

The Unintended Consequences of the Rat Race:
The Detrimental Effects of Performance Pay on Health

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Abstract

Performance pay schemes have been linked to many labor market outcomes, but one unintended consequence, suggested as early as Adam Smith, is that performance pay is detrimental to health. Previous work focuses on the relationship between performance pay and injuries on the job. However, this paper focuses on general health and specific diseases, to investigate if there is a link between performance pay and health. Using data from the British Household Panel Survey, this study utilizes time failure modes to assess if being in jobs with a performance pay element increases the likelihood of health deterioration, *ceteris paribus*.

Keywords: Performance Pay, health, duration models
JEL: J33, I1

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I. Introduction

The economics literature has firmly established the link between performance pay and increased productivity. Research by Lazear (2000) and others indicate that pay based on the performance of workers (usually in the form of piece rates, merit pay or similar pay-for-performance schemes) generate higher productivity through an increased incentive for effort or by offering incentives for more highly productive workers to sort themselves into these types of jobs.

However, a related literature examines the unintended consequences of such payment schemes. If the contract is not set up appropriately, ‘adverse specialization’ (MacDonald and Marx, 2001) can occur where workers perform only those aspects that are rewarded, while ignoring other aspects that are not rewarded. Thus, workers may stress quantity over quality or overuse physical capital in order to increase production. These unintended consequences of performance pay schemes have led some researchers to question whether these schemes actually increase profitability, despite the fact that they may increase worker productivity.

An interesting and little explored potential unintended consequence of performance pay is its effect on health. Adam Smith was the first to observe in *The Wealth of Nations*, “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). Except for a limited number of studies (e.g. Foster and Rosenweig, 1994, and Bender *et al.*, 2012), this observation has not been empirically tested, and the small literature that has examined this topic has focused very narrowly on injuries at work. The goal of this paper, however, is to use a nationally

representative dataset to broaden the definition of health to examine other health outcomes, particularly ones affected by stress, to see if Smith's observation holds, particularly with respect to the implication that increases in the length of time paid using performance pay will negatively impact 'health and constitution in a few years'.

The following section briefly reviews the literature on the unintended consequences of performance pay and the small set of papers that link health to performance pay. Section III discusses the potential pathways that performance pay might impact health over time. Section IV reviews the data and methodology. Section V reports the results, while Section VI empirically examines potential pathways for the effect of performance pay on health. A final section concludes the paper.

II. Brief Literature Review.

It is intuitive to think that certain job characteristics are correlated with health. For example, Case and Deaton (2005) use cross sectional data to show that manual workers have worse health than non manual workers, even after controlling for such things as education and income. More recently, Fletcher *et al.* (2011) find that long exposure to adverse physical demands and environmental conditions in their occupations cause workers to have worse health. However, most papers in this vein do not examine particular job characteristics.

The literature that links health and performance pay is small and is often focused on case studies of particular industries or occupations. Sundstroem-Frisk (1984) finds that accident rates among Swedish loggers is lower for those paid hourly rates rather than piece rates. Saha *et al.* (2004) investigate fertilizer production workers in India to show those on performance pay experienced

higher workplace accidents. Freeman and Kleiner (2005) report evidence from a US shoe manufacturer that piece rates are associated with higher workers compensation costs. Toupin *et al.* (2007) report higher heart rates for Canadian loggers paid by piece rates, suggesting ‘negative consequences for worker health and safety.’ Several papers on over-the-road truckers in the US (Williamson *et al.* 2009, Rodriguez *et al.* 2006, Belman *et al.* 2005, and Monaco and Williams 2000) generally find that truckers paid by the hour have smaller probabilities of being in accidents compared to truckers who get paid by the mile.

Three papers are more closely aligned with this paper’s focus. The first is by Foster and Rosenweig (1994). While they, like the papers referenced above, focus on a narrow occupation (subsistence farmers in the Philippines), they link performance pay with overall health, as opposed to injuries on the job. Overall health in their paper is proxied by the body mass index (BMI) which is shown to be lower for farm workers paid piece rates, *ceteris paribus*. In this specific case, this indicates worse health since these subsistence farmers have very low BMIs to begin with.

The other two papers are by Bender *et al.* (2012) and Artz and Heywood (2013), focusing on the link between performance pay and workplace injury. Unlike the papers discussed above, they consider the performance pay-injury relationship across many different occupations and industries. Bender *et al.* (2012) use a Europe-wide cross-sectional dataset called the European Working Conditions Survey, finding a strongly robust relationship that workers with piece rates experience higher probabilities of workplace injury, *ceteris paribus*. Artz and Heywood (2013) use the US National Longitudinal Survey of Youth to find that this relationship exists even when controlling for individual fixed effects.

The goal of the current paper is to extend these last papers by examining broader measures of health beyond workplace injuries, using a nationally representative dataset that covers many different occupations and industries. While this would seem easy to do, the difficulty, in fact, is identifying a dataset that includes measures of performance pay and health and contains a wide array of microeconomic information (e.g. socio-economic data, education, earnings, etc). Standard microeconomic datasets in the US such as the Current Population Survey, the Panel Study on Income Dynamics, and even the National Longitudinal Survey of Youth do not generally contain all the necessary variables. (Indeed, this may explain, in part, the lack of research in the area.) However, these data do exist for a subset of years in the British Household Panel Survey (BHPS) and, thus, it is this data source that provides the data for this study.¹

III. Potential Pathways

The literature above only alludes to potential pathways that might generate worse health due to performance pay. Bender *et al.* (2012) suggest that one pathway for workplace injury is the increased effort caused by performance pay giving incentives to increase their speed on the job or take greater risks on the job. This point is echoed in several of the papers mentioned above that focus on particular occupations.

While the above might explain the link between performance pay and injuries on the job, other pathways are possible when thinking of the cumulative effects of performance pay on health.

¹ One dataset that does have these measures is the US Health and Retirement Study (HRS), but it has a very limited age range of 51 to 61 year olds in 1992. Initial investigations into this dataset generated inconclusive results on the link between health and performance pay, but this may be partially explained by the fact that since older workers are more likely to have health problems, they would be less likely to sort into jobs with performance pay. Thus, it is more appropriate to use a survey such as the BHPS which includes workers of all ages.

