are substantially smaller at each threshold even as they retain high statistical significance. Thus, in the FE model workers who receive PRP are just under 1 percentage point more likely to work more than 50 hours in a week suggesting two-thirds of the original 3 percentage point influence reflects sorting. Nonetheless, the remaining just under 1 percentage point from the FE represents roughly a 10 percent increase on the base of around 9 percent of employees working more than 50 hours. The absolute change is small, but the relative change seems on par with estimates of health behaviors. Thus, Artz et al (2021) found a 5-percentage point increase in regular drinking associated with performance pay in worker fixed effect estimates. This was on a base of 47 percent for a similar roughly 10 percent increase.

While the FE estimates are highly statistically significant and not irrelevant relative to their respective bases, they continue to seem too small in absolute magnitude to generate the health deterioration that others have associated with performance pay. This could reflect institutional constraints that limit the desired hours response. In this way our estimates would

not be those of the true underlying behavioral response to performance pay but only those allowed by firm and policy constraints on allowed hours of work. This difference has been noted in other contexts. For example, in examining a substantial Danish tax change, Labanca and Pozzoli (2022) demonstrate a much larger hours response by those workers in firms without institution hours constraints than in those with such constraints.

In our application, the estimates we have presented on the increase in long hours combine those constrained (perhaps not changing at all) and those unconstrained (presumably changing much larger). The second is the behavior response to performance pay identified originally by Adam Smith and it could be among this unconstrained group that dramatic changes happen.

The measures to proxy institutional hours constraints in the data are imperfect but we identify workers who are constrained in their starting and stopping times each day. While this constraint is not identical to a limit on hours of work, it certainly implies one. Thus, workers who are required to start and stop at the same time each day have a *de facto* hours limit. It remains possible that there exist workers not limited in their starting time that also face a total hours limit per week or month.

We return to the estimates in Table 3 and add the constraint indicator (one if facing a constraint). We also interact the constraint indicator with each of the performance pay variables. The results highlighting the role of a fixed starting and stopping time are shown in Table 4.

INSERT TABLE 4

Those workers constrained to fixed starting and stopping times are significantly less likely to work long hours. This is apparent in both the OLS and FE estimates and across all three long hours measures, working more than 40, 45 or 50 hours. The constrained workers also appear

to respond less to performance pay as anticipated. The coefficients on the interactions with the two performance pay measures are typically negative. They are always significantly so for the bonus indicator but not for the performance related pay indicator.

Including the indicator for the constraint and its interaction causes the size of the coefficients for those not constrained to increase. This resulting estimate may be closer to the true behavioral response of workers absent institutional constraints. As an illustration, focus on the coefficients in the fixed effect estimate for working more than 50 hours. Across the entire sample in Table 3 it was 0.0092 for performance related pay suggesting an increase in long hours of less than one percentage point. The unconstrained estimate in Table 4 is 0.0142 or almost half again as large. Across the entire sample in Table 3 it was 0.0065 for bonuses. The unconstrained estimate in Table 4 is 0.0082.

These larger estimates appear to confirm that the original estimates are biased down because of institutional constraints.[7] We remain unsure where the constraints originate. They could be in the interest of firms to limit worker earnings costs or insure joint production (workers on an assembly line at the same time). They could also be imposed by governments or unions. They could even be agreed to in contract by workers who do not want to respond to incentives to work longer hours in a self-binding mechanism. Regardless of the source, these constraints both limit hours and reduce the response to performance pay.

Yet, given the health motivation of our paper, even the larger and more nearly behavioral responses remain small. First, they only apply to the population of unconstrained workers and the health deterioration identify by other was not constrained to this population. Second, even for this smaller population the point estimates of just over or just under a

[7] We also experimented with a proxy that identified whether workers desired to work more hours on the assumption that such out of equilibrium workers might face an institutional constraint. The results are broadly similar, but we do not show them at as only five percent of workers reported desiring more hours limiting its relevance.

percentage point increase in long working hours appear too small to have confidence that they drive health effects.[8]

As another general concern, it might be argued that we should focus on the combined influences of both performance pay measures. Indeed, while 6.3 percent of all worker observations receive performance related pay alone and 18.8 receive bonuses alone, 8.8 percent do receive both. The influences are, however, not additive. As an example, performance related pay alone is associated with a 1.2 percentage point increase in the likelihood of working more than 50 hours in the fixed effect estimate. Bonuses alone are associated with 0.8 percentage point increase. Receiving both is associated with a 1.4 percentage point increase, only weakly larger than performance related pay alone.

