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IZA DP No. 15412

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ABSTRACT

Performance Pay and Work Hours: US Survey Evidence*

We examine the hypothesis that performance pay increases work hours. If performance pay incentivizes greater hours, this could cause the demonstrated link between performance pay and poorer worker health. Using US survey data, we confirm greater work hours and an increased likelihood of long working hours for performance pay workers. This remains in worker fixed effect estimates and in worker with employer fixed effect estimates. The magnitudes remain sufficiently large to support the potential role of long hours as an intermediary between performance pay and reduced worker health. Despite managers being the most likely to both receive performance pay and work long hours, we show this association largely reflects sorting and not the behavioral response evident for other workers.

JEL Classification: J22, J33
Keywords: performance related pay, hours worked

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1. Introduction

Performance pay has increasingly been linked to worker stress, illness, and injury. We review these links but emphasize that the causal mechanisms behind them remain in doubt. One suggested mechanism recognizes that long hours of work cause exhaustion, stress, inattention, and worse health. Thus, under this mechanism, performance pay causes employees to work longer hours in pursuit of higher pay and these longer hours harm health. As a critical step in this chain, we examine the extent to which performance pay generates longer hours among US workers.

Critically, theory provides no consensus on how hours respond to performance pay. While one fairly anticipates that performance pay increases worker effort, hours remain a poor proxy. The additional earnings associated with performance pay provide an income effect suggesting fewer work hours. Moreover, performance pay replaces hourly wages that reward only time on the job. This reduces adverse specialization in work hours, "face time" at an extreme (MacDonald and Marx 2001). Also, performance pay that rewards groups is well known to create free-rider issues that undermine both effort and working hours. Added to this theoretical ambiguity, the modest empirical literature presents both positive and negative associations between performance pay and hours.

We use US individual panel data to examine the influence of performance pay on work hours. The initial pooled cross-section indicates performance pay is associated with around 3 extra hours of work a week. It is also associated with increased chances of working more than a 45-hour week and more than a 50-hour week. The rough magnitudes remain robust to a reasonably wide variety of changes in controls. Consequently, we examine the role of worker heterogeneity and the associated sorting. This is important as performance pay may simply attract those already working long hours. Such sorting would merely rearrange the contract of those working long hours but not create any new adverse health effects.

Worker fixed-effect estimates continue to reveal statistically significant increased hours and probabilities of long work weeks associated with performance pay. These persist even in estimates controlling for worker with employer fixed effects. Indeed, the size of the influence in the long-hours estimates are generally not much attenuated by either fixed effect estimates. Thus, the possibility that those working long hours are simply sorted by performance pay appears unlikely.

Thus, our empirical evidence supports the claim that performance pay causes employees to work longer hours. We examine the patterns of this influence by occupations and provide a variety of robustness examinations. In what follows, the next section motivates our inquiry and reviews past evidence. The third section introduces our data and empirical approach. The fourth section provides the basic results, both the pooled and the two fixed effect estimates. The fifth section provides additional heterogeneity and robustness examinations while the final section concludes.

2. Background and Motivation

Adam Smith conjectured that piece rates incentivize workers to harm their health. Since then a large literature examines the health consequences of performance pay.[1] Swedish loggers have higher accident rates after transitioning to piece rates (Sundstroem-Frisk 1984) and tree cutters in Canada are more prone to heart attacks (Toupin et al. 2007). Workplace accidents are more likely 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 more accidents than those paid by the hour (Monaco and Williams 2000). A German steel plant experienced increased sickness absence after introducing production bonuses (Frick et al. 2003). Putting a larger share of sales workers'

[1]This literature stands beside the evidence that performance pay increases productivity. It does so both by increasing productivity from existing workers (Banker et al. 1996, Lazear 2000 , Bandiera et al. 2005, Gielen et al. 2010, Heywood et al. 2011) and by attracting inherently more productive workers (Lazear 2000, Cadsby et al. 2007, Dohmen and Falk 2011 and Shaw 2015).

income at risk with commissions generates greater stress, emotional exhaustion, and sick days (Habel et al. 2021).

Broad survey evidence supplements these case studies. Bockerman et al. (2012) examine high-performance work practices in Finland that include performance pay and find no relationship between this set of practices and accidents. Yet, Bender et al. (2012) use the European Working Conditions Survey to show that piece rates are associated with an increased risk of workplace injury. Artz and Heywood (2015) show a higher risk of workplace injury when US blue-collar workers receive output-based pay (piece rates or bonuses). DeVaro and Heywood (2017) show greater sickness absence and physical ailments among UK workers at establishments using performance pay.

Outcomes other than injury and absence have been examined. Foster and Rosenzweig (1994) show that agricultural workers receiving piece rates expend sufficient extra effort to worsen their basic physical health. Davis (2016) examines workers in 109 clothing factories controlling for each factory's occupational safety and health compliance. Workers paid by the piece report both lower physical and emotional health. Bender and Theodossiou (2014) demonstrate a larger hazard of falling out of good self-reported health for UK workers receiving a very broad measure of performance pay. Andelic et al. (2022b) expand on this by examining a wide range of very specific health indicators. While not all are associated with performance pay, they show lower self-reported mental health, significantly higher blood pressure and higher inflammation markers in the blood for those on performance pay.[2] Baktash et al. (2021) use German data to show that workers receiving a broad measure of performance pay report greater stress. Yet, the risk tolerant receiving performance pay suffer less stress than do the risk averse.

[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."

Confirming such survey data, Cadsby et al. (2016) present laboratory experiments showing that performance pay increases self-reported stress among risk averse individuals. Allan et al. (2021) eliminate self-reporting with alternative classroom experimental evidence. They confirm that those earning performance pay suffer higher stress as measured objectively by cortisol hormone levels. This complements early field experiment evidence on manufacturing workers randomly assigned either piece rates or hourly wages (Timio and Gentili, 1976). The piece rate workers had greater stress as measured by higher hormone levels.

