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Abstract

Poor health in the workforce is costly to employers and the economy. This is partly due to health problems causing people to spend less time at work but is also due to people being less productive while at work. In this paper, we investigate the causes of presenteeism, defined as reduced productivity at work due to health problems. This is the first study to estimate the extent of presenteeism in the UK workforce as a whole. We assess the extent to which physical and mental health affect people's ability to do their job effectively and seek to expose some of the 'hidden' costs of ill health on the UK economy. We find that both physical and mental health significantly predict the probability of presenteeism. These effects persist in a longitudinal framework, such that a worsening of health over time significantly increases the probability of presenteeism; and the effects of mental health problems seem to be worse than physical health. In comparison, changes to other characteristics, such as work circumstances, have little or no effect on presenteeism, with the exception of perceived job security. However, being in part time work and having autonomy over work tasks both significantly reduce the effect of mental health on presenteeism, suggesting that conducive working conditions can help to mitigate the negative impact of health on productivity.

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JEL classification: I14, J24

Introduction

Poor health in the workforce is costly to employers and the economy. This is partly due to health problems causing people to spend less time at work, for example via unemployment, worklessness, reduced hours and absenteeism, but is also due to people being less productive while at work. Research suggests that reduced productivity at work due to ill-health (often referred to as 'presenteeism') is a widespread phenomenon in the UK. Recent estimates suggest that 1.5 days of work time are lost due to presenteeism for every one day lost due to absenteeism, and the cost of presenteeism to business is double that of absenteeism, amounting to about £21.2 billion per year (Parsonage and Saini 2017). Another survey estimates that the equivalent of 35 days per person per year are lost to presenteeism in the UK (Vitality Health / Rand Europe 2019).

However, presenteeism is intrinsically difficult to measure, as are its effects. While numerous survey tools exist to try to measure the productivity of individuals in the workplace (see Schultz and Eddington 2007 for a review), and the extent to which any deficiencies are due to ill health at work, such instruments are not routinely included in large scale national datasets and therefore limited evidence exists on the scale of presenteeism across the workforce as a whole.

This paper is the first to estimate the extent of presenteeism in the UK workforce as a whole. We assess the extent to which physical and mental health affect people's ability to do their job effectively and seek to expose some of the 'hidden' costs of ill health on the UK economy. Unlike most previous studies in this field, we make use of a large nationally representative dataset and adopt a longitudinal framework to help establish causal relationships. We also explore the heterogeneity of health effects across a range of characteristics and investigate whether certain working conditions may mitigate the impact of health on presenteeism.

We find that both physical and mental health significantly predict the probability of presenteeism. This effect persists in a longitudinal framework, such that a worsening of health over time increases the probability of presenteeism. Specifically, the onset of any physical health condition that impairs daily living increases the incidence of presenteeism by a magnitude of 7 percentage points while the estimated effect of the onset of clinically poor mental health is 12 percentage points. However, two job characteristics appear to play a role in reducing the mental health effect: it is only 8 percentage points for people in part time employment and 10 percentage points for people with autonomy over their work tasks.

Literature review

As Johns (2010) points out, various definitions of 'presenteeism' are found in the literature. A very common definition, and the one he favours, is 'the act of going to work despite feeling unhealthy'. Most empirical studies investigating the prevalence of presenteeism and its correlates adopt this definition by

analysing surveys in which respondents are asked to report how many days they attended work when they could (or should) have taken sick leave.

According to this definition, presenteeism is essentially a choice. Conditional on their state of health, which is to some extent hidden from the employer, individual workers make a decision whether or not to be absent from work on a given day. Economic theory predicts that, keeping income constant, being in poor health reduces the utility gained from attending work relative to staying at home (Brown and Sessions 2004). Nevertheless, under certain conditions, individuals may have an incentive to be absent from work despite being in good health (described in the literature as 'shirking') or to be present at work despite being in poor health (presenteeism). Employers are assumed to prefer fit workers to attend work but prefer workers with health below an acceptable threshold to stay away from work, due to the potential negative consequences of presenteeism, including prolonging recovery times, infecting co-workers or making costly mistakes. As shown in the theoretical work of Hirsch et al. (2017), Arnold and de Pinto (2015), Brown and Sessions (2004) and Chatterji and Tilley (2002), employers can design wage and sick pay structures, or invest in costly monitoring, to reduce incentives for both presenteeism and shirking. Askenazy and Cartron (2020) provide empirical evidence that reducing short-term absence can result in increased presenteeism, which in turn can lead to increased absenteeism in the long run.

Several empirical studies investigate the extent to which different aspects of work are associated with presenteeism, based on this definition. In general, people experiencing poor working conditions are more likely to attend work while sick. This includes stressful working conditions (Hirsch et al. 2017), lack of support from colleagues (Arnold 2016, Caverley et al. 2007), dissatisfaction with work environment (Leineweber et al. 2011) and workplace bullying (Conway et al. 2016). Presenteeism is also associated with indicators of responsibility and workload, such as work autonomy (Arnold 2016), supervisory responsibilities (Arnold and de Pinto 2015), being on a permanent full time contract (Bockerman and Laukkanen 2009) and long or irregular working hours (Arnold 2016, Bockerman and Laukkanen 2009, Hansen and Andersen 2008). These findings suggest that time pressure or responsibility for completing work tasks can inhibit people from being absent from work. Lack of job security (Hirsch et al. 2017, Caverley et al. 2007) and lack of flexibility from employers to support sickness absence (Johansson and Lundberg 2004) are also associated with higher presenteeism.

Where health is controlled for in the analysis, most studies simply measure this using general self-assessed health (for example, where the respondent rates their health on a five-point scale between 'Excellent' and 'Very poor'), and find that poor health is predictive of presenteeism. In one of the few papers that explore the impact of health in more depth, Gosselin et al. (2013) find that some conditions (namely gastritis, insomnia and allergies) are associated with presenteeism but not absenteeism while other more

serious conditions (back pain and emotional problems) predict both. Caverley et al. (2007) find that the presence of a chronic medical condition is more predictive of presenteeism than absenteeism.

It should be noted that many of the cited studies base their findings on analysis of relatively small bespoke samples of workers, and most of them focus on specific occupations or industries. Moreover, none of them use longitudinal data, so the reported relationships may reflect confounding factors rather than causality. Furthermore, none of these studies are focused on the UK.