Nonetheless, we recognize that we are examining a very broad average influence and the concern may be those who respond in ways far different than the broad average. Thus, we begin a set of estimations designed to further explore the heterogeneity in the influence.

5. Patterns of Heterogeneity

There likely exist large difference across occupations in terms of what precisely performance related pay contracts involve, and the extent to which hours are readily varied by workers. As a starting point, Table 5 reports estimates split broadly into white-collar and blue-collar workers according to occupational codes. These demonstrate higher effects on total hours worked for blue-collar workers. They also continue to demonstrate the importance of sorting as the fixed effect estimates remain much smaller. The fixed effect estimates for blue-collar workers are almost twice the size of those for white-collar workers for both PRP and bonus/profit shares. Yet, the pattern is interesting as the larger blue-collar estimate is on a small

[8] A full set of such interactive estimates is available upon request and routinely show that the influences fall far short of additive.

base of only 34 hours compared to the smaller white-collar estimate which is on a base of 38 hours.[9]

INSERT TABLE 5.

To investigate and illustrate this point further Table 6 provides estimates for workers at two broad ends of these occupational spectrum, managers and labourers. The picture is more extreme version of that just examined. The PRP estimates for labourers are three times those of managers. Sorting continues to explain most of the initial estimates within each occupational group. In the fixed effect estimate the influence of PRP on hours is, for the first time, both very small and insignificantly different from zero. This happens despite a sizable share of managers receiving PRP. The fixed effect estimates for labourers remain significantly different from zero at about .8 of an hour for PRP and 1.2 hours for bonus/profit shares. Critically, the near absent effect for managers is on a base of over 43 hours while the larger estimates for labourers are on very small base of only 32 hours.

INSERT TABLE 6

The picture of the harried manager working long hours as a response to incentives from performance pay is simply not evident.

This picture remains absent in examining the determinants of working long hours. Table 7 present OLS and fixed effects estimates of the probability of long hours by managers and by labourers. Focusing on the last four columns, performance related pay is associated with a significant increase of 1.9 percentage points in the probability of working more than 50 hours in the OLS estimate but an insignificant increase of less than 0.8 of a percentage point in the

[9] Venkatesh (2022) documents a growing work hours difference in favor of those in more educated occupations.

fixed effect. These are on a base of 14.8 percent of all managers reporting working more than 50 hours.

INSERT TABLE 7

The evidence on labourers again paints a very different picture. Performance related pay is associated with a significant increase of 5.1 percentage points in the probability of working more than 50 hours in the OLS estimate. This drops only modestly to a 4.3 percentage point increase in the fixed effect estimate. This is large both absolutely and in terms of the underlying probability as 7.1 percent of all labourers report working more than 50 hours.

This pattern is repeated in examining the bonus variable. The fixed effect estimate for managers is small and insignificant while that for labourers is large and statistically significant. Thus, if managers are working themselves into ill health, it is not because of performance pay. Instead, it is labourers that "when liberally paid by the piece, are very apt to overwork themselves, and to ruin their health and constitution in a few years (Smith 1776, p. 83)."

6. Conclusions

Performance pay has been linked to a wide range of worse worker health outcomes. Yet, the mechanisms that cause these worse outcomes remains in doubt. One candidate emphasized, but rarely tested, claims that the hours of work increase under performance pay and that the increase is sufficient to harm health. Despite this claim, standard theoretical treatments of performance pay provide ambiguous predictions on the effect of hours worked. At a minimum, if results are rewarded rather than hours, the influence on hours remains unclear. This paper explored performance pay and hours worked using representative longitudinal data for the UK.