Dahl and Pierce (2018) show that the adoption of performance pay increases the use of anti-anxiety drugs and anti-depressants by four to six percent. They argue that performance pay induces stress and anxiety harming mental health and increasing prescription use. Self-medication may be even more profound. 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. 2022, for evidence from Germany).

While this review suggests that performance pay may reduce worker health, it does not explain the channel through which it happens. A common explanation is that performance pay incentivizes working longer hours and that this can happen to a point of physical and/or mental exhaustion harming health (DeVaro and Heywood 2017). Pencavel (2015) describes the long hours of munition workers paid by the piece during World War I Britain. He explains 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)."

The epidemiological evidence is clear. Long hours are unhealthy. Long working hours led to 745,000 deaths from stroke and heart disease in 2016, a nearly 30 percent increase since 2000 according to the World Health Organization. Long work hours stand out as the most important risk factor with the largest occupation disease burden. Indeed, it accounts for over

1/3 of that total burden (Pega et al. 2021). US studies show that long hours are risky not only because they are concentrated in inherently dangerous occupations and industries or because long hours workers spend more time at risk. Instead, long hours genuinely increase the underlying risk of illness (Dembe et al 2005). The definition of long hours varies and depends on other family responsibilities but 50 hours a week is among the most common definitions. In the latest meta-analysis of the epidemiological evidence (drawing largely on studies in industrial democracies including the US) Wong et al. (2019) draw three critical conclusions. First, long working hours (of 50 or more) are recorded across virtually all countries and studies. Second, long working hours are strongly associated with poorer health *outcomes* including cardiovascular diseases, chronic fatigue, stress, depression, anxiety, hyper-tension, and all-cause mortality among others. Third, long working hours are strongly associated with worse health *behaviors* including sleep deprivation, poor eating habits, lack of exercise, smoking, drinking and drug use.

These strong health associations help motivate the hypothesis that performance pay generates poor health through longer hours. Yet, the evidence is far from uniform. Jones (2013) studied schoolteachers in the US. In all but one state, introducing performance pay led to fewer hours per week. This performance pay was at the school or team level and the decrease in hours was taken as evidence of free-riding. Florida only permits individual level performance pay and Florida teachers worked more hours in response to performance pay. Pay-for-performance contracts for general practice medicine in the UK resulted in practices increasing staff size but not in an increase in hours (Gemmell et al. 2009). Bilikopf and Norton (1992) and Bilikopf (1995) showed that farmworkers trimming California vineyards 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. According to the authors, the farmworkers appeared to work "faster and smarter" but not longer.

Pekkarinen and Riddell (2004) use data from the Finnish metal industry. Conditional on controls, piece rate workers record slightly fewer hours on average than hourly wage workers. Yet, an increase in hours is observed when following those moving from hourly wages to piece rates. This happens because workers that transition to piece rates come from the lower end of the hours distribution among hourly workers (Pekkarine and Riddell 2008). Thus, there exists an increase in hours but given that they merely increase to the average of the hourly wage distribution, the increase is unlikely to drive health consequences.

DeVaro (2022) uses the linked employer-employee data of the UK WERS. As part of a study of absenteeism and health, he studies the presence of long hours within establishments. Performance pay increases the likelihood of long hours if the cut-off is modest (35 to 39) but not for cutoffs of 40 or more. Thus, echoing the Finnish data, performance pay may move workers up to full time but again may not create the long hours that deteriorate health.[3]

As mentioned in the introduction, one might anticipate both a behavioral response and a sorting response. The hours of existing workers may respond to performance pay and workers with preferences over hours (vs. earnings) may sort into performance pay. Green and Heywood (2022) demonstrate the importance of sorting among UK workers. Larger initial hours estimates are greatly attenuated in worker fixed effect estimates. Importantly, the attenuation is largest among those workers working more hours, managers and associated white collar workers. Indeed, among this subsample the fixed effect estimate causes the hours premium associated with performance pay to vanish. Managers that work long hours in any event are simply attracted to performance pay. This attraction is unlikely to generate any further harm to health as the hours would be worked in any event. The attenuation with fixed-effects is much more modest among laborers and other blue-collar workers. Here the hours increase associated with

[3] Lemieux et al. (2012) use the PSID to show that annual hours are larger for those in bonus jobs. Yet, their data construction and interpretation suggest that this largely represents an increase in employment probability and weeks worked rather than in hours worked per week.

performance pay seems merely to bring the average laborer to approximately full time (again chiming in with earlier studies). Again, a harm to health seems unlikely in such a move. Thus, although hours influences were confirmed, their magnitude and location within the hours distribution did not support the hypothesized mechanism that long hours routinely serve as the crucial intermediary between performance pay and harmed health.

While not directly examining hours of work, Andelic et al. (2022a) examine a cross-section of UK workers to isolate how performance pay influences time use. They confirm Becker (1965) type time reallocations. Performance pay workers are less likely to attend leisure events and spend less time on exercise and sleep. They do, however, eat and drink out more frequently. These reallocations would be anticipated if performance pay increased both work hours and earnings.

We note that often survey measurers of performance pay are sufficiently ambiguous that they could include earnings from tips. While tips are certainly variable compensation, they are discretionary, seen as rewarding quality rather than productivity and are subject to extensive rent seeking by employers (Azar 2020). This leaves in doubt their theoretical influence on hours worked. Thus, the incentive of piece rates to increase output is substantially reduced when quality is monitored and rewarded (Jack and Guiteras 2017). It was this incentive that Adam Smith originally saw as causing piece rate workers to harm their health by overwork.[4] In addition to the theoretical ambiguity, most tipped jobs have both fixed shifts and typically work hours far less than full time (BLS 2021). While we will include tips as performance pay in our core estimates, our data uniquely allows us to explicitly observe tips and so we will present robustness exercises that exclude them.

[4] "Workmen…when they are 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)."