An alternative definition of presenteeism, and the one we adopt for this paper, is 'reduced productivity at work due to health problems' (Johns 2010). This is very similar to the definition used by Schultz and Edington (2007), who review more than 100 studies focusing on the links between health and on-the-job productivity, and is sometimes classified as being the American (as opposed to European) understanding of presenteeism (Karanika-Murray and Cooper 2018).

This is a very different concept to the idea of coming to work while sick, as it describes an outcome rather than a behaviour. In this understanding, presenteeism is not a choice but a consequence of behaviours and other circumstances. The choice to forego sickness absence may be a primary reason for productivity loss due to health problems, but it should be noted that going to work while feeling unwell does not necessarily result in productivity loss. For example, Karanika-Murray and Biron (2019) identify 'functional presenteeism' where ill-health does not have a significant impact on job performance, and 'therapeutic presenteeism' where attendance at work helps people to cope with and recover from their ill-health. Moreover, it is possible for a person's health to affect their productivity even when they have not explicitly made a decision to attend work rather than take sick leave. This may be particularly pertinent for long term health conditions, where the presence of the condition is 'normal' for the individual and not a reason in itself to be absent from work.

Some studies seek to measure this productivity loss using indicators of lost productive time. For example, Stewart et al. (2003) find that depression leads to significant costs due to lost productive time and that most of these costs are 'invisible', in the sense that that they are caused by hour-equivalent reduced performance at work rather than hours of work missed. Similarly, Kessler et al. (1999) find that depressed workers have significantly more 'work-disability days' than healthy workers and Kessler and Frank (1997) find that workers with psychiatric disorders are most likely to exhibit work impairment, and that 'work cutback' days (presenteeism) are much more prevalent than 'work loss' days (absenteeism).

Other studies make use of a number of survey tools that exist to identify reduced productivity due to disability and ill-health. As shown by Schultz and Edington (2007), there are a large number of such tools. In their review of the literature, they find that productivity loss at work is associated with a number of

different health conditions, including diabetes, depression and arthritis. Moreover, individuals with multiple health conditions report greater presenteeism than those with few conditions, and the magnitude of work impairment increases with every additional chronic condition.

There are some more recent studies that focus on the determinants of presenteeism using these productivity questionnaires. Pedersen and Skagen (2014) find that poor health, low job satisfaction and not having managerial responsibility are all associated with lower work performance on the Stanford Presenteeism Scale. Adler et al. (2006) find that depression has a negative impact on work performance, and to a much greater degree than rheumatoid arthritis, according to the Work Limitations Questionnaire. Most recently, Brunner et al. (2019) find that job stressors (relating both to the task itself and relationships at work) have a negative effect and job resources (including job control, task significance, supportive behaviour from supervisors and appreciation at work) have a positive effect on health-related productivity (due to both absenteeism and presenteeism) as measured by the Work Productivity and Impairment-General Health questionnaire.

These studies rely on bespoke datasets due to these productivity instruments not being generally available in large-scale longitudinal surveys. Hence they are useful only for providing inference on small selected populations and lack external validity. Moreover, if these samples are based on a single cross-section then it is not possible to account for unobserved heterogeneity between individuals that may bias the estimated effect of health on presenteeism. To our knowledge, the only study that has attempted to investigate presenteeism using a national panel dataset is that of Bubonya et al. (2017). They use the Household Income and Labour Dynamics in Australia (HILDA) survey to assess the effects of mental health on absenteeism and presenteeism within the Australian workforce. To measure presenteeism, the authors consider responses to certain questions in the Short Form 36 (SF-36) Health Survey (Ware et al., 1993) that focus on the extent to which emotional problems affect the quality and quantity of work tasks and other activities accomplished. They find that the odds of presenteeism are six to seven times higher for people with poor mental health than people with good mental health. Moreover, the presenteeism of people with poor mental health is less sensitive to changes in employment conditions (namely job control, job security, job complexity and job stress) than people with good mental health.

Data and descriptive analysis

The data we use comes from Understanding Society: The UK Household Longitudinal Study (UKHLS) (University of Essex, 2019). This is a large national survey covering all four countries of the UK, in which households and individuals are interviewed on an annual basis. Our dataset contains responses from all even-numbered waves of UKHLS to date, namely wave 2 (2010-11), wave 4 (2012-13), wave 6 (2014-15)

and wave 8 (2016-17).[1] The sample retains all observations where the respondent was employed (self-employed individuals are excluded) and between the ages of 21 and 55; this is to retain a focus on the prime age workforce, and abstract as far as possible from the issue of health and retirement. After also excluding any observations with missing values on any variables included in the full model, we are left with a sample of 53,103 observations across 25,179 unique individuals. This is an unbalanced panel where each individual is observed an average of 2.1 times. Table 1 shows the observations lost due to restricting the sample.

To construct an indicator for presenteeism, we broadly follow the approach of Bubonya et al. (2017) by utilising specific questions in the Short Form 12 (SF-12) Health Survey (Ware et al, 1995).[2] These questions form part of the self-completion questionnaire that all adult participants in UKHLS are asked to complete every year. Specifically, we use five of the SF-12 questions. The wording used for each of the five questions is as follows [bold font as in the questionnaire]:

- During the **past 4 weeks**, how much of the time have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?
    - **Accomplished less** than you would like
    - Were limited in the **kind** of work and other activities
- During the **past 4 weeks**, how much of the time have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?
    - **Accomplished less** than you would like
    - Did work or other activities **less carefully than usual**
- During the **past 4 weeks**, how much did pain interfere with your normal work (including both work outside the home and housework)?

There are five possible responses to each of these questions. The responses to the first four questions are: “All of the time”; “Most of the time”; “Some of the time”; “A little of the time”; and “None of the time”. The responses to the fifth question on pain are: “Not at all”; “A little bit”; “Moderately”; “Quite a bit”; and “Extremely”.

[1] The odd-numbered waves are dropped because they do not include some questions on working conditions that we use in our models.

[2] The SF-12 is a shorter general health instrument derived from the SF-36. The HILDA survey used by Bubonya et al. (2017) contains the SF-36, while our UKHLS data contains the SF-12. The available variables are not precisely the same as in the HILDA although they are very similar.