One way is through increased stress associated with performance related pay. This stress might be generated in a variety of ways. Although not a focus of their study, Dohmen and Falk (2011, Table 5) analyze data from a series of experiments to find that piece rate payments generated both more effort and more stress and exhaustion than those paid a fixed rate, particularly after participants were allowed to sort into a payment scheme. Medical evidence, such as the reviews by Cooper and Marshall (1976) and Blake *et al.* (1996) shows that this physical stress can lead to adverse health outcomes, both physiological (e.g. skin problems, hypertension and fatigue) and psychological (e.g. depressions, emotional fatigue and feelings of anxiousness). Furthermore, performance related pay is generally found to be more variable than salaried or time based pay. This variability may induce further stress with the increased uncertainty of an income stream.²

Another potential pathway is an outcome of the view that health status is determined through a health production function. This function could have many arguments, but one key aspect to better health is time – time spent in healthy behaviors such as exercise, learning about nutrition and good health, relaxation from the stress of work, cooking healthy meals etc. Thus, health production is a form of household production. If, as Lazear and others have shown, performance pay generates increased effort, this would generate more hours at work because the opportunity cost of time in healthy behavior increases. Therefore, there will be fewer hours in which to put into the health production function (e.g. Mullahy and Robert, 2010), which generates worse health. However, the effects may not be instantaneous (as they may be if a worker takes a greater risk in the job and an injury immediately results), but rather the effects may build up over

² Of course, this would be mitigated by any compensating wage differential paid for performance related pay. Furthermore, there is some evidence from recent papers such as Grund and Sliwka (2010) and Corneilissen *et al.* (2011) that less risk averse workers sort into jobs that pay for performance. We should note, however, as shown below and in Artz and Heywood (2013) including proxy measures of risk tolerance does not affect the health-performance pay relationship.

time as, for example, workers spend less time in exercise and gradually gain weight and then suffer from adverse health conditions such as heart disease.

IV. Methodology and Data

There are several potential pathways that point to performance pay leading to adverse health outcomes but, one commonality is that any ill health from performance pay is not expected to be instantaneous. That is, unlike the previous research which finds a link between performance pay and injuries on the job, there may be a further link that indicates long exposure to performance pay will affect health. This indicates the need for a panel dataset rather than a cross sectional one, since one would want to observe the effect of performance pay on health over a period of time. Thus, the focus of this study is to evaluate the impact of performance pay on the duration of good health spells using duration/hazard models. Specifically, this study examines whether performance pay increases the hazard of falling out of good health.³

Each individual is observed at a number of points in time. In the dataset, time intervals are of one year of length, and so the interval boundaries are $t = 1, 2, 3, \dots$ and the interval t is $(t-1, t]$. Thus the dependent variable is the dummy variable indicating that at interval t , the individual remained in good health. Otherwise, the spell of good health has been observed to end. A spell of good health can either be complete ($c_i = 1$) or right censored, i.e. either the individual continues to be in good health at the end point or the individual left the sample before the end point ($c_i = 0$). In this specification, re-entry into the panel is not allowed (which would introduce

³ This approach fits into a newer line of research that is examining such issues as the effect of unemployment on the duration of good health as in Cooper *et al.* (2008).

problems of endogeneity), and so only a single completed or uncompleted spell for each individual is included.

We start by presenting the results from estimating Cox (1972) hazard models. While this methodology is frequently used in the literature, there are potential problems with it in this context. First, it assumes a continuous hazard. However, given that the data used here are yearly for only 10 years, a discrete hazard model might be more appropriate. Second, there may be a series of unobservable characteristics that are specific to the worker and can affect the hazard. This uncontrolled individual heterogeneity is called ‘frailty’ in the literature and can bias the estimated coefficients in the hazard regressions (see also Heckman and Borjas 1990 and Lancaster 1979). Jenkins (2013, Chapter 8, p. 81) stresses the importance of correcting for frailty to control for “omitted variables (unobserved in the available data, or intrinsically unobservable such as ‘ability’)”. Thus, this study employs the Jenkins (2004) approach to estimating the effect of performance pay after controlling for both observable *and* unobservable individual characteristics on the length of time an individual remains in good health. It is important to note that this methodology can potentially control for *unobserved* factors either from the employee side (e.g. the individual’s attitude to risk) or by the employer side (e.g. employment relations).

Specifically we follow Jenkins (1995, 2004)⁴ by assuming that the instantaneous hazard rate function for person i at time $t > 0$ is assumed to take the proportional hazard form:

⁴ According to Jenkins, this methodology is an adaptation of a frailty correcting methodology proposed by Prentice and Gloeckler (1978) and modified by Meyer (1990). We follow the methodology as it is set out in Jenkins (1995). Note that there is a second similar methodology that uses nonparametric estimation of the distribution of the frailty term. Using this methodology, the qualitative results are very similar to the reported results below and are available upon request.

$$\lambda_{it} = \lambda_0(t)\varepsilon_i \exp(X_{it}'\boldsymbol{\beta}) = \lambda_0(t) [\exp(X_{it}'\boldsymbol{\beta}) + \log(\varepsilon_i)] \quad (1)$$

where ε_i is a Gamma distributed random variable with mean 1 and variance $\sigma^2 = v$. Thus, the model incorporates a Gamma distributed random variable to take into account the frailty or unobserved (or omitted variable) heterogeneity between individuals, that is to control for factors and characteristics that are not observed by the researcher in the dataset but they affect the duration of the good health spell.

The discrete – time hazard function for the model is

$$h_t(X_{it}) = 1 - \exp\{-\exp[X_{it}'\boldsymbol{\beta} + \gamma_t + \log(\varepsilon_i)]\}. \quad (2)$$

The log-likelihood of eq. (2) is

$$\log L = \sum_{i=1}^N \log\{(1 - c_i)A_i + c_i B_i\} \quad (3)$$

where

$$A_i = \left(1 + v \sum_{j=1}^{t_i} \exp[X_{ij}'\boldsymbol{\beta} + \theta(j)]\right)^{-1/v} \quad (4)$$

and

$$B_i = \left(1 + v \sum_{j=1}^{t_i} \exp[X_{ij}'\boldsymbol{\beta} + \theta(j)]\right)^{-1/v} - A_i, \text{ if } t_i > 1 \quad (5)$$

or

$$B_i = 1 - A_i, \text{ if } t_i = 1 \quad (6)$$

and $\theta(j)$ is a function describing duration dependence in the hazard rate⁵ (see Jenkins, 1995, for further details).

⁵ The methodology is implemented in this paper by using the “pghaz8” subroutine available in STATA (Jenkins, 2004).

Finally, the methodology adopted in this paper establishes the direction of causality and circumvents the problem of endogeneity. In particular, the sample consists of individuals who have reported good health at the initial period (the start of the survey). When the individual exits good health, his or her time in good health is recorded and this event should be expected to be an outcome of events occurring during the intervening period. Thus, this procedure ensures that the direction of causality is from performance pay to health. In addition to this, unobserved heterogeneity is controlled for in the Jenkins (2004) methodology and as a further robustness check we include indicators of past bad health to explicitly control for the initial conditions of poor health.