3. Data and Empirical Approach

We draw our data from the 1997 National Longitudinal Survey of Youth. (NLSY). The NLSY contains information on payment methods, hours of work self-reported and a strong variety of controls related to a worker's primary job. The NLSY follows a single cohort that may not be fully representative of the population and began interviewing in 1997 when all respondents were in their teen-age years. Our working sample consists of annual waves of data between years 1997 and 2011, and then biennially collected waves from 2013 through 2019.

The survey allows us to control for demographic variables such as gender, race, age, education, region of residence, marital status, and the number of children in the household. We also control for job characteristics such as length of tenure with the employer, union membership, public sector employment, and industry and occupation categories using the 2002 Census of Industrial and Occupational Classification Codes. We remove all observations with missing data, save for those lacking region, occupation or industry data. In each of these we classify missing observations with an additional category to preserve more data, particularly for the fixed effect estimations[5]. In all, our working sample totals 102,425 person-year observations across 8,827 individual employees.

The NLSY identifies five forms of performance pay: tips, commissions, bonuses, incentive pay, and a small "other" category. It is not made clear whether these are individually or group oriented nor whether the bonuses and incentive pay are objectively set (by formula) or determined by the subjective judgment of a supervisor. In the absence of clear guidance, we combine all five into one measure of performance pay but experiment with alternatives. Roughly 17.5% of respondents report receiving at least one type of performance pay. Our ultimate examination of narrow worker and employer matches helps alleviate concern that

[5] We note that removing these missing observations does not appreciably alter the sign, size or significance of the coefficient estimates.

specific jobs or employers are associated with both a specific type of performance pay and long work hours.

The hours measure reflects regular weekly hours worked and includes regular hours workers claim as overtime. It is developed from adding respondents' answers regarding "the number of regular hours worked per week… (overtime hours are not included)" with "in a normal week, how many hours do/did you work overtime for pay?". Approximately 20% of workers claim to work some number of regular overtime hours, and this increases the average weekly hours worked from 33.2 to 34.8 hours. We also utilize two binary measures indicating employees working long hours, first working 45 or more hours (approximately 21% of the sample) and second working 50 or more hours (nearly 14%).

Table 1 provides summary statistics. In addition to the previously mentioned proportions, Table 1 shows the sample is roughly split by gender and includes disproportionately large proportions of Black and Hispanic workers, 25% and 21% respectively[6]. The sample's young average age of 25 years reflects the cohort's start in their teen-age years. Similarly, the low proportion of married workers and the somewhat large percentage of observations without a high school degree reflects the sample's youth. Regarding employment, a worker averages over 2 years of tenure with their employer, 10% of which is a government entity. Nearly 9% of workers are union members and a strong plurality (46%) work in large organizations alongside at least 200 other employees. Finally, Table 1 notes 4 geographic regions, 22 occupational categories and 15 industries.

To further explore distributional differences in hours worked, Figure 1 provides kernel density estimates in total hours worked comparing those with and without performance pay. While all share a mass around full-time hours, there is a higher density of hours worked beyond this amount for performance pay workers.

[6] The NLSY over-samples Black and Hispanic workers to ensure sufficient observations for statistical analysis.

Our main estimating equations take the form:

$$Hours_{it} = \alpha_1 PerfPay_{it} + \beta' \boldsymbol{X}_{it} + \mu_t + \varepsilon_{it} \quad (1)$$

Where hours is the measured weekly hours worked, $\boldsymbol{X}$ is a vector of controls and μ_t are the year of survey dummies. The estimate α_1 is our primary parameter of interest. The basic controls include age, gender, highest educational level, and marital status. Occupation, industry, and year of survey controls are also included. The errors are clustered at the individual level to account for repeated observations on the same worker.

We first estimate variants of (1) in a pooled cross-section using OLS. Yet, we take seriously the likelihood that those who would inherently work more hours will sort into performance pay jobs. Consequently we also estimate the effect of performance pay on work hours with individual worker fixed effects. These estimates dutifully control for time-invariant and unobservable worker characteristics that likely influence sorting behavior. Moreover, we posit that performance pay's effect on work hours may change with employers. A worker's change in hours may be due to an employer change rather than a change in performance pay. Since workers may switch roles or jobs at their employer and potentially gain or lose performance pay compensation as a result, we also control for worker-in-employer fixed effects. These estimations essentially provide the effect on hours of a worker changing performance pay status within their employer. Differences between these estimates are informative insofar as they provide a gauge of the role of sorting in generating differences in hours worked across contract types. We will also estimate on subsamples, blue-collar vs. white-collar, and on the representative broad occupations of managers. The resulting heterogeneity shows different roles for the share explained by sorting vs. a direct behavioral response that contrast with previous research.

We also present long hours estimates in which the dependent variable is whether the individual works more than a threshold number of hours. Again, the estimates with and without worker fixed effects will be contrasted. These are estimated as linear probability models, but we emphasize that conditional logit estimates are very similar.

4. Initial Results

Table 2 presents initial estimates of the relationship between performance pay and hours worked. The first column shows the results of the pooled estimation. The controls demonstrate the familiar pattern that males work more hours (Venkatesh 2021). Critically, the estimate indicates that those receiving performance pay work an additional 2.9 hours per week conditional on the controls (the average hours of work in the sample is 35).

INSERT TABLE 2

The second column shows the worker fixed effect estimates. These are within worker comparisons and so remove the influence of 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 only modestly smaller at 2.6 hours per week.

The third column presents the worker with employer fixed effect. Thus, the variation excludes the influence of changing employers that influence the earlier worker fixed effect estimates. The variation examined is that which exists as performance pay status changes for a given worker matched to specific employer. This reduction in variation excludes cases where a worker changes employers and so performance pay status, and this is associated with a change in hours. To the extent that the change in hours at the new employer were for reasons other than (but correlated with) performance pay, it provides a further improvement in identifying

the behavioral response. The estimate drops to an additional 1.9 hours associated with a given worker moving to performance pay at the same employer. The estimate remains significantly different from zero.