We define person i as experiencing presenteeism in wave t if they gave one of the top two responses to one or more of the five questions. We also explore different definitions, to check that our results and conclusions are not sensitive to the particular definition of presenteeism. This is discussed further below.

The main difference between this measure and that of Bubonya et al. (2017) is that we include limitations attributable to both physical health and mental health in the dependent variable, while their dependent variable only includes questions related to emotional problems (mental health). Given the likelihood of comorbidity between physical and mental health problems, it does not seem reasonable to separate them in this way. Further, in Bubonya et al. (2017), while parts of the SF-36 form the dependent variable, other parts of the same instrument (namely the physical functioning sub-scale, as a proxy for physical health) are included on the right hand side of their estimation equation. In contrast, we take both our physical and mental health explanatory variables from completely different questions in the UKHLS, rather than from the SF-12 questions that make up our dependent variable.

It is important to note that productivity loss due to health problems can occur both through the means of reduced hours (absenteeism) and on-the-job productivity loss (no reduction in hours but a reduction in output per hour). We are not able to control fully for absenteeism as this is not precisely identified in UKHLS[3] so our presenteeism variable should be interpreted as an overall indicator of self-assessed productivity loss due to health (which includes reduced hours, reduced output and productivity loss in household production).

As our main explanatory variables of interest, we construct two dichotomous variables for physical health and mental health respectively. Our physical health variable is derived from a question in the main interview stage of the survey in which respondents are asked to report whether, as a result of health problems or disabilities, they experience substantial difficulties with particular functions, often classified as the activities of daily living; for example, mobility, lifting and manual dexterity. If they do not report any impairment then we deem them to be in good physical health, but if they report one or more impairments they are defined as being in poor physical health. The mental health variable is derived from the General Health Questionnaire (GHQ). This is a 12-question instrument completed as part of the self-completion questionnaire in UKHLS. The GHQ is a clinically validated psychological tool which can be used to quantify a person's mental well-being. We use this information to create a dichotomous mental health

[3] UKHLS identifies whether the respondent has a paid job but did no work in the previous week, and whether the reason for this was sickness or injury. We have replicated our analysis removing the 4% of the sample not at work in the previous week, and find very similar results. UKHLS does not identify respondents who did *some* work in the previous week but also had *some* sickness absence, nor does it identify any sickness absence taken over the previous four weeks, which is the time period covered by our presenteeism proxy measures.

variable, where people exceeding a diagnostic threshold are deemed to have poor mental health.[4] The questions used to compute the physical health and mental health variables are described in Appendix A2 and A3 respectively.

We also control for a number of other sociodemographic and work-related covariates, namely: gender, age group, marital status, whether has children, highest qualification, ethnicity, own income, other household income, whether works in the public sector, whether job is temporary, whether job is part time, occupation classification, workplace size, whether individual uses formal or informal flexible working arrangements, extent to which individual has autonomy at work across different dimensions and whether the individual deems their job to be secure. Detailed definitions for all variables are provided in Appendix A1.

Table 2 presents descriptive statistics for all variables in the model. It shows that, by our definition, about 9% of the prime age working population experiences presenteeism in a given month, but these rates are considerably higher among people with health problems. Presenteeism is experienced by about a third (32%) of people with at least one physical impairment and over a quarter (26%) of people with poor mental health. Women are more likely to experience presenteeism than men and it is also more common among older workers, and single people without children. Presenteeism tends to be higher among people with lower qualifications and in lower skilled occupations. People in smaller workplaces and those in part time and temporary jobs are also more likely than average to experience presenteeism but there is very little difference between the public and private sectors. Workers who feel that they have autonomy over their work life are less likely to experience presenteeism, as well as people who feel that their job is secure.

Econometric analysis

Our research question is addressed using two econometric models. Firstly, we use a probit model on the pooled data to estimate the association between presenteeism and health. In other words, to what extent does health explain differences in the incidence of presenteeism across the population? Secondly, we use a correlated random effects (CRE) probit model to explain the extent to which changes in presenteeism over time are explained by changes in health over time. This latter model provides the most robust results as the estimates are not confounded by systematic differences in the unobserved characteristics between people with and without health problems that may be explaining differences in presenteeism.

[4] This measure is derived from the GHQ-12 caseness score. The original GHQ permits responses of 0 to 3 for each of the 12 questions. The caseness score recodes values of 0 and 1 on individual questions to 0, and values of 2 and 3 to 1; giving a scale from 0 (least distressed) to 12 (the most distressed). A person is assumed to have poor mental health if their caseness score is 4 or above. This cut-off is used by the NHS to define being in poor mental health for monitoring purposes. See Health and Social Care Information Centre (2013).

We assume that the probability that a given individual i experiences presenteeism in wave t conditional on her observed health status and other characteristics can be expressed by a probit equation.

$$\Pr(P_{it}|H_{it}, X_{it}) = \Phi(H_{it}\beta_1 + X_{it}\gamma_1) \quad (1)$$

Here, P_{it} is a binary indicator equal to 1 if individual i experiences presenteeism in wave t and 0 otherwise. The vector H_{it} contains all health related variables describing the health state of individual i at time t, X_{it} contains all other observable variables assumed to influence presenteeism and Φ denotes the normal distribution. We estimate equation (1) using the pooled waves of data to derive the association of health with presenteeism after allowing for X_{it}. If X_{it} captured all the relevant characteristics affecting presenteeism, these associations could be interpreted causally. However, they will be biased as causal effects if there is unobserved heterogeneity which influences presenteeism and is also correlated with H_{it} and X_{it}. To deal with this, we define v_i as the unobserved characteristics common to an individual but invariant over time. Following Wooldridge (2010), we assume that v_i is linearly related to the group means of the explanatory variables such that:

$$v_i = \psi + \bar{H}_i\eta + \bar{X}_i\xi + a_i \quad (2)$$

Here, $\bar{H}_i = \frac{1}{T}\sum_{t=1}^{T} H_{it}$ and $\bar{X}_i = \frac{1}{T}\sum_{t=1}^{T} X_{it}$. The error term a_i is assumed to be uncorrelated with the group means and normally distributed. We can now add the unobserved heterogeneity into the equation and specify a CRE probit that can be estimated consistently using maximum likelihood:

$$\Pr(P_{it}|H_{it}, X_{it}, v_i) = \Phi(\psi + H_{it}\beta_2 + X_{it}\gamma_2 + \bar{H}_i\eta + \bar{X}_i\xi + a_i) \quad (3)$$

The coefficient vector β_2 in equation (3) can essentially be interpreted as the effect on presenteeism associated with a change in health status from one time period to the next. For both the pooled probit in equation (1) and the CRE probit in equation (3), we report the estimated average marginal effects (AME). The AME measures the effect of a one unit change of the explanatory variable on the probability of presenteeism, averaged over all individuals in the sample.