On average, performance pay is robustly associated with both longer worker hours and a higher probability of working very long hours, the margin at which we think negative effects of hours worked may be concentrated. Yet, standard worker fixed effects estimates suggests

that most of the influence of performance pay results from sorting. Workers who prefer to work longer hours sort into payment by performance, and performance pay perhaps allows them to receive a (more direct) return on their desire to work long hours. While the remaining effects (after sorting) are statistically significant, they appear to be too small to likely generate the range of negative health effects documented in the literature. This is confirmed by our event study.

Heterogeneity in the average result exists. Performance pay has larger links to working hours for blue-collar workers. The extent of sorting appears far less than that for white-collar workers. Thus, for blue-collar workers it remains possible that performance pay could drive hours and these extra hours help cause poorer worker health.

This becomes even more evident when focusing on extremes within blue- and white-collar workers. At the most damaging margin of working more than 50 hours, there is little or no evidence that performance pay for managers plays a role beyond sorting. Managers would work long hours independent of payment method. At that same margin, blue-collar labourers on performance pay exhibit little sorting. The influence of performance pay increases the probability of long hours dramatically.

Reductions in worker health may generate externalities when the related expenses and trauma are not part of the employment relationship and are instead borne by families, communities, and governments. To the extent this is true, there may be a policy rationale for regulating the causes of such reductions. Our evidence suggests that while limiting the extent of performance pay could reduce the health harming long hours of blue-collar labourers, it is unlikely to change the health harming long hours of managers.

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Table 1: Performance Pay and Hours Worked, 1998-2018

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Usual Hours	Overtime	Total Hours	Usual Hours	Overtime	Total Hours	Usual Hours	Overtime	Total Hours
PRP	1.529***	0.823***	2.353***	1.145***	0.757***	1.902***	0.343***	0.271***	0.614***
	(0.0817)	(0.0623)	(0.107)	(0.0801)	(0.0605)	(0.102)	(0.0603)	(0.0458)	(0.0732)
Bonus/Profit Share	1.186***	0.444***	1.631***	0.831***	0.513***	1.344***	0.441***	0.297***	0.738***
	(0.0754)	(0.0487)	(0.0929)	(0.0732)	(0.0466)	(0.0885)	(0.0514)	(0.0391)	(0.0624)
Constant	30.20***	3.151***	33.36***	33.77***	3.814***	37.58***	34.22***	6.347***	40.57***
	(0.363)	(0.223)	(0.447)	(0.447)	(0.266)	(0.539)	(2.301)	(1.748)	(2.793)
Occupation & Industry Controls				X	X	X	X	X	X
Worker Fixed Effects							X	X	X
Sample Average	33.77	3.45	37.22						
Observations	143,579	143,579	143,579	135,943	135,943	135,943	135,943	135,943	135,943
R-squared	0.205	0.045	0.207	0.257	0.079	0.266	0.022	0.008	0.026
Number of workers							40,502	40,502	40,502

All include controls for year of interview, month of the year, age, educational level, gender and marital status. Robust standard errors in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level respectively

Table 2: Performance Pay, Hours Worked: Controlling for Wages, 1998-2018

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Usual Hours	Overtime	Total Hours	Usual Hours	Overtime	Total Hours	Usual Hours	Overtime	Total Hours
PRP	1.168***	0.612***	1.780***	0.961***	0.616***	1.578***	0.288***	0.216***	0.504***
	(0.0820)	(0.0643)	(0.108)	(0.0806)	(0.0628)	(0.105)	(0.0590)	(0.0484)	(0.0736)
Bonus/Profit Share	0.915***	0.307***	1.222***	0.605***	0.359***	0.964***	0.334***	0.235***	0.569***
	(0.0741)	(0.0510)	(0.0932)	(0.0720)	(0.0488)	(0.0888)	(0.0508)	(0.0416)	(0.0633)
Log Hourly Wage	0.0133	0.664***	0.677***	-0.278***	0.635***	0.357***	-0.821***	0.576***	-0.245***
	(0.0483)	(0.0283)	(0.0581)	(0.0500)	(0.0292)	(0.0589)	(0.0319)	(0.0261)	(0.0398)
Constant	32.48***	2.075***	34.56***	35.70***	2.768***	38.47***	36.70***	4.746**	41.44***
	(0.370)	(0.248)	(0.466)	(0.452)	(0.288)	(0.554)	(2.309)	(1.894)	(2.881)
Occupation & Industry Controls				X	X	X	X	X	X
Worker Fixed Effects							X	X	X
Observations	141,638	140,728	140,612	134,405	133,550	133,446	134,405	133,550	133,446
R-squared	0.189	0.051	0.188	0.230	0.082	0.235	0.027	0.014	0.024
Number of workers							37,844	37,774	37,730