The second three columns repeat the first three columns but controls for the hourly earnings. This 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.[7] As a short cut, we examine this by including hourly wages into our main equations. Conditional on controls, the higher wage is associated with fewer hours of work but the general pattern for the role of performance pay is unchanged. An increase of about 3 hours in the pooled estimate drops modestly in the individual fixed effect estimate and yet remains 2.2 hours in the worker with employer fixed effect. All these estimates remain statistically significant.

We have modified the specification in a variety of ways, but the basic pattern presented on hours remains broadly similar. In addition to simply removing various controls, we focused on the fact that a quarter of respondents claim to work the standard 40 hours per week. This may be an automatic response for salary workers independent of the actual hours worked. Such automatic responses introduce measurement error. Moreover, 40 hours is the maximum before paying overtime to hourly workers creating a type of censoring as employers may not allow greater hours. After removing all those working exactly 40 hours per week, the estimated performance pay effect in the individual fixed-effects regression increases to more than 3 hours per week from approximately 2.6 in Table 2 column 2.

In a second examination, we recognize that tip workers are frequently in part-time jobs that may limit their working hours to specific shifts. Indeed, being paid tips is negatively

[7] Thus, within workers largely paid piece rates, US truck drivers, Belzer and Sedo (2017) demonstrate a backward bending supply curve with the income effect dominating at higher piece rates.

related to weekly work hours in a fixed effects regression. After removing tip workers from the specification, the estimated effect of performance pay increases to over 4 regular work hours per week. We further explore the influence of tips in Section 5. The four other performance pay types have large positive impacts on work hours. In fixed effects estimates that separate out the five performance pay types in the specification, bonuses (commissions) correlate with the largest (smallest) positive increase in work hours, 4.42 (1.78) hours respectively.

Yet, while the evidence of an increase in average hours fits the hypothesis, it seems poorly targeted. If long hours drive poor health, the pattern of long hours should be directly examined. We now turn to that with two measures of long hours. The first dependent variable equals one if more than 45 hours per week are worked and the second dependent variable equals one if more than 50 hours per week are worked. The results are shown in Table 3. The first three columns show the results for hours greater than 45 hours. The pooled estimate of the linear probability model identifies that performance pay is associated with an increased likelihood of long hours of 9.8 percentage points. As the share of those not receiving performance pay but working long hours is 19.3 percent, this is a meaningful increase of approximately 50%. The next two columns show the worker fixed effect estimate and the worker with employer fixed effect estimate. The increased likelihood of long hours remains substantial at 8.7 and 8.2 percentage points. The result from the earlier hours estimates in which the worker with firm fixed effect is less than two-thirds the pooled estimate is not repeated.

INSERT TABLE 3

The second three columns show the estimates of the likelihood of working more than 50 hours per week. Those receiving performance pay are around 6.2 percentage points more

likely to work long hours. The share of the sample not receiving performance pay who work long hours is 12.3 percent, so this again represents about a 50% increase. The fixed effect estimates show modest diminution but retain meaningful magnitudes.

The size effects on long-hours can be compared with health effects of performance pay in the literature. The point is not to suggest that all health and behavioral consequences fit our estimates but to broadly suggest our result sizes are meaningful. Thus, for example Mehrzad et al, (2022) show that measures of stress increase about 10 percent for those receiving performance pay. Artz et al. (2021) show that marijuana use increases about 21 percent for those receiving performance pay. Considering these magnitudes, our findings of 50% percent increases in long hours indicate that increased long hours represents a sensible channel by which the health of US workers may be hurt by performance pay.

5. Patterns of Heterogeneity

We initially examined the estimates for heterogeneity by gender and did not find meaningful differences. We then examined occupational differences starting with a broad distinction between white-collar and blue-collar workers.

This examination is motivated by evidence that even though the mean reported hours for the two groups are equal, the blue-collar sample is statistically more likely to work long hours. The share of white-collar workers reporting more than 50 hours is 12.5 percent while the share blue-collar workers reporting more than 50 hours is 15 percent. Moreover, evidence from the UK shows performance pay has a larger influence on blue collar worker hours (Green and Heywood 2022).

Table 4 presents the critical results on the two occupational categories. The estimates are run within each category for both hours and the two long hours indicators. The pooled hours estimate presents a substantial difference with white-collar workers on performance pay

reporting 4.1 additional hours of work, all else equal. This contrasts with only 1.8 additional hours for blue-collar workers on performance pay.

This pattern changes dramatically in the fixed effect estimates. In the final estimate of worker in employer fixed effects, the two estimates are essentially the same at 2.1 additional hours of work for those on performance pay. The estimates decrease with fixed effects for white-collar workers but increase with fixed effects for blue-collar workers. This suggests dramatically different sorting and selection patterns. White-collar workers who would inherently work long hours tend to sort into performance pay positions. Yet, blue-collar workers who would inherently work long hours tend to sort away from performance pay jobs.

These patterns generally persist in the long hours measures. Yet, the pattern for 50 hours or more for blue-collar workers shows no pattern of sorting with the estimates across the three estimates essentially the same. In the end, the long hours measures provide no evidence that blue-collar workers have a larger behavioral response to performance pay. If anything, the opposite appears to be the case.

This leads to subdividing the white-collar sample into managers and all other white-collar workers. A very large share of managers receive performance pay, 33 percent. Managers also report a long average of 43 hours. In the pooled estimates in Table 5 managers on performance pay report almost five more hours of work per week than those not on performance pay, all else equal. Yet, here the influence of sorting is even more dramatic as in the final fixed effect estimate that falls to only one more hour per week. Managers that would inherently work more hours sort into performance pay jobs. The behavioral response is modest. The role of performance pay for managers is one of attracting those who would work long hours in any event. The long hours indicators replicate this. The final fixed effect estimate for the 50 hours indicator is only 2.9 percent (on a large base) and is not statistically

significant. The idea of managers working long extra hours because of performance pay receives only very modest support.