Results

The main results are shown in Table 3, where the first column shows the results from the pooled probit model in equation (1) and the second column shows the results of the CRE probit model in equation (3).

It is clear that both physical and mental health have a large and significant effect on presenteeism controlling for other characteristics. The pooled probit result shows that an individual with any kind of physical impairment is 13 percentage points more likely to experience presenteeism than a person with

no impairments. However, this is only half of the raw difference between people with and without physical impairments (25 percentage points) as shown in Table 2. In other words, about half of the raw difference is explained by other personal and job characteristics which are associated with poor health. The effect halves again when we account for unobserved differences between people, as shown by the AME in the CRE probit model. This implies that developing a physical impairment leads to a 7 percentage point increase in the probability of presenteeism.

In the pooled probit model, having poor mental health is also associated with a 13 percentage point higher probability of presenteeism. This compares to a raw difference of 20 percentage points, implied in Table 2. Hence about two thirds of the raw difference is accounted for by the effect of mental health itself. The AME is only slightly smaller (12 percentage points) in the CRE probit, suggesting that unobservable differences between people have only a very modest confounding effect on the relationship between mental health and presenteeism. This also suggests that the effect of mental health on presenteeism is stronger than the effect of physical health, similar to the findings of Adler et al. (2006). Figure 1 shows the relationship between the level of mental health (measured with the continuous GHQ score) and the marginal effect on presenteeism. The graph shows that marginal effects are much higher than average for people with particularly poor mental health (higher GHQ scores). For the minority of people reporting GHQ scores of around 20 or above, the effect of a one-point increase in GHQ score (measured on a scale of 0 to 36) is to increase the probability of presenteeism by at least two percentage points, compared to less than one percentage point for people with good mental health (GHQ scores less than 10). By the same reasoning, a small improvement in mental health is predicted to have a much stronger effect on reducing presenteeism among people with poor mental health compared to people with average or good mental health.[5]

The results from the pooled probit model show that it is not just health that explains differences in presenteeism across the workforce. The probability of presenteeism is higher for those with no qualifications and reduces as own income increases. Presenteeism is significantly higher among people in lower skilled occupations, confirming a cross-sectional result from Pedersen and Skagen (2014), but lower among those who have access to informal flexibility at work, have autonomy over the manner in which they do their work and perceive their job to be secure. Perhaps surprisingly, having autonomy over one's working hours is associated with a significantly higher probability of presenteeism. Aside from the health

[5] We also looked at whether there are any delayed effects of health on presenteeism, by including a one-year lag of the physical and mental health variables. This is an indicator of whether or not the individual was in poor health in the intermediate waves of UKHLS (i.e. waves 1, 3, 5 and 7 that are excluded from the main models). In the CRE specification with lags, we find that these delayed effects are positive but not significant when also controlling for contemporaneous health. This suggests that presenteeism is affected only by current health problems, not by health problems that occurred in the past.

effects, the effects of most other variables become insignificant (at the 95% significance threshold) in the CRE probit specification, suggesting that an individual would not be expected to experience a change in presenteeism in response to a change in their personal or work circumstances. This contrasts to the results of Brunner et al. (2019) where some work characteristics continue to be predictive of presenteeism even after controlling for fixed effects. The one exception is perceived job security. Experiencing a change from feeling that one's job is not secure to feeling that one's job is secure is associated with 2 percentage point reduction in the probability of presenteeism.

While a change in work characteristics generally does not lead to a change in presenteeism keeping health constant, in some cases work characteristics may affect the extent to which a change in health impacts on presenteeism. We test for this by interacting various work characteristics with the health variables in the CRE probit regression and then estimating AMEs separately for different types of work characteristics, and show the results in Table 4. We find that the effect on presenteeism from crossing the threshold into poor mental health is much stronger for full time workers (13 percentage points) than part time workers (8 percentage points) and for people who have limited autonomy over their job tasks (14 percentage points) compared to those who do have autonomy (10 percentage points). This suggests that part time work and autonomy over one's work may be more conducive for people experiencing an onset of poor mental health, in terms of lowering the impact of their health on their productivity. There is also some relationship between occupation and mental health. Poor mental health seems to lead to presenteeism to a greater extent in associate professional and administrative occupations (14 percentage points) relative to managerial occupations (9 percentage points). However, marginal effects in lower skilled occupations are no different to average.

Perhaps the most surprising result is that the marginal effect of physical health on presenteeism is stronger among those who have access to informal flexible working (8 percentage points) than those who do not have this access (6 percentage points). We might expect the opposite insofar as better access to flexible working should help people with physical health problems to avoid presenteeism.

Robustness checks

To assess the sensitivity of our results to our specific definition of presenteeism, we repeat the analysis based on different definitions. Firstly, we broaden the scope of presenteeism by classifying anyone giving one of the top three (rather than top two) responses to at least one of the five questions as experiencing presenteeism. This implies that a person experiences presenteeism if they respond "some of the time", "most of the time" or "all of the time" to any one of the four questions referring to the impact of physical health or emotional problems or respond "moderately", "quite a bit" or "extremely" to the fifth question about the impact of pain.

We also construct a tighter definition of presenteeism by insisting that the individual experiences problems in at least two (rather than one) of the five areas. Again we vary whether we require them to have responded with a top two or top three response on the Likert scale.

The AMEs pertaining to physical and mental health for each definition of presenteeism are presented in Table 5. The effects are very different commensurate with the differences in the average probability of presenteeism according to each definition. The AMEs in both models are highest for the broadest definition (top three response for at least one problem) and lowest for the narrowest definition (top two response for at least two problems), but continue to be highly significant in all models. Also, in all CRE probit models, the effect of mental health on presenteeism is stronger than the effect of physical health (with a ratio of between about half and two-thirds).