All include controls for year of interview, month of the year, age, educational level, gender and marital status. Robust standard errors in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level respectively

Table 3: Performance Pay and The Probability of Working Long Hours

Greater than…	(1) 40 hours OLS	(2) 40 hours FE	(3) 45 hours OLS	(4) 45 hours FE	(5) 50 hours OLS	(6) 50 hours FE
PRP	0.0670***	0.0187***	0.0483***	0.00945**	0.0291***	0.0092***
	(0.0050)	(0.0042)	(0.0045)	(0.0038)	(0.0032)	(0.0030)
Bonus/Profit Share	0.0611***	0.0310***	0.0317***	0.0194***	0.0078***	0.0065***
	(0.0042)	(0.0036)	(0.0035)	(0.0031)	(0.0025)	(0.0024)
Constant	0.264***	0.460***	0.160***	0.386***	0.101***	0.155
	(0.0182)	(0.161)	(0.0157)	(0.140)	(0.0112)	(0.106)
Sample proportion	0.350		0.195		0.089	
Observations	143,579	143,579	143,579	143,579	143,579	143,579
R-squared	0.123	0.005	0.076	0.004	0.037	0.003
Number of workers		41,110		41,110		41,110

Notes: Estimated linear probability models. All include controls for year of interview, month of the year, age, educational level, gender and marital status. Robust standard errors in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level respectively

Table 4: Performance Pay and Long Hours: Constrained in Starting/Stopping Times

Greater than…	(1) 40 hours OLS	(2) 40 hours FE	(3) 45 hours OLS	(4) 45 hours FE	(5) 50 hours OLS	(6) 50 hours FE
PRP	0.0806***	0.0337***	0.0618***	0.0235***	0.0305***	0.0142***
	(0.00805)	(0.00752)	(0.00737)	(0.00648)	(0.00526)	(0.00484)
Bonus/Profit Share	0.0869***	0.0362***	0.0554***	0.0316***	0.0209***	0.00810*
	(0.00710)	(0.00688)	(0.00636)	(0.00592)	(0.00447)	(0.00442)
PRP x constraint	0.0161	-0.0190*	0.00733	-0.00907	0.0111	0.00256
	(0.0112)	(0.0104)	(0.00979)	(0.00894)	(0.00716)	(0.00669)
Bonus x constraint	-0.0562***	-0.00496	-0.0623***	-0.0192**	-0.0373***	-0.00974*
	(0.00918)	(0.00880)	(0.00790)	(0.00758)	(0.00553)	(0.00566)
Constraint	-0.0338***	-0.00754	-0.0196***	-0.0123***	-0.00550**	-0.00805**
	(0.00472)	(0.00519)	(0.00385)	(0.00447)	(0.00260)	(0.00334)
Constant	0.187***	0.303	0.0992***	0.241	0.0535***	0.304
	(0.0200)	(0.397)	(0.0164)	(0.342)	(0.0112)	(0.256)
Observations	70,911	69,960	70,911	69,960	70,911	69,960
R-squared	0.108	0.012	0.065	0.008	0.028	0.004
Number of pidp		31,263		31,263		31,263

Notes: Estimated linear probability models. All include controls for year of interview, month of the year, age, educational level, gender, marital status, occupation, and industry. Robust standard errors in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level respectively