The results for the nonmanagers show less dramatic attenuation. In the final fixed effect estimate, those on performance pay work more than 2.2 additional hours per week. This is double the estimate for managers. Again, this is repeated for the long hours indicators. Unlike the blue-collar workers, the fixed-effect estimates cause smaller point estimates but the extent to which these attenuate is far less than was true for managers.

Summarizing this heterogeneity exercise, we present the increase in the share working 50 hours as a percent of the average. Thus, for blue collar workers the increase in the share is 2.7 percentage points on a base of 15 or an increase of 18 percent. For non-managerial white-collar workers, the increase is 4.9 percentage points on a base of 10.9, or 45.0 percent. For managerial workers the point estimate suggests an increase is 2.9 percentage points on a base of 30.6 or 9.5 percent (recalling that the original point estimate was insignificantly different from zero). The managers have the longest average hours and largest shares of long hours. They also have the largest share of workers on performance pay. Yet, our estimates make clear that performance pay is not what drives the long hours. The actual behavioral response of managers is the smallest of the three groups we examine. To the extent that unhealthy work hours are driven by performance pay it is not among managers.

Finally, we examine more closely the role of tipped workers. A total of 6556 observations report receiving tips over the panel. This represents slightly more than a third of 17944 observations reporting performance pay of any kind. Given our broad division between blue-collar and white-collar, over 86 percent of the tip observations are among the blue-collar division. Tips, while variable compensation, may not generate similar incentives to overwork. This may be because of the nature of what is incentivized or because of the

institutional structure of limited hour shifts and parttime work.[8] Consequently, we re-examine the blue-collar workers eliminating tips as a type of performance pay. This moves workers with tips into the group of those receiving no performance pay.[9] An alternative that generates very similar results would be to simply remove all tip associated observations from the panel.

Table 6 reports the blue-collar results with tips eliminated as a form of performance pay. The point estimates are routinely larger in size. The pooled cross-section result is nearly four times larger 6.4 additional hours vs. 1.8 additional hours in Table 4. The worker fixed effect estimate identifies the additional hours associated with moving to performance pay is 4.9 hours. The pattern generated by the fixed effect now reverses from that earlier identified as the tipped workers seemingly generated the earlier pattern of increasing point estimates. While smaller than the pooled estimate, this worker fixed effect estimate remains much larger than that counting tips as performance pay. Finally, the worker with employer fixed effects emerges as more than 2.4 additional hours. Two points deserve emphasis. First, removing tips increases the additional hours associated with performance pay for blue-collar workers. Second, with tips removed the pattern matches that for white-collar workers with more finely identified fixed effect estimates reducing the measured hours increase.

These two points persist when examining the dichotomous long hours measures in Table 6. The estimates are larger than those that include tips and the fixed effect estimates reduce the estimates thus matching the white-collar pattern. Performance pay workers are 11.7 percentage points more likely to work more than 50 hours in pooled cross section, 9.3 percentage points more likely in the worker fixed effect and still a significant 3.7 percentage

[8] Fully 72% of tip observations work less than 40 hours a week while only 45 percent of those not receiving tips work less than 40 hours a week.

[9] Those relatively few workers receiving tips but not in the blue-collar division are largely among the non-managerial white-collar division. We undertook the same re-examination for this division but due to the same change found essentially identical results to those reported in Table 5.

points in the worker with employer fixed effect. This 3.7 percentage points on a base of 15 represents an increase of 24.7 percent. Working more than 50 hours per week is known to have detrimental health effects. These estimates suggest that blue-collar workers receiving performance pay, other than tips, are at a substantially increased risk.

6. Conclusions

A growing consensus indicates that performance pay links to harm for worker health. Yet far less evidence exists on the mechanisms that might generate this harm. One hypothesis argues that performance pay increases working hours and that these long hours harm health. However, standard theoretical treatments of performance pay provide ambiguous predictions on the effect of hours worked.

Our initial result is that performance pay is robustly associated with both longer worker hours and a higher probability of working very long hours, a margin at which we might think any negative effects of hours worked may be concentrated. Standard worker fixed effects estimates suggest substantial attenuation in the hours worked estimate but less in the probability of long hours estimate. The remaining estimates are sufficiently large to support the potential role of long hours as an intermediary between performance pay and poorer worker health.

Several important types of heterogeneity are evident. First, the sorting patterns of blue-collar and white-collar workers differ. The fixed effect estimates diminish the point estimates for white-collar workers but increase them for blue-collar workers. White collar workers who inherently work longer hours sort into performance pay while blue collar workers who inherently work longer hours sort out of performance pay. Second, the attenuation associated with the fixed effects is especially large for managerial workers. Despite being the most likely to work long hours and receive performance pay, their behavioral response to performance pay is the smallest. They tend to work long hours independently of performance pay. Thus, the

health effects associated with the behavioral response of working longer hours because of performance pay is concentrated in non-managerial workers and it is there that any firm or public policy should be concentrated.

In addition, tips play a far less evident role as a form of performance pay. When they are removed from performance pay, the increases in hours and in long hours are larger for blue-collar workers. Moreover, the contrasting pattern of fixed effect estimates increasing the size of the point estimates for blue-collar workers is lost when tips are removed. Instead, blue-collar workers match white-collar workers with declining point estimates in the fixed effect estimates.

Our examination of tips serves to illustrate a broader concern that is not well pursued with worker surveys such as that we use. Such data cannot isolate whether the influences we identify reflect worker labor supply responses and/or firm and institution responses. We cannot identify the extent to which firm contracts limit hours of workers who would otherwise work more given performance pay. Instead, we examine the increased hours associated with performance pay within the contracts that allow such increases. Nonetheless, the measured increases suggest that for large shares of the blue-collar and non-managerial white-collar labor force, performance pay is associated with increased risk of very long hours and the associated health consequences.