Discussion

The evidence is clear that both developing a functional impairment or experiencing a worsening of mental health have a significant effect on the productivity of workers in the UK. Bearing in mind that only 9% of the workforce is estimated to experience presenteeism in a given month, the effects of health are large, raising this probability by 7 percentage points from developing any physical impairment and by 12 percentage points from developing poor mental health. No other observed changes in personal or work characteristics have comparable effects on presenteeism.

Although we cannot quantify this, the potential economic effects of health-related productivity loss are substantial. For employers, the effect is reduced output leading ultimately to the erosion of profit margins or failure to meet performance targets. There may be implications for employees as well, at least in the long term, as continued presenteeism is likely to contribute to reduced earnings growth or even job loss.

In theory, reduced productivity should be reflected in reduced wages but in practice wages can be 'sticky' in the sense that they do not always change in response to exogenous changes in productivity. To explore this further, we estimated a simple Mincerian wage model regressing hourly wages on presenteeism, controlling for age and education (Mincer 1974). The results suggest that people experiencing presenteeism have 9.5% lower earnings on average. When we also control for fixed effects, the effect of presenteeism is a fall in real wages of approximately 0.85% on average. Although small in magnitude, this effect is statistically significant and also comparable to average real wage growth in recent years, estimated to be 1.4% in real terms between 2017/18 and 2018/19 in Great Britain (Office for National Statistics 2019).

These findings may go some way, therefore, to explaining the gap in earnings between disabled and non-disabled people. As discussed by Kruse et al. (2018), discrimination against disabled people and those with

health problems may still be driving much of the earnings gap, but the effects of health on productivity is also an important explanation.

The appropriate response to these findings depends somewhat on whether one subscribes to the 'biomedical' or 'social' perspectives on disability and employment (Berthoud 2008, Williams-Whitt and Taras 2010). The biomedical model essentially takes a supply side approach, making the assumption that it is the health problem itself that leads to deficiencies in productivity. Our findings provide some support for this perspective as health is clearly the biggest determinant of presenteeism relative to other factors such as work characteristics. Investments in improving the mental health and physical functioning of the workforce should be expected to yield high returns in terms of reducing health-related productivity loss.

To some extent, our findings are also consistent with the social model, in which the adverse employment prospects of disabled people are assumed to be caused by the failure of employers, or the labour market in general, to make jobs accessible to people with health problems. We find some evidence that the interaction between health and work characteristics is a significant determinant of presenteeism. In particular, the effects of mental health on presenteeism are much reduced when working part time or when one has autonomy over one's work tasks, suggesting that certain types of employment are more accommodating for people experiencing worsening health, in terms of minimising the adverse effect on productivity.

Conclusion

Health is the most important driver of presenteeism in the UK. On average, developing any kind of physical impairment is estimated to lead to a doubling (e.g. from 7% to 14%) in the probability of reduced productivity at work. Moving from good to poor mental health has an even greater effect, predicting a threefold increase in the probability of presenteeism on average (e.g. from 6% to 18%). Furthermore, the marginal effects of an incremental worsening of mental health are particularly high among people with mental health already worse than average. These effects are relatively consistent across all demographic groups, job types and working arrangements, suggesting that policies aimed at improving physical and mental health among working people should reduce the presenteeism of everyone and deliver substantial benefits to the economy. However, there are a few cases where the effects of health on presenteeism are significantly reduced depending on work characteristics, suggesting that it may also be possible to design work in such a way that health problems have a reduced impact.

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Figure 1 – Marginal effect of GHQ on presenteeism at different levels of GHQ in CRE probit model

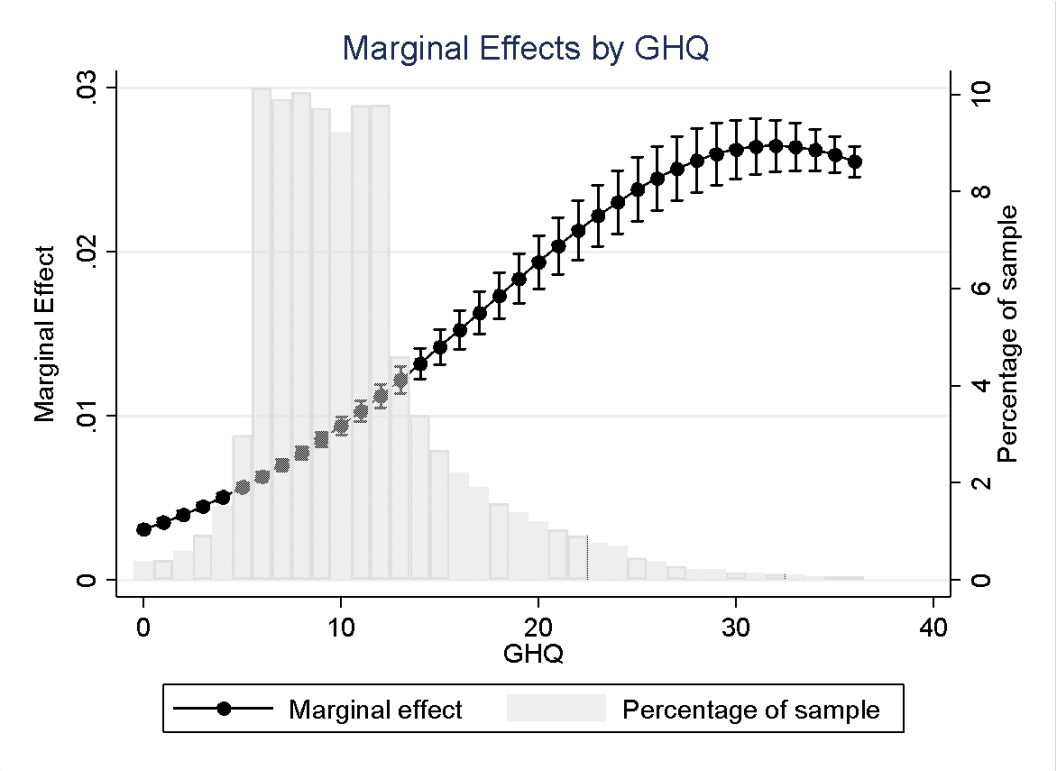

Table 1 – Derivation of study sample

	Waves	Individuals	Observations
All UKHLS respondents	8	84,925	373,772
Prime age (21-55) only	8	54,397	215,495
Employees only	8	39,775	142,556
Waves 2, 4, 6 and 8 only	4	32,534	70,931
Excluding those not completing all five of the SF-12 questions used in the analysis (e.g. due to being a proxy respondent or refusing to do the self-completion questionnaire)	4	27,325	59,205
Excluding those with missing values on any other variable in the main model	4	25,179	53,103