Table 5: Performance Pay and Total Hours Worked, Blue vs White Collar Workers

	(1) White Collar OLS	(2) White Collar FE	(3) Blue Collar OLS	(4) Blue Collar FE
PRP	1.739***	0.432***	2.412***	0.744***
	(0.114)	(0.0826)	(0.212)	(0.174)
Bonus/Profit Share	0.954***	0.490***	2.277***	0.938***
	(0.103)	(0.0752)	(0.163)	(0.126)
Constant	43.46***	39.13***	35.10***	43.25***
	(0.603)	(3.608)	(0.861)	(6.020)
Sample Mean	38.77		33.77	
Observations	83,586	83,586	43,586	43,586
R-squared	0.211	0.019	0.310	0.024
Number of workers		26,589		17,599

All include controls for year of interview, month of the year, age, educational level, gender, marital status, occupation, and industry. Robust standard errors in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level respectively

Table 6: Performance Pay and Total Hours Worked, Managers and Labourers

	Managers		Labourers	
	OLS	FE	OLS	FE
PRP	1.165***	0.221	3.434***	0.784*
	(0.189)	(0.155)	(0.505)	(0.412)
Bonus/Profit Share	1.536***	0.422***	3.148***	1.223***
	(0.180)	(0.143)	(0.331)	(0.267)
Constant	42.66***	47.63***	31.04***	18.31
	(1.099)	(7.067)	(1.586)	(15.10)
Sample Means	42.57		32.05	
Observations	19,484	19,484	11,295	11,295
R-squared	0.129	0.012	0.360	0.024
Number of pidp		7,566		5,733

All include controls for year of interview, month of the year, age, educational level, gender, marital status, and industry. Robust standard errors in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level respectively

Table 7: Probability of Working Long Hours, Managers and Labourers

Greater than…	(1) 40+ manager OLS	(2) 40+ manager FE	(3) 40+ labourer OLS	(4) 40+ labourer FE	(5) 45+ manager OLS	(6) 45+ manager FE	(7) 45+ labourer OLS	(8) 45+ labourer FE	(9) 50+ manager OLS	(10) 50+ manager FE	(11) 50+ labourer OLS	(12) 50+ labourer FE
PRP	0.0313***	-0.00679	0.0660***	0.0321	0.0298***	0.000363	0.0678***	0.0412*	0.0191**	0.00786	0.0508***	0.0429**
	(0.0101)	(0.00932)	(0.0202)	(0.0235)	(0.0103)	(0.00971)	(0.0190)	(0.0219)	(0.00769)	(0.00812)	(0.0154)	(0.0194)
Bonus/Profit	0.0937***	0.0315***	0.0927***	0.0273*	0.0659***	0.0204**	0.0551***	0.0323**	0.0307***	0.00311	0.0163*	0.0281**
	(0.00927)	(0.00873)	(0.0128)	(0.0154)	(0.00892)	(0.00876)	(0.0120)	(0.0145)	(0.00673)	(0.00767)	(0.00880)	(0.0114)
Constant	0.425***	0.780*	0.178***	0.651	0.282***	0.448	0.119***	0.607	0.215***	-0.133	0.0678**	-0.809**
	(0.0486)	(0.433)	(0.0443)	(0.562)	(0.0477)	(0.451)	(0.0393)	(0.461)	(0.0357)	(0.371)	(0.0296)	(0.402)
Observations	20,625	20,625	11,881	11,881	20,625	20,625	11,881	11,881	20,625	20,625	11,881	11,881
R-squared	0.090	0.006	0.194	0.011	0.065	0.007	0.129	0.015	0.038	0.007	0.067	0.016
Number of pidp		7,753		5,898		7,753		5,898		7,753		5,898

Notes: Estimated linear probability models. All include controls for year of interview, month of the year, age, educational level, gender, marital status, occupation, and industry. Robust standard errors in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively

FIGURE 1: Distribution of Total Hours Worked by Contract Type.