Nevertheless, one could argue that even without controlling for endogeneity, the expected endogeneity bias should move the coefficient towards zero. This is because if there is sorting; healthier individuals would be more likely to reap higher rewards from performance pay, which works in the opposite way of the arguments above. Thus, even if one does not control for endogeneity using the methods above, the estimates we generate will be lower bounds of the effect of performance pay on health.

The data utilized in this study are from the British Household Panel Survey (BHPS). The key question which is used for the main independent variable is introduced in the survey in wave eight. The question is, ‘Does your pay include performance related pay?’ Thus, there are ten waves which asks this information on performance pay for workers in wage and salary jobs (thus, we do not include the self-employed), as our dataset goes up to Wave 19.⁶ Because we

⁶ Actually there is a question asked every wave about whether pay has any bonus payment in it. Estimations using this variable generated no statistically significant results, although ‘bonuses’ could be too broad a term for our purposes since they may or may not be based on personal performance and thus may not generate the kinds of

want to test the hypothesis of whether long exposure to performance pay generates worse health, we calculate the proportion of time (over the observation period) spent in performance pay.⁷

This study utilizes four measures of health. The first is a measure of subjective overall health and is derived from the question, ‘Please think back over the last 12 months about how your health has been. Compared to people of your own age, would you say that your health has on the whole been excellent, good, fair, poor or very poor?’ In order to specify the duration of good health, the following methodology is used: Individuals who report in wave eight that they are in excellent or good health (and are employed in a wage and salary job since we have to identify performance related pay) are selected. The periods that workers who remain in this status are counted until workers either drop out of the survey while still in good health (perhaps because of non response or because of a loss in employment), continue in good health in all waves, or report fair, poor, or very poor health. The first two groups are ‘censored’ observations.

Three measures of physical health are also analyzed – whether workers suffer from heart problems, stomach/digestive problems, or anxiety/depression – which are all closely aligned with adverse health reactions to stress. As with subjective health, each sample starts with individuals who report in wave eight that they are not suffering from the respective illness. Then periods of good health are counted until workers either drop out of the survey in good health or report the onset of the health problem.

behavior which might decrease health. Indeed this is potentially an issue in the question from which we identify performance pay, since it could be considered broadly to include group-based performance. One might argue that the negative health effects would be less pronounced with such group-based forms of compensation which might bias our results to finding no effect. That we find a consistent effect below indicates that this effect is relatively small compared to the effect of individually-based performance pay.

⁷ We also tried variations on this key variable including a dummy variable for whether the respondent was in performance pay in the last period of observation or dummy variables of splines of the proportion of time spent in performance pay. Results using these variations are qualitatively similar to those below and are available upon request.

The regressions also control for standard demographic and health variables, including gender, education, age, current smoking status, four categories of earned income, marital status, the log of hours worked, broad industry and occupational indicators, and region of residence, all of these are measured at the time of the last observance of the respondent.

V. Results.

A. Survival Plots

Figure 1 shows Kaplan-Meier survival plots for the subjective health measure by whether the respondent has been in performance pay less or more than 50 percent of the time we observe him or her. The graph clearly shows there to be a greater hazard of falling into poor health for those in performance pay at least 50 percent of the time.

One complicating factor to these patterns might be income. Despite the fact that the UK has universal health care through the National Health Service, it is still likely that those who have higher income may enjoy superior health compared to lower income people. Since performance pay will likely generate higher income, there could be a confounding influence of increased income helping keep good health survival rates higher for those paid by performance. In Figure 2, the sample is disaggregated by whether a worker's earned income is above the median ('highincome'=1) or below the median ('highincome'=0). The highest hazard is for the group of workers who have been in performance pay more than 50 percent of the time and have income below the median. The negative effect of performance pay, however, is offset somewhat by increased income as shown in the hazard for workers with 50 percent of time in performance pay

and income above the median – a similar hazard to those with low income, but low exposure to performance pay. The lowest hazard is for the high income and low performance pay group.

Finally, Figure 3 shows the survival plots for the three objective health measures. As with the subjective measures, those who are in performance pay for more than 50 percent of the time have lower survival probabilities, particularly if their earned income is below the median.⁸

B. Regression Results.

In addition to income there could be a variety of confounding factors driving these results. Hence, controlling for worker heterogeneity is important. For the subjective health measure, the hazard ratios for the percentage of time spent in performance pay are reported in Table 1 for different econometric specifications and samples.⁹ The first column reports hazard rates from Cox proportional hazard regression results. For the overall sample, increases in the percentage of time spent in performance pay are associated with higher odds of falling into worse health. Although the point estimate is statistically significant at the 1 percent level, it seems that the marginal impact is quite small (an increase in odds by 1.004), but this is only for a one percentage point rise in the percent of time for performance pay. A one standard deviation rise in percent of time (about 25 percentage points) would generate much higher odds of poor health, with the projected hazard at 1.103. The next column reports the odds ratio on performance pay using the Prentice-Gloeckler method that controls for discreteness in the hazard functions. As

⁸ Formal tests for equality of the survivor functions generally failed for all figures, particularly among the relatively low earnings group. Results are available from the authors.

⁹ Full results for the overall sample for subjective health for the three econometric specifications are given in Appendix Table A1. Generally the hazard ratios for the independent variables correspond to intuition and previous findings. Full results for all regressions are available from the authors.

can be seen, controlling for this discreteness generates little difference in the odds ratio, increasing it from 1.004 to 1.005, while maintaining its statistical significance.

The above regressions circumvent the problem of endogeneity. The control for endogeneity comes through the set up of the sample, where the sample consists of individuals who have reported good health at the initial period (here in Wave 8 of the BHPS). When the individual exits good health, his or her time in good health is recorded, and this event should be expected to be an outcome of events occurring during the intervening period. Thus, this procedure ensures that the direction of causality is from performance pay to health and thus circumvents the problem of endogeneity. Furthermore, previous health is a potential omitted variable. Thus, in the second row, we include a series of dummy variables to control for the number of times the worker had reported bad health in the first eight waves of the survey. As can be seen, this has no appreciable effect on the point estimate or statistical significance. Control for unobserved heterogeneity or frailty comes through the use of the Prentice-Gloeckler (PG) regressions. Interestingly this generally *increases* the hazard ratio. So while the impact of a one percentage point increase in the amount of time spent in performance pay increased the odds by 1.005 times without controlling for frailty, the odds jump to 1.013 when frailty is controlled for (or a projected hazard of 1.396 for a one standard deviation rise in the percent of time in performance pay). The jump is even almost as big when previous health is controlled (1.004 to 1.009). However, the pattern of performance pay correlating with worse health outcomes remains regardless of controlling for these frailty effects.¹⁰

¹⁰ However, even if the endogeneity is not completely circumvented, the direction of the bias is almost certainly towards a positive relationship between performance pay and health, since those who are generally more healthy will naturally be more likely to want to be paid by performance. Thus, if one finds consistently negative and statistically significant relationships, in the presence of endogeneity, this implies that the regressions are *underestimating* the negative effect of performance pay on health.