Table 2 – Descriptive statistics

	% presentee	Unweighted N	% of total sample
Total sample	9.4	53,103	100.0
No physical impairments / disabilities	6.8	47,272	89.0
Any physical impairment / disability	32.1	5,831	11.0
Type of physical impairment / disability:			
Mobility	46.9	2,014	3.8
Lifting / carrying	42.6	2,498	4.7
Manual dexterity	51.2	716	1.3
Continence	37.2	426	0.8
Hearing	22.4	422	0.8
Sight	29.6	371	0.7
Communication or speech	38.9	167	0.3
Memory, concentration	44.3	811	1.5
Recognising physical danger	59.1	64	0.1
Physical coordination	50.6	612	1.2
Difficulties with personal care	65.8	322	0.6
Other health problem	29.2	1,647	3.1
Mental health state:			
Good mental health	6.2	44,426	83.7
Poor mental health	26.3	8,677	16.3
Other characteristics:			
Male	8.2	23,862	44.9
Female	10.6	29,240	55.1
Age 21-24	8.8	3,942	7.4
Age 25-34	9.1	13,196	24.8
Age 35-44	8.9	16,887	31.8
Age 45-55	10.3	19,078	35.9
Married	8.8	38,655	72.8
Not married	10.8	14,448	27.2
Children	8.9	23,908	45.0
No children	9.8	29,195	55.0
White British	9.0	42,771	80.5
Other white	9.4	2,718	5.1
Mixed race	8.9	893	1.7
Asian / Chinese	14.6	4,183	7.9
Black Caribbean / African	15.0	1,852	3.5
Other ethnicity	17.3	310	0.6
Highest qual: degree	7.2	19,125	36.0
Highest qual: other higher ed	10.3	7,385	13.9
Highest qual: A-level	9.9	11,787	22.2
Highest qual: GCSE	10.9	10,504	19.8
Highest qual: Other qual	12.2	2,979	5.6
Highest qual: No quals	14.7	1,323	2.5
Public sector	9.3	20,034	37.7
Private sector	9.5	33,069	62.3
Temporary job	10.8	2,562	4.8

	% presentee	Unweighted N	% of total sample
Permanent job	9.3	50,541	95.2
Full time	8.8	42,101	79.3
Part time	11.9	11,002	20.7
SOC1: Managers	6.9	7,245	13.6
SOC2: Professional	6.5	9,481	17.9
SOC3: Associate professional	9.2	9,323	17.6
SOC4: Administrative	9.3	6,766	12.7
SOC5: Skilled trades	7.3	3,246	6.1
SOC6: Personal services	13.2	5,507	10.4
SOC7: Sales/customer service	12.1	3,948	7.4
SOC8: Process operatives	9.9	2,936	5.5
SOC9: Elementary occupations	14.4	4,651	8.8
Under 25 employees	10.5	15,967	30.1
25-99 employees	9.2	13,742	25.9
100-499 employees	8.6	12,139	22.9
500 or more employees	9.0	11,255	21.2
Uses formal flexible working	9.7	23,403	44.1
Does not use formal flexible working	9.2	29,700	55.9
Access to informal flexible working	8.7	34,301	64.6
No access to informal flexible working	10.9	18,802	35.4
Autonomy over job tasks	8.6	39,042	73.5
No autonomy over job tasks	11.8	14,061	26.5
Autonomy over work pace	8.8	39,845	75.0
No autonomy over work pace	11.2	13,258	25.0
Autonomy over work manner	8.8	44,483	83.8
No autonomy over work manner	12.9	8,620	16.2
Autonomy over task order	8.8	44,013	82.9
No autonomy over task order	12.6	9,090	17.1
Autonomy over work hours	8.4	24,404	46.0
No autonomy over work hours	10.3	28,699	54.0
Job security	8.8	48,562	91.4
No job security	15.5	4,541	8.6
Own income less than or equal to median	11.3	19,658	37.0
Own income greater than median	8.3	33,445	63.0
Other household income less than or equal to median	10.2	25,931	48.8
Other household income greater than median	8.6	27,172	51.2

Weighted by UKHLS person-level weights (adult main and proxy interview).

Table 3 – Average Marginal Effects on Probability of Presenteeism

	Pooled Probit	CRE Probit
Poor physical health	0.133***	0.075***
	(0.003)	(0.006)
Poor mental health	0.126***	0.119***
	(0.003)	(0.005)
Female	-0.001	
	(0.003)	
Married	-0.007*	-0.009
	(0.004)	(0.008)
Age 21-24	0.004	-0.013
	(0.005)	(0.011)
Age 25-34	0.004	-0.013
	(0.003)	(0.008)
Age 35-44	0.007**	-0.010*
	(0.003)	(0.006)
Children	-0.002	-0.003
	(0.003)	(0.006)
Degree	-0.035***	0.063
	(0.008)	(0.040)
Other higher education	-0.020***	0.069
	(0.008)	(0.045)
A-level	-0.023***	0.079*
	(0.007)	(0.041)
GCSE	-0.025***	0.075*
	(0.007)	(0.040)
Other qualification	-0.008	0.015
	(0.008)	(0.031)
Public sector	-0.001	-0.008
	(0.003)	(0.006)
Temporary job	-0.011*	-0.012*
	(0.006)	(0.007)
Part time	0.001	0.003
	(0.004)	(0.006)
SOC2: Professional	-0.002	-0.007
	(0.005)	(0.010)
SOC3: Associate professional	0.004	-0.004
	(0.005)	(0.009)
SOC4: Administrative	0.010**	-0.003
	(0.005)	(0.011)
SOC5: Skilled trades	0.012**	-0.011
	(0.006)	(0.014)
SOC6: Personal services	0.033***	0.002
	(0.005)	(0.013)
SOC7: Sales/customer service	0.025***	-0.005
	(0.006)	(0.012)

	Pooled Probit	CRE Probit
SOC8: Process operatives	0.026***	-0.012
	(0.006)	(0.014)
SOC9: Elementary occupations	0.037***	-0.019*
	(0.006)	(0.011)
Log of own net weekly income	-0.010***	0.001
	(0.003)	(0.004)
Log of other household net weekly income	-0.001	0.000
	(0.001)	(0.001)
25-99 employees	-0.004	0.002
	(0.003)	(0.007)
100-499 employees	-0.003	0.014*
	(0.003)	(0.008)
500 or more employees	0.003	0.012
	(0.004)	(0.009)
Uses formal flexible working	-0.001	0.005
	(0.003)	(0.004)
Access to informal flexible working	-0.010***	0.003
	(0.003)	(0.004)
Autonomy over job tasks	0.000	-0.008*
	(0.003)	(0.005)
Autonomy over work pace	0.002	-0.001
	(0.003)	(0.005)
Autonomy over work manner	-0.013***	-0.002
	(0.004)	(0.006)
Autonomy over task order	-0.002	0.003
	(0.004)	(0.005)
Autonomy over work hours	0.011***	-0.005
	(0.003)	(0.004)
Job security	-0.028***	-0.021***
	(0.004)	(0.006)
N	53,102	53,103

****p<0.01 **p<0.05 *p<0.1. Standard errors in brackets. Pooled probit regression includes wave dummies (not shown). CRE probit regression includes the mean of all time variant variables (not shown).*

Table 4 – Average Marginal Effects on Probability of Presenteeism across subgroups

Health variable	Effect of mental health		Effect of physical health	
	AME	Chi-sq test of difference	AME	Chi-sq test of difference
Full time work	0.1285***		0.0703***	
	(0.0062)		(0.0067)	
Part time work	0.0836***	14.77***	0.0901***	2.11
	(0.0102)		(0.0126)	
Permanent work	0.1197***		0.0734***	
	(0.0056)		(0.0062)	
Temporary work	0.0965***	1.50	0.1040***	1.65
	(0.0186)		(0.0237)	
Private sector	0.1203***		0.0748***	
	(0.0072)		(0.0077)	
Public sector	0.1155***	0.18	0.0730***	0.02
	(0.0085)		(0.0093)	
SOC1: Managers	0.0950***		0.0926***	
	(0.0135)		(0.0178)	
SOC2: Professional	0.1099***	0.61	0.0546***	2.72*
	(0.0135)		(0.0149)	
SOC3: Associate professional	0.1353***	4.65**	0.0658***	1.45
	(0.0133)		(0.0139)	
SOC4: Administrative	0.1388***	4.22**	0.0726***	0.68
	(0.0166)		(0.0168)	
SOC5: Skilled trades	0.1320***	1.52	0.0696***	0.62
	(0.0267)		(0.0230)	
SOC6: Personal services	0.1202***	1.40	0.0846***	0.10
	(0.0164)		(0.0177)	
SOC7: Sales/customer service	0.1258***	1.72	0.0735***	0.51
	(0.0194)		(0.0203)	
SOC8: Process operatives	0.1088***	0.24	0.0963***	0.02
	(0.0247)		(0.0238)	
SOC9: Elementary occupations	0.0977***	0.02	0.0778***	0.37
	(0.0160)		(0.0169)	
Less than 25 employees	0.1077***		0.0761***	
	(0.0095)		(0.0106)	
25-99 employees	0.1080***	0.00	0.0679***	0.31
	(0.0102)		(0.0111)	
100-499 employees	0.1265***	1.51	0.0666***	0.35
	(0.0121)		(0.0122)	
500 or more employees	0.1322***	2.55	0.0880***	0.50
	(0.0118)		(0.0131)	
Does not use formal flexible working	0.1178***		0.0776***	
	(0.0068)		(0.0074)	
Uses formal flexible working	0.1134***	0.17	0.0662***	1.04
	(0.0089)		(0.0095)	
Does not have access to informal flexible working	0.1249***		0.0619***	
	(0.0078)		(0.0079)	
Has access to informal flexible working	0.1157***	0.76	0.0835***	3.97**
	(0.0077)		(0.0087)	
No autonomy over job tasks	0.1390***		0.0806***	
	(0.0090)		(0.0094)	
Autonomy over job tasks	0.1043***	10.08***	0.0715***	0.65
	(0.0070)		(0.0078)	
No autonomy over work pace	0.1250***		0.0758***	

Health variable	Effect of mental health		Effect of physical health	
	AME	Chi-sq test of difference	AME	Chi-sq test of difference
	(0.0088)		(0.0092)	
Autonomy over work pace	0.1097***	2.01	0.0742***	0.02
	(0.0071)		(0.0078)	
No autonomy over work manner	0.1302***		0.0751***	
	(0.0105)		(0.0107)	
Autonomy over work manner	0.1106***	2.67	0.0733***	0.02
	(0.0067)		(0.0075)	
No autonomy over task order	0.1310***		0.0798***	
	(0.0103)		(0.0105)	
Autonomy over task order	0.1146***	1.90	0.0713***	0.50
	(0.0068)		(0.0075)	
No autonomy over work hours	0.1269***		0.0742***	
	(0.0069)		(0.0073)	
Autonomy over work hours	0.1090***	2.77*	0.0759***	0.03
	(0.0087)		(0.0097)	
No job security	0.1339***		0.0647***	
	(0.0130)		(0.0139)	
Job security	0.1119***	2.45	0.0766***	0.63
	(0.0066)		(0.0073)	

****p<0.01 **p<0.05 *p<0.1. Standard errors in brackets. Estimated from CRE probit regressions with interactions with AMEs estimated separately for each sub-group. Chi-square tests whether the AME from the sub-group in question is significantly different to the baseline sub-group.*

Table 5 – Average Marginal Effects on Probability of Presenteeism, by varying the definition of Presenteeism