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Figure 1: Hours kernel density plots by performance pay status

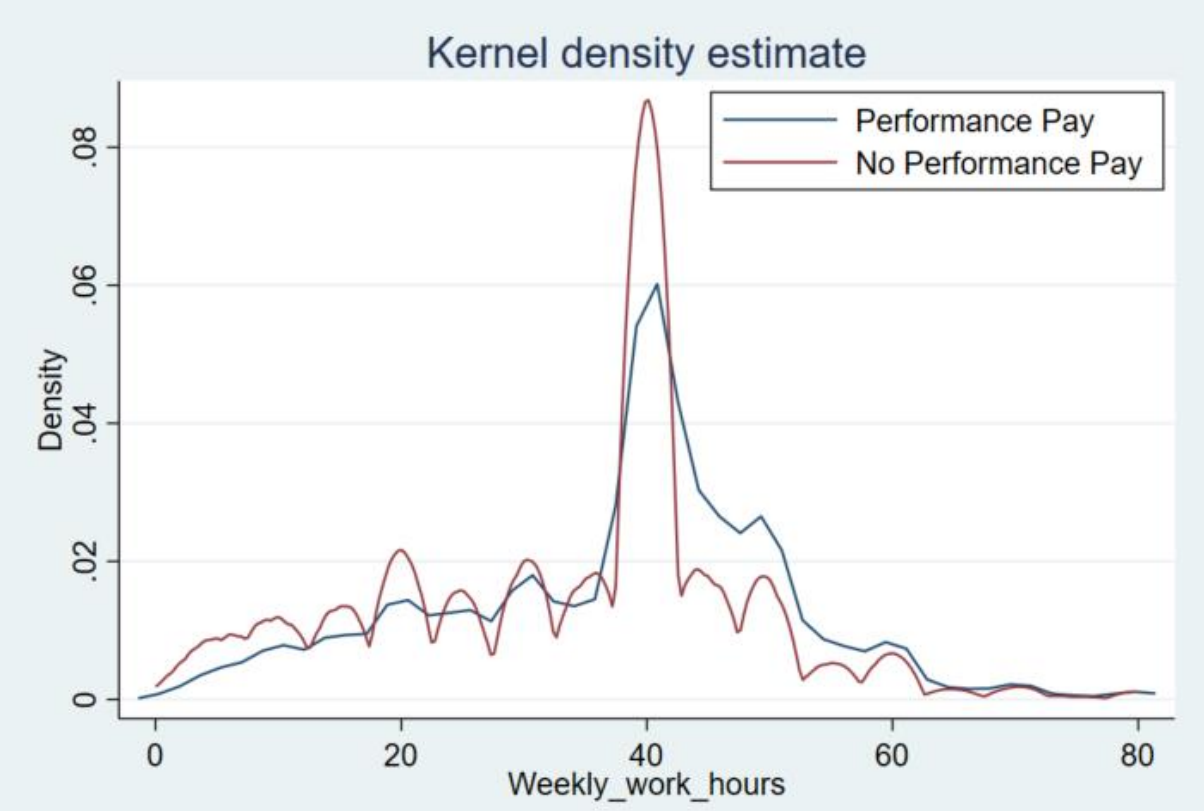

Table 1: Variable Definitions and Descriptive Statistics

Variable Definitions	Means	(St. Dev.)
Hours: = regular weekly hours worked, including overtime hours	34.819	(15.574)
Performance pay: = 1 if respondent earned extra compensation; 0 otherwise #	0.175	(0.380)
Hourly wage: = the respondent's total hourly rate of pay in nominal dollars	21.236	(427.888)
Male: = 1 if respondent is male; 0 otherwise	0.503	(0.500)
Black: = 1 if respondent is Black; 0 otherwise	0.250	(0.433)
Hispanic: = 1 if respondent is Hispanic; 0 otherwise	0.210	(0.407)
Age: age of respondent in years	24.973	(6.026)
High school degree: = 1 if respondent completed between 12 and 15 years of education; 0 otherwise	0.517	(0.500)
College degree: = 1 if respondent completed at least 16 years of education; 0 otherwise	0.209	(0.407)
Married: = 1 if respondent is married; 0 otherwise	0.229	(0.420)
Children: = the number of household members under age 18	1.056	(1.258)
Tenure: = the number of weeks respondent has worked at primary job, divided by 100	1.195	(1.526)
Public sector: = 1 if respondent's employer is a government entity; 0 otherwise	0.100	(0.301)
Union: = 1 if respondent is covered by a union or employee association; 0 otherwise	0.086	(0.280)
Medium employer: = 1 if the number of employees at respondent's workplace is between 40 and 200; 0 otherwise	0.171	(0.377)
Big employer: = 1 if the number of employees at respondent's workplace is more than 200; 0 otherwise	0.459	(0.498)

Notes: The working data include 22 occupation categories, 15 industry categories, 4 geographic regions, and 19 years/waves from 1997 – 2019. Observations = 102,425.
Extra compensation from either tips, commissions, bonuses, incentives or "other"