Further, Table 1 contains the results of the subjective health measure for different samples. There is little difference by gender for the Cox or PG without frailty regressions, and the odds are generally higher when frailty is controlled for all samples, although the point estimate is statistically insignificant for the female sample in the frailty corrected regressions. Unlike in the figures, it does not seem to matter much if one is above or below median income (after controlling for the other covariates including income) as the hazards are nearly identical regardless of the estimation method. Finally, workers in manual occupations generally have higher hazard ratios than workers in non manual occupations, *ceteris paribus*.

Table 2 contains the hazard ratios for the percentage of time in performance pay for the three objective health measures by regression method and sample. Generally, the results show that increased time in performance pay, *ceteris paribus*, leads to a higher hazard of poor health, typically in the 1.005 to 1.010 range for the Cox regression and from 1.008 to 1.049 for the PG regressions with frailty corrections. Most, although not all are statistically significant at least at the 10 percent level (only ten of 72 coefficients are not significant). Although we cannot directly test the difference in the hazard ratios across health groups, it seems that women have slightly higher hazards for both heart health and anxiety/depression where males have higher hazards for stomach health. There are no consistent differences by income level for heart health or anxiety/depression, although higher income workers have higher hazards for stomach health. Non manual workers are more susceptible to heart problems, while manual workers are more likely to have stomach and anxiety/depression problems. Controls for heterogeneity (either by including past health or frailty controls) do not seem to affect the pattern of results in any appreciable manner.

C. Robustness Checks

We estimate a series of other regressions to investigate how robust these results are. First, even though the study controls for unobserved heterogeneity and endogeneity, there is still the possibility of not adequately controlling for the level of risk via the workers attitude to risk. One may argue that attitude to risk may affect health (e.g. Kowert and Hermann 1997; Nicholson *et al.* 2005; Khwaja *et al.* 2006; Lia and Liu 2008) and that risk averse workers may not opt for performance pay. Although we already control for some factors that are correlated with risk such as smoking behavior (Viscusi 2001) and industry and occupation, there is no direct measure of risk attitude included in the regressors. The BHPS does not include questions that provide appropriate measures of attitude to risk. However, two variables are used to approximate attitude to take risk (a) have reported gambling winnings (b) if the individual can be characterized as an introvert.¹¹ The inclusion of either sets of controls do not affect the results appreciably.

Second, one might be concerned about the samples used in the study. Two issues were investigated. First, given that we have only a limited panel there will be an unavoidable discreteness in the percentage of time spent in performance pay. Thus, we estimate models where we observe people for at least 4 waves. As above, the results did not change appreciably. Finally, we estimate a series of regressions based on a sample of only those with some performance pay – that is on the selected group. The point estimates tend to be slightly higher than those reported in Tables 1 and 2, but all are statistically significant and indicate that the longer one stays in performance pay, the higher the odds to drop into poor health¹².

¹¹ This comes from a question in the BHPS that asks whether a person thinks that ‘Life is full of opportunities.’ People who answer ‘No’ to this are labeled as an introvert.

¹² These results are available from the authors on request.

VI. Pathways

Overall, then, there seems to be consistent evidence that increases in the percentage of time in performance pay generates a higher hazard of falling out of good health, *ceteris paribus*. However, as discussed above, it is interesting to explore what pathways might be generating this effect. One potential source might be on the amount of time available for ‘healthy’ activities. If performance pay increases time spent at work, there will be fewer hours in the day, potentially, to engage in healthy behaviors. Taking the sample of healthy workers from Wave 8 of the BHPS (the starting sample from above) and running a regression of total weekly hours (both regular and overtime hours) on performance pay and a series of other demographic and job characteristics¹³, we find that the coefficient on performance pay is 1.29 and is significant at the ten percent level, meaning that workers on performance pay work almost 1.3 hours more than those not in performance pay. If we use a sample of all workers, regardless of their health, the marginal effect is 1.5 hours, which is statistically significant at the one percent level.

Unfortunately, the BHPS does not have a large array of information on the leisure activities of respondents, but we do have a couple for Wave 8: the amount of time participating in sports, participating in evening classes (including ‘keep fit’ light exercise classes), drinking, and eating out. These are all five point ordered responses from ‘Never/almost never’ to ‘at least once a week’. Table 3 has selected results from ordered probit estimations using Wave 8 data, both with the ‘Healthy Worker’ sample used in the duration analysis above, but also for ‘All Workers’ in Wave 8, regardless of health. Interestingly, there seems to be little effect on some leisure

¹³ Other controls include gender, education, age, age squared, marital status, currently smoking, labor income, occupation and region. Regressions that include total numbers of hours, give similar results.

activities like participating in sports or in evening classes. However, there is an increase in participation in both frequent drinking and for eating out. While these are not necessarily unhealthy behaviors, dietary guidelines on both sides of the Atlantic suggest moderation in both drink and in the consumption of the heavier meals served in restaurants, and may be a pathway to the ill health found above.

A final potential pathway is through increased stress which, as discussed before, the medical literature has linked to adverse health outcomes. The BHPS lists several self reported measures of stress through the General Health Questionnaire (GHQ), including difficulties with sleep, making decisions, feeling under strain, ability to overcome difficulties, loss of confidence, and general happiness. As we did with the health outcomes above, we choose a sample from Wave 8 of the BHPS where the respondents are reporting 'low stress' (e.g. no problems with sleep, making decisions, not feeling under strain, no problems with ability to overcome difficulties, no loss of confidence and feeling generally happy) and track these workers over the next ten waves of the BHPS to see whether they report a higher stress level. Also as above, we estimate this for the standard Cox model, as well as the PG model without and with frailty for several different samples.