		Top two responses			Top three responses		
		Unweighted mean of dependent variable	Pooled Probit	CRE Probit	Unweighted mean of dependent variable	Pooled Probit	CRE Probit
At least one problem area	Physical health	0.102	0.133***	0.075***	0.270	0.262***	0.133***
			(0.003)	(0.006)		(0.005)	(0.008)
	Mental health		0.126***	0.119***		0.310***	0.270***
			(0.003)	(0.005)		(0.004)	(0.007)
At least two problem areas	Physical health	0.043	0.063***	0.040***	0.170	0.196***	0.110***
			(0.002)	(0.004)		(0.004)	(0.007)
	Mental health		0.065***	0.066***		0.223***	0.212***
			(0.002)	(0.004)		(0.003)	(0.007)
	N		53,102	53,103		53,102	53,103

****p<0.01 **p<0.05 *p<0.1. Standard errors in brackets. Pooled probit regressions include wave dummies and all other covariates in Table 3 (not shown). CRE probit regressions include all other covariates in Table 3 and the mean of all time variant variables (not shown).*

Appendix A1: Variable definitions

Variable	Definition
Physical health (functional impairment)	See Appendix A2
Mental health (GHQ)	See Appendix A3
Female	Whether female
Married	Whether either married, in a registered same-sex civil partnership or living as a couple
Age	Age at time of interview
Children	Whether has one or more own children in the household, including natural children, adopted children and step children, under age of 16.
Highest qualification	Highest educational or vocational qualification
Public sector	Whether works for some other type of organisation, not a private firm or business or other limited company
Temporary job	Whether current job is in some way not permanent
Part time	Whether employed part time (defined as 30 or fewer hours per week)
Occupation	Standard Occupational Classification 2010 of current job, at 1-digit level
Log of own net monthly income	Natural log of total net personal income – no deductions
Log of other household net monthly income	Natural log of the difference between total household net income and total net personal income
Workplace size	Number of people employed at current workplace
Uses formal flexible working	Whether flexible working is available at respondent's place of work and they currently work in any of the following ways: part-time working; working term-time only; job sharing; flexi-time; working a compressed week; working annualised hours; working from home on a regular basis; other flexible working arrangements
Access to informal flexible working	Whether is able to vary working hours on an informal basis, for example by re-arranging start or finish times if needed
Autonomy over job tasks	Whether has some or a lot of influence over the tasks one does in one's job
Autonomy over work pace	Whether has some or a lot of influence over the pace at which one works
Autonomy over work manner	Whether has some or a lot of influence over how one does one's work

Variable	Definition
Autonomy over task order	Whether has some or a lot of influence over the order in which one carries out tasks
Autonomy over work hours	Whether has some or a lot of influence over the time one starts or finishes one's working day
Job security	Whether respondent thinks it is unlikely or very unlikely that they will lose their job during the next 12 months, due to being sacked, laid off, made redundant or not having their contract renewed

Appendix A2: The Activities for Daily Living (ADL) Questionnaire

The physical health variable is based on the Activities for Daily Living (ADL) questionnaire which forms part of the UKHLS interview. The question is as follows:

Do you have any health problems or disabilities that mean you have substantial difficulties with any of the following areas of your life?

1. Mobility (moving around at home and walking)
2. Lifting, carrying or moving objects
3. Manual dexterity (using your hands to carry out everyday tasks)
4. Continence (bladder and bowel control)
5. Hearing (apart from using a standard hearing aid)
6. Sight (apart from wearing standard glasses)
7. Communication or speech problems
8. Memory or ability to concentrate, learn or understand
9. Recognising when you are in physical danger
10. Your physical co-ordination (e.g. balance)
11. Difficulties with own personal care (e.g. getting dressed, taking a bath or shower)
12. Other health problem or disability
13. None of these

Respondents are deemed to be in good physical health if they respond with option 13 (none of these) and in poor physical health if they give one or more of the other responses.

Appendix A3: The General Health Questionnaire (GHQ)

The mental health variable is based on the General Health Questionnaire (GHQ), which consists of the 12 questions below. For the dichotomous mental health variable, the respondent is deemed to be in poor mental health if they give response 3 or 4 to at least four of the 12 questions, and in good mental health otherwise. To compute the continuous GHQ score, the 1-4 scale is converted to a 0-3 to scale by subtracting 1 from each numerical response, and then the scores from all 12 questions are summed to provide a composite score in the range 0-36. Hence a score of 0 indicates very good mental health and 36 indicates very poor mental health. Further details about the GHQ and its use is available from Goldberg and Williams (1988).

a) The next questions are about how you have been feeling recently. Have you recently been able to concentrate on whatever you're doing?
    1. Better than usual
    2. Same as usual
    3. Less than usual
    4. Much less than usual
b) Have you recently lost much sleep over worry?
    1. Not at all
    2. No more than usual
    3. Rather more than usual
    4. Much more than usual
c) Have you recently felt that you were playing a useful part in things?
    1. More than usual
    2. Same as usual
    3. Less than usual
    4. Much less than usual
d) Have you recently felt capable of making decisions about things?
    1. More so than usual
    2. Same as usual
    3. Less so than usual
    4. Much less capable
e) Have you recently felt constantly under strain?
    1. Not at all
    2. No more than usual
    3. Rather more than usual
    4. Much more than usual
f) Have you recently felt you couldn't overcome your difficulties?
    1. Not at all
    2. No more than usual
    3. Rather more than usual
    4. Much more than usual
g) Have you recently been able to enjoy your normal day-to-day activities?
    1. More than usual
    2. Same as usual
    3. Less so that [sic] usual
    4. Much less than usual
h) Have you recently been able to face up to problems?
    1. More so than usual
    2. Same as usual
    3. Less able than usual
    4. Much less able
i) Have you recently been feeling unhappy or depressed?
    1. Not at all
    2. No more than usual
    3. Rather more than usual
    4. Much more than usual
j) Have you recently been losing confidence in yourself?
    1. Not at all
    2. No more than usual
    3. Rather more than usual
    4. Much more than usual
k) Have you recently been thinking of yourself as a worthless person?
    1. Not at all
    2. No more than usual
    3. Rather more than usual
    4. Much more than usual
l) Have you recently been feeling reasonably happy, all things considered?
    1. More so than usual
    2. About the same as usual
    3. Less so than usual
    4. Much less than usual