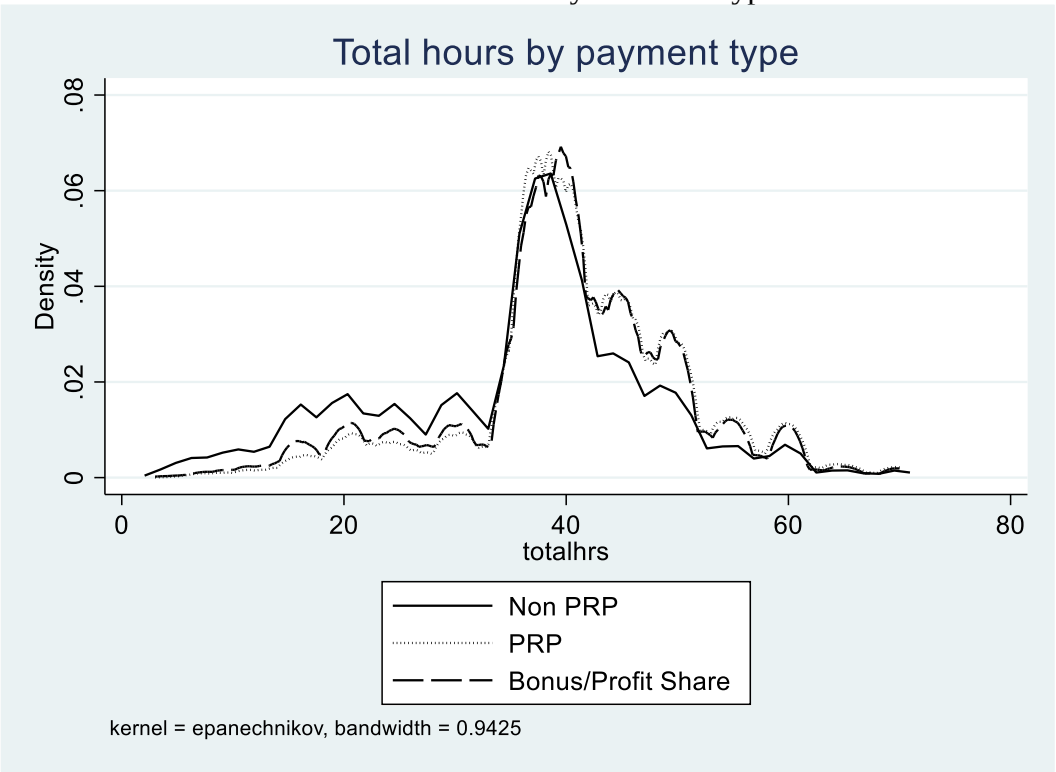


FIGURE 2: Distribution of Total Hours Worked by Contract Type Excluding Mass at 40 Hours.