The results for these regressions are found in Table 4. Overall the general results mimic the results for health – namely, that an increase in the percentage of time spent in performance pay increases the hazard to report more stress (across ALL stress measures) or lower happiness. For sleep difficulties the Cox estimates are around 1.003 or 1.004 for all subsamples, including when past sleep problems (before Wave 8) are controlled for. The hazards also increase when frailty is controlled for to at least 1.016 (when past health is controlled for) and as high as 1.031 for

manual workers. All of the frailty controlled results are statistically significant at least at the ten percent level. This pattern is remarkably consistent for each stress measure or for subjective measures of happiness with most Cox hazards in the 1.003 to 1.009 range and the frailty corrected PG hazards between 1.009 and 1.041, and except for a handful of samples, all are statistically significant. While this is not proof of a link between performance pay and health, it is suggestive of a pathway where performance pay may impact the health of workers.

VII. Conclusions and Future Work

Previous research shows that performance related pay generates increased effort and productivity at work. However, it may also generate a series of unintended consequences. Observations by Adam Smith indicate that one such consequence might be on the health of workers, although little has been done to estimate whether his observation has empirical validity. Using multiple waves of the BHPS, duration models find that increasing the time in which workers' pay comprises at least in part of performance pay generates higher odds of falling into bad health – either measured by subjective health or along one of three physical health dimensions. These results are very robust to variations in variables or estimation procedure. In addition, the estimates serve as a lower bound of the negative effect of performance pay on health since even if endogeneity is not perfectly captured in the regressions there will be a likely positive bias due to healthier workers selecting performance pay jobs.

Furthermore the study investigated potential pathways in which this linkage between performance pay and health might lay. While performance pay is found to increase work time, it does not seem to be significantly correlated with activities designed to promote health, although performance pay is correlated with increases in drinking and restaurant meals. A more

consistent pattern was found with a series of measures of stress, where duration models find that increases in the time spent in performance pay increase the hazard of five measures of stress.

Although we have found a very robust relationship between performance-based pay and the duration of good health, there are several limitations in the paper. First, we measure performance pay only broadly. The strongest theoretical effects should come through individual-based performance pay, but this information is not available in the BHPS. Similarly, we cannot measure the intensity of individual pay (that is, what proportion of pay is based on performance), meaning that we are making the implicit assumption that any intensity of performance pay generates the same health outcomes when the effects are likely strongest for those whose pay is mostly determined by performance. Finally, we cannot control for changing jobs, which can also induce stress. If workers are forced to change jobs that happen to have a performance pay aspect, there may be a stronger correlation between performance pay and ill health because of this job change stress. On the other hand, there will also be workers who are forced to change jobs that will have no performance pay, and thus, it is not clear how strong this bias might be. This effect will be further mitigated by the frailty corrections for omitted variables (Jenkins, 2013).

Performance pay can generate a variety of efficient labor market outcomes. However, the findings here are firmly in the camp of a potential unintended consequence of performance pay and support the insight of Adam Smith. Like other research that finds that performance pay can lead to workers, for example, focusing on quantity rather than quality or overusing physical capital, long term exposure to performance pay is related to worse health, suggesting that firms may face increased health insurance or workers compensation costs (e.g. Freeman and Kleiner,

2005). Perhaps to mitigate these increases in costs, future research, using more detailed health data, should focus on identifying the pathways that performance pay can affect health. Unfortunately, the BHPS offers information on few and relatively crude approximations of the pathways. It may well be through increased stress, as suggested in the results here, but this should be more explicitly examined with more detailed data. Further research may extend this argument to other forms of payment schemes. For example, stress and other factors that can induce ill health may increase in ‘tournaments’ where there is a ‘winner-take-all’ payoff, so that the effects of fierce competition for promotions would be an interesting extension of this research.

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Table 1. Selected Results for Hazard Ratios for Overall Subjective Health: Odds Ratio on Percentage of Time Spent in Performance Pay

Sample	Cox	Prentice-Gloeckler	
		w/o Frailty	w/ Frailty
Overall	1.004*** (3.42)	1.005*** (4.01)	1.013*** (3.01)
Overall with Past health controlled	1.004*** (2.93)	1.004*** (3.37)	1.009** (2.57)
Female	1.004** (1.97)	1.004** (2.46)	1.009 (1.57)
Male	1.004*** (2.73)	1.005*** (3.31)	1.017** (2.45)
Income<=median	1.005*** (2.91)	1.005*** (2.93)	1.017** (2.37)
Income>median	1.004*** (2.39)	1.005*** (2.78)	1.014** (2.38)
Manual occupation	1.007*** (2.79)	1.008*** (3.31)	1.025*** (2.60)
Nonmanual occupation	1.003** (2.36)	1.004*** (2.78)	1.010** (2.00)

Notes: z-statistics under odds ratios. All regressions also include a constant and indicators for gender, noncompletion of secondary education (excluded), completion of secondary education, completion of postsecondary education, age less than 26 (excluded), age between 26-35, age between 36-45, age between 46-55, age above 55, married, currently smoking, labor income quartile, the log of hours worked, broad industry and occupation and region where the P-G regressions also include log of time. Numbers under odds ratios are asymptotic z-statistics. *, **, and *** indicate statistical significance at the 10, 5 and 1 percent level. The sample is those people who were working in wage and salary jobs for the entire time we observe them and who start out with excellent or very good subjective health in wave eight. For the overall sample, there are 2,410 observations where 51% are censored.

Table 2. Hazard ratios for the Percentage of Time Spent in Performance Pay by Objective Health Measure

Sample	Prentice-Glockler		
	Cox	w/o Frailty	w/ Frailty
<i>Heart Health (n=2,694)</i>			
Full	1.008*** (4.24)	1.008*** (4.49)	1.026*** (5.02)
Overall with Past health controlled	1.006*** (2.85)	1.007*** (2.97)	1.009*** (2.85)
Female	1.008*** (3.12)	1.008*** (3.31)	1.039*** (3.47)
Male	1.008*** (3.08)	1.008*** (3.26)	1.018*** (3.07)
Income<=median	1.009*** (3.29)	1.009*** (3.49)	1.022*** (2.86)
Income>median	1.006** (2.27)	1.006** (2.36)	1.029*** (3.60)
Manual	1.005 (1.39)	1.006 (1.48)	1.010 (1.43)
Nonmanual	1.008*** (3.97)	1.009*** (4.20)	1.039*** (4.40)
<i>Stomach Health (n=2,675)</i>			
Full	1.008*** (4.14)	1.009*** (4.47)	1.021** (2.36)
Overall with Past health controlled	1.006** (2.41)	1.007*** (2.66)	1.008** (2.75)
Female	1.006* (1.91)	1.006** (2.14)	0.999 (-0.07)
Male	1.010*** (3.83)	1.011*** (4.06)	1.030** (2.36)
Income<=median	1.006** (2.07)	1.006* (1.93)	1.007 (0.39)
Income>median	1.009*** (3.56)	1.010*** (3.97)	1.027*** (2.65)
Manual	1.016*** (4.44)	1.017*** (4.75)	1.042** (2.05)
Nonmanual	1.005** (2.14)	1.006** (2.37)	1.019 (1.34)
<i>Anxiety/Depression (n=2,703)</i>			
Full	1.007*** (3.52)	1.007*** (3.79)	1.020** (2.53)
Overall with Past health controlled	1.009*** (3.58)	1.010*** (3.73)	1.011*** (3.49)
Female	1.010*** (4.60)	1.011*** (4.94)	1.038** (2.57)
Male	0.999 (-0.25)	0.999 (-0.24)	1.049** (2.07)
Income<=median	1.008*** (3.07)	1.007*** (2.78)	1.021 (1.54)
Income>median	1.006** (2.17)	1.007** (2.37)	1.021** (2.05)
Manual	1.013*** (3.07)	1.014*** (3.26)	1.187 (1.57)
Nonmanual	1.006** (2.59)	1.006*** (2.91)	1.017** (2.21)