Table 2: Total Hours of Work OLS Regressions

	Pooled cross-section	Worker FE	Worker in employer FE	Pooled cross-section	Worker FE	Worker in employer FE
Performance pay	2.876***	2.551***	1.855***	3.013***	2.833***	2.219***
	(18.987)	(18.101)	(12.351)	(19.070)	(19.295)	(14.470)
Log hourly wage				-0.374**	-0.920***	-1.748***
				(-2.485)	(-6.131)	(-8.800)
Male	3.157***			3.185***		
	(19.469)			(19.502)		
Black	0.902***			0.879***		
	(4.811)			(4.664)		
Hispanic	1.443***			1.430***		
	(7.430)			(7.354)		
Age	4.966***	3.838***	1.380***	4.987***	3.894***	1.434***
	(27.657)	(16.122)	(3.340)	(27.713)	(16.306)	(3.469)
Age squared	-7.959***	-6.431***	-2.315***	-7.983***	-6.535***	-2.442***
	(-22.764)	(-18.665)	(-3.291)	(-22.800)	(-18.861)	(-3.474)
High school degree	-0.835***	1.272***	1.243***	-0.806***	1.288***	1.234***
	(-4.687)	(7.069)	(5.100)	(-4.514)	(7.161)	(5.058)
College degree	-0.135	5.991***	2.837***	-0.021	6.190***	2.903***
	(-0.543)	(23.179)	(8.059)	(-0.084)	(23.907)	(8.241)
Married	1.045***	0.783***	-0.172	1.081***	0.868***	-0.117
	(6.009)	(4.749)	(-0.922)	(6.199)	(5.250)	(-0.624)
Children	0.024	-0.548***	-0.461***	0.022	-0.550***	-0.460***
	(0.442)	(-9.578)	(-6.163)	(0.394)	(-9.605)	(-6.147)
Tenure	-0.382***	-0.240***	0.198	-0.342***	-0.171*	0.421
	(-3.764)	(-2.593)	(0.543)	(-3.369)	(-1.857)	(1.148)
Tenure squared	0.051***	0.028**	0.006	0.047***	0.022*	0.001
	(3.700)	(2.431)	(0.420)	(3.450)	(1.921)	(0.060)
Public sector	0.242	1.008***	-2.576	0.221	0.979***	-2.663
	(0.837)	(3.401)	(-1.279)	(0.766)	(3.297)	(-1.281)
Union	3.474***	3.121***	1.142***	3.539***	3.237***	1.183***
	(15.362)	(15.100)	(4.977)	(15.563)	(15.564)	(5.171)
Medium employer	2.368***	1.987***	0.044	2.392***	2.024***	0.029
	(14.530)	(12.993)	(0.270)	(14.617)	(13.197)	(0.176)
Big employer	0.591***	0.538***	-0.523***	0.620***	0.596***	-0.529***
	(4.291)	(4.174)	(-3.280)	(4.516)	(4.624)	(-3.318)
Occupations (22 groups)	Yes	Yes	Yes	Yes	Yes	Yes
Industries (15 groups)	Yes	Yes	Yes	Yes	Yes	Yes
Regions (4 groups)	Yes	Yes	Yes	Yes	Yes	Yes
Years (19 waves)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	102,425	102,425	102,425	102,425	102,425	102,425
Constant	-22.787***	-10.053***	15.593***	-20.613***	-4.820	26.680***
	(-8.893)	(-3.058)	(2.580)	(-7.664)	(-1.419)	(4.319)

Notes: T-statistics are in parentheses; *, **, *** reflect statistical significance at the 10%, 5% and 1% levels, respectively. Heteroskedasticity robust standard errors are clustered at the individual level. Observations with missing occupation, industry or regional data are coded as additional groups in each variable.

Table 3: Long Hours of Work OLS Linear Probability Regressions

	Dep. = 1 if hours > = 45			Dep. = 1 if hours > = 50		
	Mean (st. dev.): 0.214 (0.410)			Mean (st. dev.): 0.136 (0.343)		
	Pooled	**Worker**	**Worker**	**Pooled**	**Worker**	**Worker**
Performance pay	0.098***	0.087***	0.082***	0.062***	0.055***	0.045***
	(20.297)	(19.862)	(13.589)	(14.536)	(14.479)	(8.819)
Log hourly wage	0.028***	0.014***	-0.005	0.019***	0.003	-0.013***
	(9.001)	(4.755)	(-1.162)	(6.657)	(1.025)	(-3.255)
Male	0.085***			0.065***		
	(18.965)			(16.859)		
Black	-0.007			-0.011***		
	(-1.382)			(-2.717)		
Hispanic	0.003			-0.005		
	(0.554)			(-1.177)		
Age	0.040***	0.029***	0.020	0.026***	0.019***	-0.009
	(8.672)	(4.303)	(1.352)	(6.538)	(3.253)	(-0.733)
Age squared	-0.061***	-0.046***	-0.035	-0.037***	-0.028***	0.008
	(-6.291)	(-4.606)	(-1.382)	(-4.299)	(-3.253)	(0.377)
High school degree	-0.022***	0.007	0.005	-0.022***	-0.001	-0.002
	(-4.537)	(1.573)	(0.714)	(-5.234)	(-0.278)	(-0.394)
College degree	0.010	0.068***	0.027***	0.004	0.039***	0.015*
	(1.386)	(10.193)	(2.618)	(0.656)	(6.797)	(1.782)
Married	0.026***	0.019***	-0.009	0.020***	0.013***	0.000
	(4.915)	(4.008)	(-1.175)	(4.271)	(3.031)	(0.062)
Children	0.000	-0.007***	-0.007***	0.000	-0.005***	-0.006***
	(0.241)	(-4.719)	(-2.882)	(0.343)	(-3.411)	(-2.644)
Tenure	0.004	0.009***	0.018	-0.003	0.003	0.002
	(1.151)	(3.195)	(1.521)	(-1.244)	(1.204)	(0.163)
Tenure squared	-0.000	-0.001*	-0.001	0.000	-0.000	-0.000
	(-0.014)	(-1.917)	(-1.550)	(0.709)	(-0.665)	(-0.578)
Public sector	-0.011	-0.006	-0.042	-0.001	0.007	-0.033
	(-1.426)	(-0.805)	(-1.190)	(-0.125)	(1.073)	(-1.132)
Union	0.064***	0.056***	0.021**	0.041***	0.036***	0.017**
	(8.502)	(8.558)	(2.397)	(6.248)	(6.286)	(2.218)
Medium employer	0.052***	0.042***	0.011*	0.037***	0.030***	0.009
	(10.014)	(9.134)	(1.679)	(8.650)	(7.910)	(1.585)
Big employer	0.020***	0.017***	-0.004	0.018***	0.014***	-0.006
	(5.142)	(5.035)	(-0.751)	(5.622)	(4.957)	(-1.219)
Occupations (22 groups)	Yes	Yes	Yes	Yes	Yes	Yes
Industries (15 groups)	Yes	Yes	Yes	Yes	Yes	Yes
Regions (4 groups)	Yes	Yes	Yes	Yes	Yes	Yes
Years (19 waves)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	102,425	102,425	102,425	102,425	102,425	102,425
Constant	-0.262***	-0.096	0.151	-0.047	0.058	0.405**
	(-4.355)	(-1.057)	(0.782)	(-0.869)	(0.732)	(2.142)

Notes: T-statistics are in parentheses; *, **, *** reflect statistical significance at the 10%, 5% and 1% levels, respectively. Heteroskedasticity robust standard errors are clustered at the individual level. Observations with missing occupation, industry or regional data are coded as additional groups in

Table 4: Effect of performance pay on continuous and dichotomous forms of hours; white collar and blue collar sub-sample estimates

	White collar			Blue collar		
	Pooled Cross-section	Worker FE	Worker in employer FE	Pooled Cross-section	Worker FE	Worker in employer FE
Perf. Pay mean (st. dev.)	0.167 (0.373)			0.184 (0.388)		
Dependent variables						
Total hours of work	4.057***	3.290***	2.134***	1.814***	2.090***	2.093***
	(20.423)	(17.742)	(11.819)	(7.316)	(8.636)	(7.619)
Dep. Var. Mean (st. dev.)	34.943 (14.444)			34.669 (16.838)		
Long hours = 1 if hours > = 45	0.135***	0.109***	0.084***	0.059***	0.065***	0.067***
	(19.388)	(17.481)	(11.034)	(8.800)	(9.896)	(6.750)
Dep. Var. Mean (st. dev.)	0.201 (0.401)			0.231 (0.421)		
Long hours = 1 if hours > = 50	0.088***	0.068***	0.050***	0.035***	0.039***	0.027***
	(14.367)	(13.241)	(7.803)	(5.933)	(6.581)	(3.185)
Dep. Var. Mean (st. dev.)	0.125 (0.331)			0.150 (0.357)		
Observations	56,075	56,075	56,075	46,350	46,350	46,350

Notes: each estimate reflects the effect of performance pay on each of three different dependent variables presented first in Tables 2 and 3. T-statistics are in parentheses; *, **, *** reflect statistical significance at the 10%, 5% and 1% levels, respectively. Heteroskedasticity robust standard errors are clustered at the individual level. Observations with missing occupation, industry or regional data are coded as additional groups in each variable. All Table 2 and 3 controls are included in each estimation, including log wages. White collar workers include occupation codes between 10 and 3650 and between 4700 and 5930. Blue collar workers include all others.

Table 5: Effect of performance pay on continuous and dichotomous forms of hours; manager and non-manager white collar sub-sample estimates

	Managers			Non-Manager		
	Pooled Cross-section	**Worker FE**	**Worker in employer FE**	**Pooled Cross-section**	**Worker FE**	**Worker in employer FE**
Perf. Pay mean (st. dev.)	0.329 (0.470)			0.152 (0.359)		
Dependent variables						
Total hours of work	4.745***	2.131***	1.097**	3.936***	3.228***	2.239***
	(8.010)	(4.458)	(2.278)	(18.887)	(16.290)	(11.293)
Dep. Var. Mean (st. dev.)	42.743 (13.043)			34.234 (14.356)		
Long hours = 1 if hours > = 45	0.169***	0.090***	0.061***	0.128***	0.107***	0.089***
	(8.423)	(4.315)	(2.686)	(17.601)	(16.282)	(10.643)
Dep. Var. Mean (st. dev.)	0.428 (0.495)			0.180 (0.384)		
Long hours = 1 if hours > = 50	0.119***	0.054***	0.029	0.081***	0.067***	0.049***
	(6.343)	(2.728)	(1.370)	(13.077)	(12.446)	(7.194)
Dep. Var. Mean (st. dev.)	0.306 (0.461)			0.109 (0.311)		
Observations	4,671	4,671	4,671	51,404	51,404	51,404

Notes: each estimate reflects the effect of performance pay on each of three different dependent variables presented first in Tables 2 and 3. T-statistics are in parentheses; *, **, *** reflect statistical significance at the 10%, 5% and 1% levels, respectively. Heteroskedasticity robust standard errors are clustered at the individual level. Observations with missing occupation, industry or regional data are coded as additional groups in each variable. All Table 2 and 3 controls are included in each estimation, including log wages. Managers include occupation codes between 10 and 430.

Table 6: Effect of performance pay on continuous and dichotomous forms of hours; blue collar estimates after removing tips from the performance pay indicator

	Blue collar		
	Pooled Cross-section	**Worker FE**	**Worker in employer FE**
Perf. Pay mean (st. dev.)	0.072 (0.258)		
Dependent variables			
Total hours of work	6.424***	4.895***	2.444***
	(18.666)	(15.786)	(7.809)
Long hours = 1 if hours > = 45	0.186***	0.143***	0.081***
	(17.004)	(14.449)	(6.472)
Long hours = 1 if hours > = 50	0.117***	0.093***	0.037***
	(11.331)	(9.972)	(3.422)
Observations	46,350	46,350	46,350

Notes: each estimate reflects the effect of performance pay on each of three different dependent variables presented first in Tables 2 and 3. T-statistics are in parentheses; *, **, *** reflect statistical significance at the 10%, 5% and 1% levels, respectively. Heteroskedasticity robust standard errors are clustered at the individual level. Observations with missing occupation, industry or regional data are coded as additional groups in each variable. All Table 2 and 3 controls are included in each estimation, including log wages. Blue collar workers include all occupation codes except those between 10 and 3650 and between 4700 and 5930.