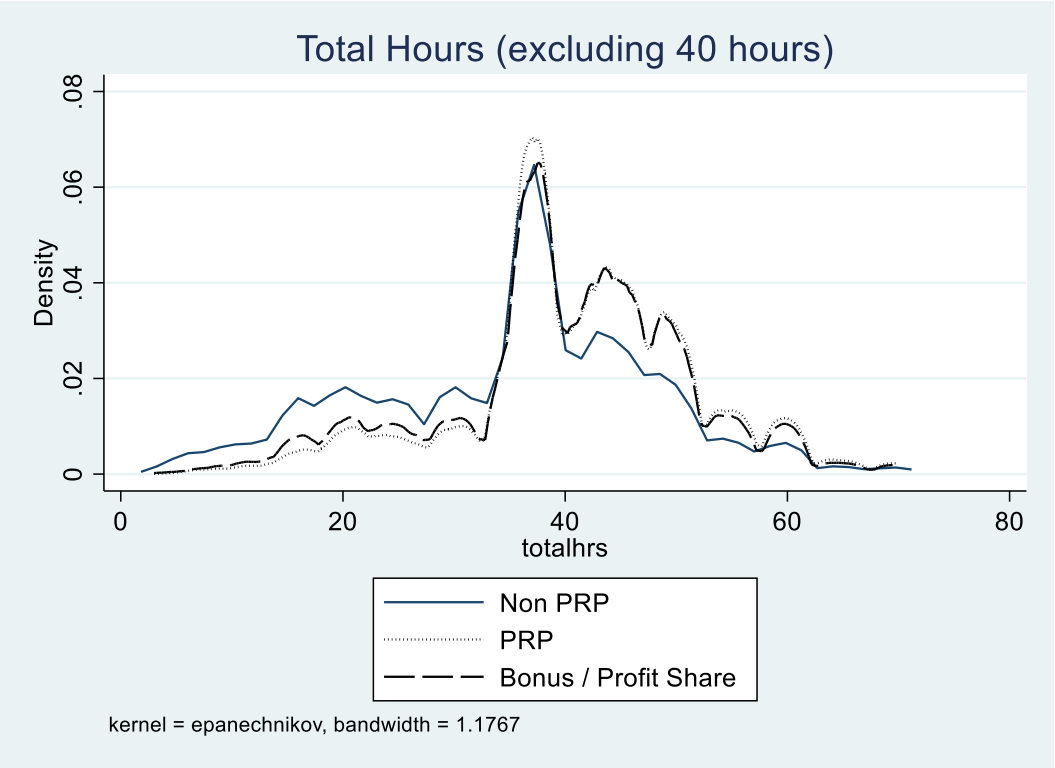
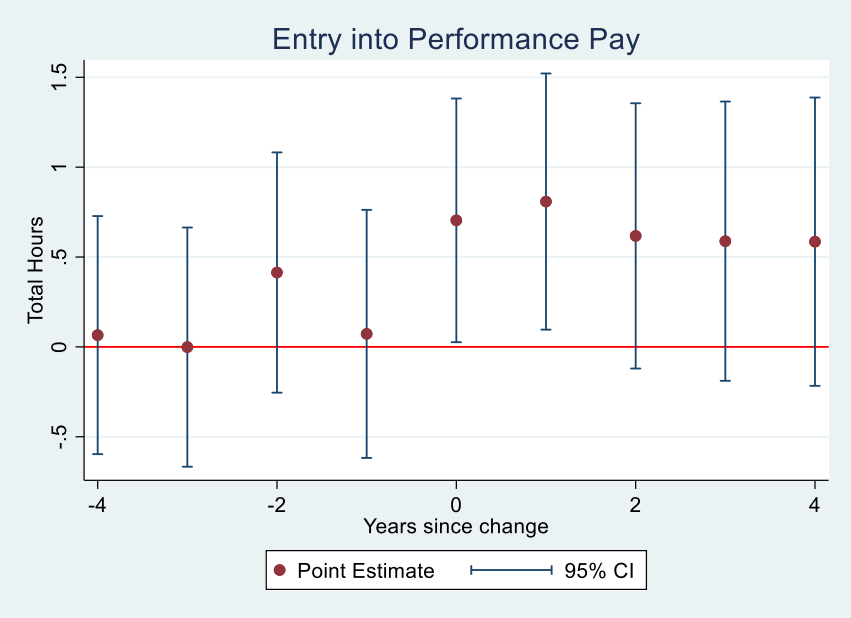
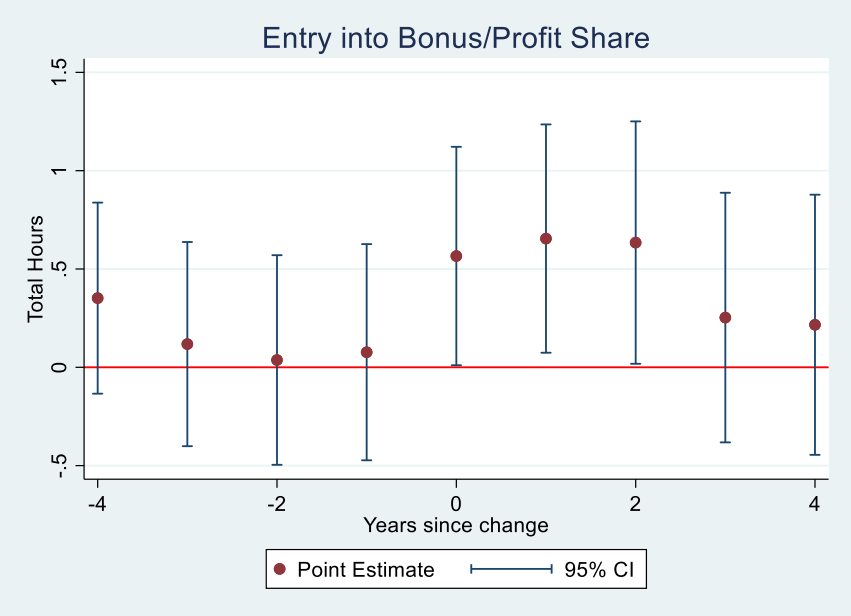