Notes: Same covariates as in Table 1. Numbers under hazard ratios are asymptotic z-statistics. *, ** and *** indicate statistical significance at the 10, 5 and 1 percent level, respectively. Sample sizes are given above.

Table 3. Selected Ordered Probit Regression Results for Coefficient on Percentage of Time Spent in Performance Pay

Leisure Activity	Sample	Coefficient
Sports	Healthy workers	-0.019 (-0.27)
	All workers	-0.017 (-0.41)
Evening classes (incl keep fit)	Healthy workers	-0.043 (-0.55)
	All workers	0.009 (0.18)
Drink	Healthy workers	0.148** (2.22)
	All workers	0.134*** (3.34)
Eat Out	Healthy workers	0.123* (1.90)
	All workers	0.130*** (3.36)

Notes: Regressions based on data on wage and salary workers from Wave 8 of the BHPS. Other covariates include: gender, education, age, age squared, marital status, indicator for currently smoking, labor income, occupation and region.

Table 4. GHQ: Stress Results. Hazard Ratio on Percentage of Time in Performance Pay by Duration Model and Sample

Sample	Cox Regression	Prentice-Gloeckler	
		w/o Frailty	with Frailty
<i>Sleep (n=2,703)</i>			
Full	1.003*** (3.30)	1.004*** (4.17)	1.020*** (3.22)
Overall with Past health controlled	1.003*** (3.32)	1.004*** (4.27)	1.016*** (2.95)
Income<median	1.003* (1.87)	1.004** (2.34)	1.017* (1.80)
Income>median	1.004*** (2.99)	1.005*** (3.79)	1.022*** (2.71)
Female	1.004** (2.48)	1.005*** (3.20)	1.017** (2.28)
Male	1.003* (1.85)	1.003** (2.34)	1.023** (2.02)
Manual	1.003 (1.47)	1.004 (1.60)	1.031* (1.83)
Nonmanual	1.003*** (2.70)	1.004*** (3.57)	1.016** (2.43)
<i>Decision Making (n=2,858)</i>			
Full	1.004*** (3.12)	1.005*** (3.54)	1.024*** (3.18)
Overall with Past health controlled	1.004*** (3.17)	1.005*** (3.55)	1.019*** (2.85)
Income<median	1.003 (1.39)	1.004* (1.65)	1.019 (1.62)
Income>median	1.005*** (2.88)	1.006*** (3.45)	1.036*** (3.38)
Female	1.004** (2.04)	1.004** (2.36)	1.032** (2.52)
Male	1.005** (2.36)	1.005*** (2.66)	1.022** (2.02)
Manual	1.008*** (2.76)	1.009*** (3.06)	1.027** (1.98)
Nonmanual	1.004** (2.44)	1.004*** (2.82)	1.026** (2.54)
<i>Under Strain (n=2,405)</i>			
Full	1.005*** (5.52)	1.007*** (7.07)	1.035*** (4.68)
Overall with Past health controlled	1.005*** (5.17)	1.006*** (6.78)	1.029*** (4.22)
Income<median	1.005*** (3.23)	1.007*** (4.48)	1.037*** (2.87)
Income>median	1.005*** (4.11)	1.006*** (5.59)	1.037*** (3.93)
Female	1.006*** (4.27)	1.008*** (5.50)	1.034*** (3.25)
Male	1.004*** (3.00)	1.005*** (3.81)	1.036*** (3.23)
Manual	1.007*** (3.33)	1.008*** (3.85)	1.037*** (2.85)
Nonmanual	1.005*** (4.26)	1.006*** (5.64)	1.041*** (3.89)

Overcome Difficulties (n=2,791)

Full	1.005*** (4.02)	1.006*** (4.80)	1.022*** (3.50)
Overall with Past health controlled	1.004*** (3.74)	1.005*** (4.32)	1.018*** (3.42)
Income<median	1.005*** (2.77)	1.005*** (3.02)	1.026** (2.49)
Income>median	1.004*** (2.79)	1.006*** (3.75)	1.009*** (4.69)
Female	1.005*** (3.11)	1.006*** (3.77)	1.024*** (2.69)
Male	1.004** (2.31)	1.005*** (2.79)	1.019* (1.94)
Manual	1.009*** (3.71)	1.010*** (4.19)	1.041*** (2.99)
Nonmanual	1.003** (2.53)	1.004*** (3.21)	1.013* (1.76)

Lose Confidence (n=2,787)

Full	1.003** (2.44)	1.004*** (3.01)	1.023** (2.14)
Overall with Past health controlled	1.003** (2.59)	1.004*** (3.22)	1.010** (2.02)
Income<median	1.005*** (2.91)	1.005*** (2.85)	1.021** (2.21)
Income>median	1.001 (0.74)	1.002 (1.39)	1.010 (1.40)
Female	1.004** (2.37)	1.005*** (2.96)	1.015* (1.93)
Male	1.002 (0.98)	1.002 (1.25)	1.014 (1.35)
Manual	1.006** (2.05)	1.007** (2.33)	1.041** (2.56)
Nonmanual	1.002* (1.75)	1.003** (2.31)	1.004 (0.69)

Happiness (n=2,769)

Full	1.004*** (3.16)	1.004*** (3.91)	1.016*** (3.15)
Overall with Past health controlled	1.004*** (3.16)	1.004*** (3.67)	1.009** (2.18)
Income<median	1.003 (1.64)	1.003** (1.96)	1.016** (2.03)
Income>median	1.004** (2.42)	1.005*** (3.35)	1.018*** (2.73)
Female	1.004*** (2.72)	1.005*** (3.43)	1.019** (2.56)
Male	1.003* (1.67)	1.003** (2.07)	1.013* (1.76)
Manual	1.004* (1.73)	1.005** (1.96)	1.016* (1.82)
Nonmanual	1.003** (2.47)	1.004*** (3.20)	1.015** (2.36)

Notes: Duration model starts with respondents in Wave 8 saying that they have GHQ difficulty ‘not at all’ or ‘no more than usual’ or that happiness is ‘much more than usual’ or the ‘same as usual’. Thus failure happens when the respondent reports difficulty ‘rather’ or ‘much’ more than usual. Frailty controls for log duration (last three time periods combined). Regressions based on data on wage and salary workers from Wave 8 of the BHPS. Other covariates include those in Table 3. Sample sizes given in table.

Figure 1. Survival Plots for Subjective Health

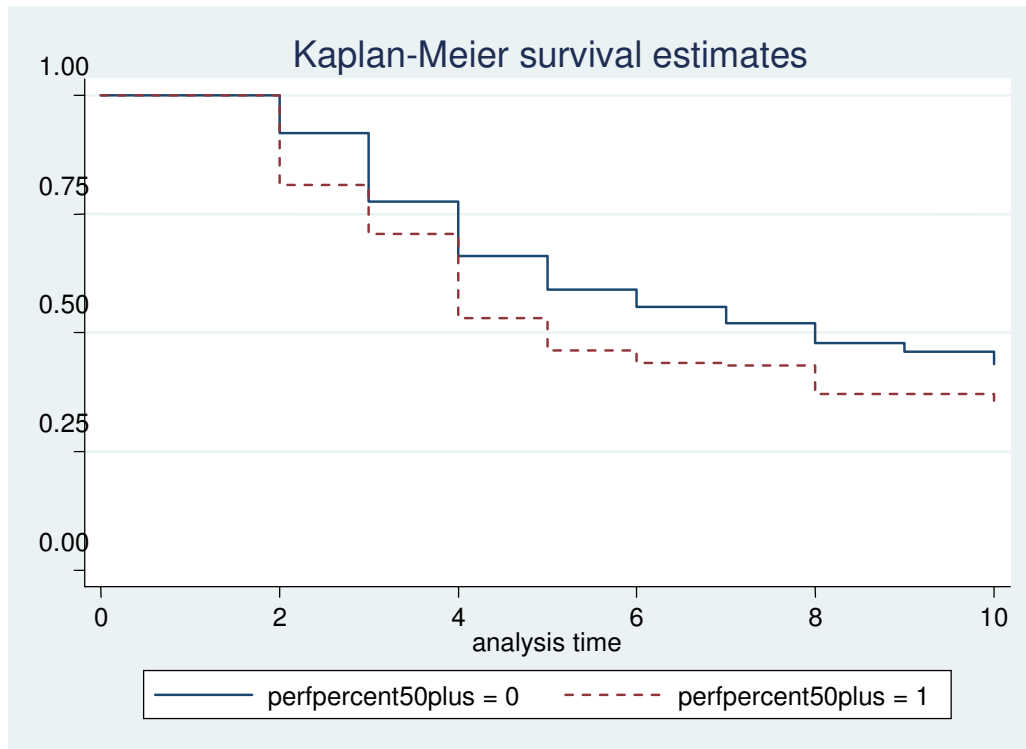


Figure 2. Survival Plots for Subjective Health, Controlling for Earned Income

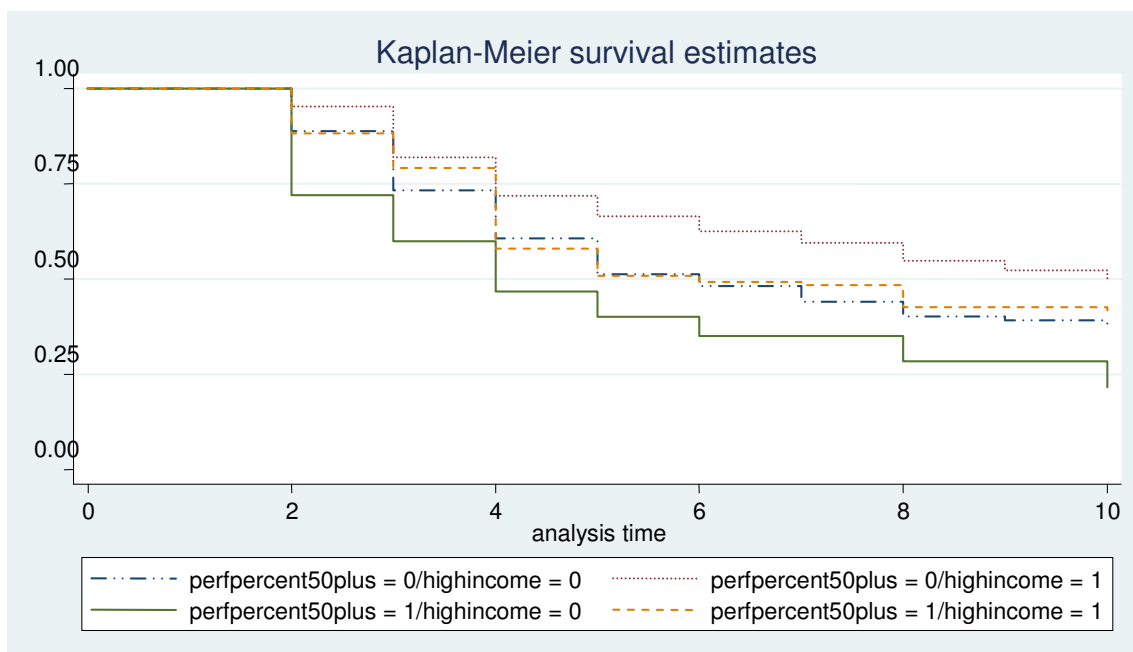
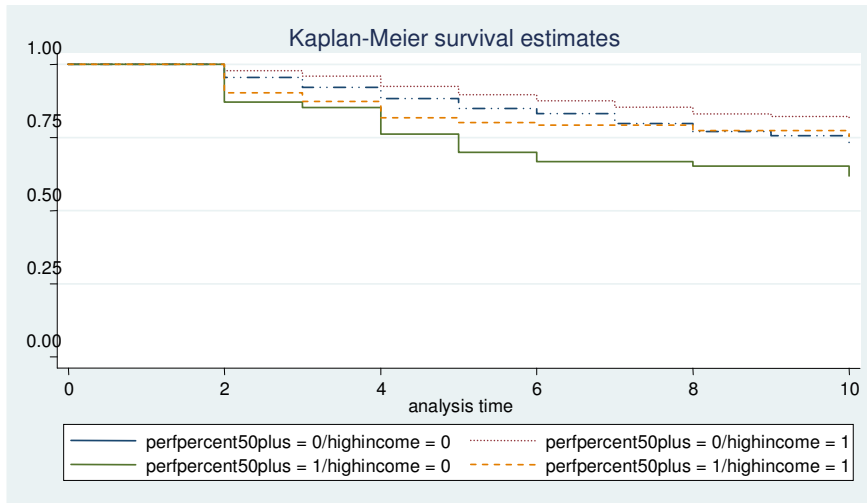
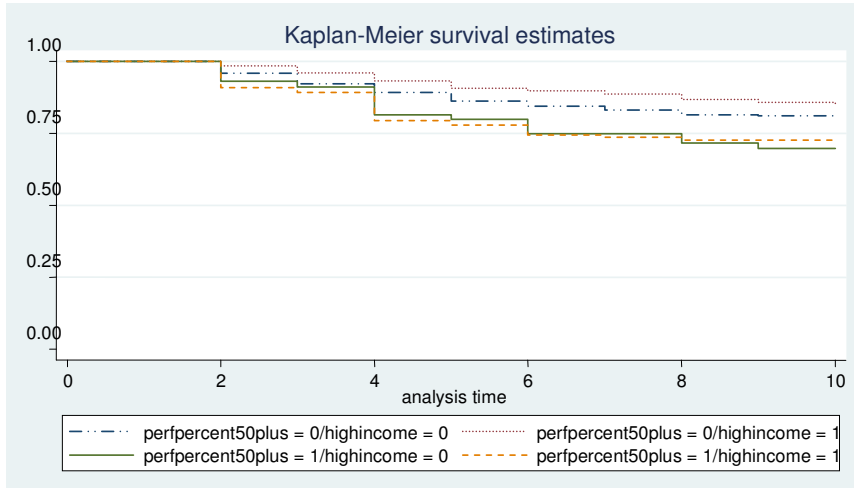


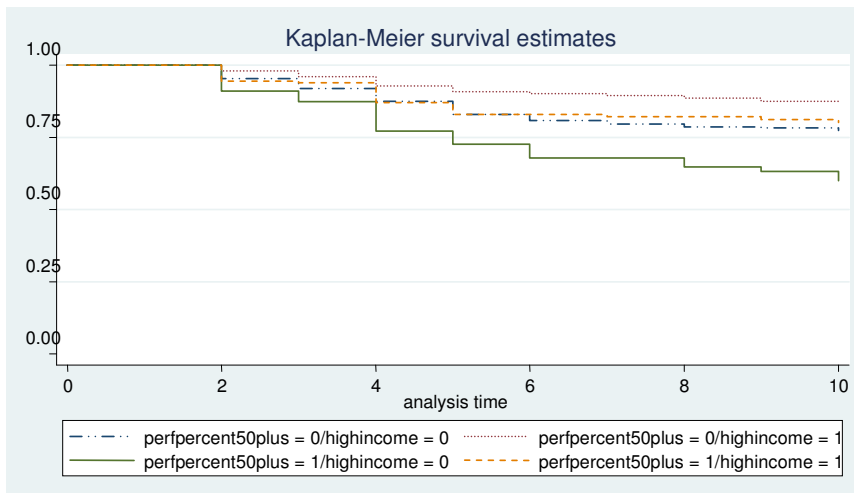
Figure 3. Survival Plots for the Three Objective Measures of Health
Heart Problems



Stomach Problems



Anxiety/Depression



Appendix Table A1: Full Results for Subjective Health for Full Sample: Cox, P-G with and without Frailty: Odds Ratios

Variable	Cox Regression	Prentice-Gloeckler	
		without Frailty	with Frailty
% of time in performance pay	1.004*** (3.42)	1.005*** (4.01)	1.013*** (3.01)
Male	0.936 (-0.87)	0.940 (-0.81)	1.027 (0.09)
Post-secondary educ.	0.789** (-2.09)	0.742*** (-2.62)	0.552 (-1.38)
Secondary educ.	0.808** (-2.52)	0.761*** (-3.21)	0.420** (-2.49)
Age 26-35	1.024 (0.23)	1.032 (0.31)	1.525 (1.14)
Age 36-45	0.984 (-0.16)	0.966 (-0.34)	1.629 (1.26)
Age 46-55	1.070 (0.62)	1.056 (0.50)	1.253 (0.55)
Age 56+	1.391** (2.20)	1.473** (2.58)	3.004* (1.83)
Married	1.005 (0.07)	0.974 (-0.36)	1.190 (0.65)
Currently Smokes	1.182** (2.56)	1.236*** (3.24)	1.385 (1.27)
Labor Income: 1 st Quartile	1.942*** (5.94)	2.075*** (6.55)	36.517*** (7.00)
Labor Income: 2 nd Quartile	1.598*** (4.86)	1.686*** (5.41)	9.832*** (5.72)
Labor Income: 3 rd Quartile	1.184* (1.84)	1.210** (2.06)	2.245** (2.39)
Professional occ	1.421** (2.29)	1.419** (2.29)	5.109*** (2.82)
Managerial occ	1.187* (1.93)	1.183* (1.89)	3.201*** (3.37)
Skilled manual occ	1.123 (1.17)	1.131 (1.24)	1.253 (0.62)
Partly skilled manual	1.105 (0.96)	1.148 (1.32)	0.808 (-0.54)
Unskilled manual	1.035 (0.22)	1.057 (0.36)	1.335 (0.47)
London	1.218* (1.83)	1.260** (2.08)	1.519 (1.03)
Scotland	0.978 (-0.22)	0.969 (-0.30)	1.261 (0.59)
Farming, extraction, metal ind	1.126 (1.19)	1.118 (1.11)	2.754** (2.42)
Manufacturing ind	1.236* (1.87)	1/218* (1.72)	5.571*** (3.64)
Construction, transport ind	1.235* (1.91)	1.248** (2.00)	1.699 (1.24)
Other ind	1.127 (1.52)	1.155* (1.83)	1.234 (0.68)
Ln(hours)	1.241** (2.57)	1.266*** (2.82)	2.944*** (3.28)
ln(t)	na	1.487*** (9.03)	643.064*** (10.62)

Notes: z-statistics under odds ratios. Regressions also include a constant term. The excluded variables are: did not complete secondary education, age under 26 years, income in 4th quartile, skilled nonmanual occupation, regions of England, Wales and Northern Ireland that are not in greater London or in Scotland, and services and banking industry. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.