FIGURE 3: Event Studies – Changing Contract Type and Worker Hours





APPENDIX

Table A1 Summary Statistics

	All		Performance Pay		Bonus / Profit	
	Mean	Std.Err	Mean	Std.Err	Mean	Std.Err
Normal Hours	33.775	9.769	36.403	7.757	35.895	8.407
Overtime	3.448	5.442	4.574	6.152	4.085	5.647
Age	41.113	11.289	39.599	10.625	39.947	11.010
A Level	0.228	0.420	0.197	0.398	0.245	0.430
Diploma	0.224	0.417	0.248	0.432	0.262	0.440
Degree or Higher	0.384	0.486	0.462	0.499	0.348	0.476
Male	0.464	0.499	0.556	0.497	0.580	0.494
married	0.290	0.454	0.301	0.459	0.307	0.461
PRP	0.151	0.358				
Bonus / Profit Share	0.276	0.447				
Observations	143,579		21,745		39,565	

Table A2: PRP, Hours Worked and the Role of Personality Traits

VARIABLES	(1) I hours	(2) II overtime	(3) III totalhrs	(4) I Hours	(5) II overtime	(6) III totalhrs
PRP	1.600***	0.990***	2.574***	1.239***	0.906***	2.131***
	(0.103)	(0.0852)	(0.142)	(0.101)	(0.0826)	(0.137)
Bonus/Profit Share	1.178***	0.383***	1.564***	0.892***	0.462***	1.354***
	(0.0969)	(0.0659)	(0.122)	(0.0942)	(0.0624)	(0.116)
Agreeableness	-0.435***	-0.235***	-0.673***	-0.314***	-0.206***	-0.521***
	(0.0639)	(0.0387)	(0.0797)	(0.0608)	(0.0365)	(0.0747)
Conscientiousness	0.392***	0.317***	0.707***	0.316***	0.293***	0.605***
	(0.0648)	(0.0378)	(0.0800)	(0.0615)	(0.0357)	(0.0748)
Openness	0.0608	0.163***	0.222***	0.0293	0.115***	0.140**
	(0.0554)	(0.0311)	(0.0681)	(0.0524)	(0.0294)	(0.0639)
Extraversion	0.00229	0.0255	0.0307	0.000586	0.0301	0.0336
	(0.0505)	(0.0309)	(0.0634)	(0.0481)	(0.0292)	(0.0597)
Neuroticism	-0.323***	-0.0698***	-0.393***	-0.261***	-0.0415*	-0.302***
	(0.0474)	(0.0267)	(0.0582)	(0.0451)	(0.0252)	(0.0548)
Constant	30.85***	2.435***	33.22***	33.99***	3.551***	37.46***
	(0.845)	(0.515)	(1.043)	(0.891)	(0.539)	(1.087)
Occupation & Industry Controls				X	X	X
Observations	104,270	103,592	103,407	100,498	99,850	99,675
R-squared	0.195	0.049	0.196	0.239	0.082	0.248

All include controls for year of interview, month of the year, age, educational level, gender, marital status, occupation, and industry. Robust standard errors in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively