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Workplace autonomy and mental health

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Abstract

This paper explores the relationship between work-related autonomy and mental health. Using Understanding Society data from the United Kingdom, I assess the association between mental health and autonomy, defined across five different dimensions, using a range of different controls, including person and occupation fixed effects. I find low work-related autonomy consistently associates with poor mental health. The degree of selection bias on observable controls is small. Finally, I bound causal effects under assumptions about the degree of confoundedness of unobservables, and assess the possibility of reverse causality.

Keywords: Mental health; Working conditions; Health inequality

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1 Introduction

Poor mental health is a significant source of global disease. In the United Kingdom (UK), nearly half the population has a diagnosable psychiatric disease in their lifetime, with many patients attributing poor mental health to the workplace environment.[1]

Autonomy at work is a key aspect of the workplace environment. Work-related autonomy refers to the level of control a worker has over their working conditions and the nature of their work. A large body of psychological research argues that work-related autonomy is an important resource for managing stress in the workplace (e.g., Van Yperen and Snijders 2000, Bond and Flaxman 2006, Bond, Flaxman, and Bunce 2008, Schreurs et al. 2010, Park and Searcy 2012 Park and Jang 2017, Dong et al. 2021). In the health economics literature, researchers have shown that greater levels of work-related autonomy predict higher overall life satisfaction (Coad and Binder 2014), better mood (Johannsen and Zak 2020), and are associated with better clinical mental health outcomes (Stansfeld, Fuhrer, Head, et al. 1997, Stansfeld, Fuhrer, Shipley, et al. 1999, Bentley et al. 2015). Karasek (1979) theorizes that workplace stress results from the interaction between demands and control, where worker control over how to manage workplace demands can mitigate the stress caused by those demands. Alternatively, higher work-related autonomy may be a marker of status or "work dignity" (Dube, Naidu, and Reich 2022).

I estimate associations between work-related autonomy and mental health in a large representative sample of the UK population. My data allow me to study individuals across a long panel of nine years, and separate work-related autonomy into five different components. I consider autonomy over work tasks, work pace, work manner, task order, work hours, and a summary index of overall, work-related autonomy. I measure mental health using two clinical screening measures of mental health: the GHQ12 caseness score and the SF12 mental health index. I use a wide variety of specifications, showing sensitivity to different controls in order to assess the degree of selection bias. My preferred specification exploits within-person, within-occupation variation in work-related autonomy and includes a rich set of controls including recent mental health history, marital status, and age. I show that low levels of work-related autonomy are

[1] https://www.hse.gov.uk/statistics/causdis/stress.pdf

consistently associated with poor mental health, and the inclusion of observable controls only moderately decreases the association despite increasing the R-squared substantially. My results show a robust relationship between autonomy and mental health which cannot be explained by controls. This finding is consistent with psychologists' theories, and may inform effective targeting of mental health interventions.

To assess how far my observed associations are likely to be causal, I use Oster's (2019) method of selection on unobservables. I calculate the causal effect of work-related autonomy on mental health under different assumptions about the degree of selection on unobservables, and the percentage of variation in the dependent variable explained by the treatment and its confounders. I find that low work-related autonomy has an adverse effect on mental health under most assumptions. The selection bias attributable to unobserved confounders would need to be large relative to the selection bias attributable to observable controls to eliminate the causal effect. For individual components of autonomy, my results are generally less robust to different assumptions about the degree of confounding. I find an adverse effect of low autonomy over work tasks on mental health under most assumptions, though these results are not always statistically significant. I find a statistically significant adverse effect of low autonomy over work hours on women's mental health under all assumptions.

I conduct a number of exercises to assess robustness of my results and test potential mechanisms. My results are robust to correction for attrition bias, accounting for the role of the COVID-19 pandemic, and sensitivity to variable definitions and sample selection. I find that women who work part time experience a smaller association between work-related autonomy and mental health. I also show that the differential relationship between autonomy over hours and mental health for men and women cannot be explained by a differential reaction to having children or different occupation sorting, but may be partially explicable by the distribution of personality across sexes.

Finally, I investigate the potential for reverse causality, that is, whether a deterioration in mental health, holding occupation and person fixed effects constant, can cause decreases in work-related autonomy. Reverse causality could happen if workers who experience adverse mental health

shocks choose to switch to low-autonomy jobs, or if firms impose lower levels of autonomy on workers who experience negative mental health shocks. On the first point, I restrict my sample to those who do not change employer, and show that the estimated associations are similar. Thus, it is unlikely that my results are driven by workers switching employers to change their work-related autonomy as a result of changes in mental health. One interpretation of this result is that workers with poor mental health do not necessarily desire lower levels of autonomy. On the second, I argue that it is unlikely that employers systematically reduce the autonomy of workers with poor mental health because UK employment law requires changes in working conditions to accommodate mental illness which are as likely to *increase* work-related autonomy as decrease it. Finally, if working conditions respond to mental health, then controlling for lagged mental health would significantly attenuate the estimated association. In fact, the attenuation from controlling for lagged mental health is small.

My results suggest that short- and medium-run trends in working conditions in the UK could have important implications for mental health. Firstly, in the public sector, currently composed of 5.8 million employees,[2] work practices have tended towards tighter supervision and greater use of performance targets (Le Grand 2003). Secondly, a shift in the industrial composition of the UK economy has increased surveillance of employees. For example, there has been a large increase in employment in call centers, where high levels of monitoring are used to increase productivity (Bain and Taylor 2000, Burgess and Connell 2004). My results suggest that both of these trends might be associated with adverse population-level effects on mental health outcomes.

On the other hand, more recently, the COVID-19 pandemic led to a large increase in remote and hybrid working, with almost half of UK workers working remotely at the height of the pandemic, and a majority of them continuing to work either hybrid or remotely.[3] Remote working could increase one's work-related autonomy. One has more control over the exact

[2] `https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/publicsectorpersonnel/bulletins/publicsectoremployment/september2022#public-sector-employment-data`

[3] `https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/ishybridworkingheretostay/2022-05-23`. Hansen, Lambert, Peter, Bloom, Davis, Sadun, and Taska (2023) also document an uptick in rates of employment opportunities offering remote or hybrid work across English-speaking countries since the pandemic.

environment in which one works, and may have increased flexibility over when one works. On the other hand, adaptations to working practices since 2020 have seen employers regain some control with additional surveillance (Aloisi and De Stefano 2022). To the extent that the shift to remote working engenders a permanently higher level of work-related autonomy, my results suggest that we may find remote working is associated with better mental health.

Finally, the rise of the "gig economy" (Woodcock and Graham 2019) could increase or decrease average employee autonomy. On the one hand, there is an increase in a worker's autonomy about exactly when to do work. On the other hand, conditional on accepting a job, the specific online platform may dictate the manner and pace of work. The contrast illustrates the importance of differentiating between various dimensions of autonomy.

My research contributes to a growing literature which relates working conditions to health outcomes (Ravesteijn, Kippersluis, and Doorslaer 2018, Michaud and Wiczer 2018), including mental health (Jolivet and Postel-Vinay 2020). I contribute to this literature in three ways. Previous literature has linked work-related autonomy to outcomes other than mental health such as life satisfaction (Coad and Binder 2014), and mood (Johannsen and Zak 2020), estimated the association within particular occupations such as civil servants (Stansfeld, Fuhrer, Head, et al. 1997, Stansfeld, Fuhrer, Shipley, et al. 1999), estimated the effect of "skills and discretion", a variable which includes aspects of autonomy but also features such as task complexity (Belloni, Carrino, and Meschi 2022), and investigated the effect of delayed retirement for women working in a job with low control over decisions (Carrino, Glaser, and Avendano 2020). My research estimates the relationship between work-related autonomy and mental health using a representative sample of the working-age population. The closest paper to mine is Bently et al. (2015) who estimate associations between work control and mental health outcomes in a representative sample of the Australian population. I replicate their result in a new context (the UK) and build on their research by using Oster's (2019) methodology, which allows me progress beyond associations to bound causal effects under some assumptions.

Secondly, where most previous literature has used a single overall summary measure of workplace autonomy, my data allow me to disaggregate overall work-related autonomy into 5 areas

and show which are most important. Thus, I provide a more nuanced analysis of the relationship between work-related autonomy and mental health. This contribution is important in light of psychological research which suggests that different forms of autonomy may have different effects on well-being (Kubicek, Paškvan, and Bunner 2017).

Thirdly, I demonstrate that there is significant within-occupation variation in work-related autonomy and exploit variation within occupations. The majority of previous research exploits variation across occupations (e.g., Carrino, Glaser, and Avendano 2020), occupation-specific trends (e.g., Belloni, Carrino, and Meschi 2022), or variation within one specific occupation which may not generalize to the wider population (e.g., Stansfeld, Fuhrer, Head, et al. 1997, Stansfeld, Fuhrer, Shipley, et al. 1999). My data allow me to control for occupation fixed effects which avoids confounding with other occupation-specific characteristics.

This paper also relates to a literature estimating the value that workers place on flexibility about when they work. Employees are often found to place high value on flexibility over working hours (Mas and Pallais 2017, He, Neumark, and Weng 2021) and it is associated with higher workplace satisfaction (Lyness et al. 2012). Greater flexibility over when one works has also been linked to greater productivity in some contexts (Chen et al. 2019), which may enhance work satisfaction. To my knowledge, I am the first to assess the effect of autonomy over work hours on mental health. I contribute to this literature by showing that greater autonomy over work hours is related to overall mental health amongst women. This finding suggests that women may value flexibility over hours because of its beneficial effect on their mental health. On the other hand, it suggests that men's preferences for flexibility over hours does not relate to an effect on mental health.

Goldin (2014) finds that selection into jobs with greater flexibility over hours contributes substantially to the gender wage gap; divergence in wages between genders increases in the presence of children, and can be partially explained by women's preference for work which is less "greedy" (Goldin 2021), i.e., offering greater flexibility of working hours. I contribute to this literature by showing that while it is plausible that women experience beneficial mental health effects from greater autonomy over hours, it is unlikely that this effect is driven by the

presence of children (i.e., the association is not attenuated amongst women who do not have children). This results implies that women's preference for more flexible hours when they have children is not reflected in an effect on mental health.

This paper proceeds as follows: section 2 describes key features of the data, and sample construction. Section 3 investigates associations between work-related autonomy and mental health. Section 4 builds on these associations, using Oster's (2019) method to bound causal effects. Section 5 explores robustness of my baseline results to alternative variable definitions, samples, and attrition bias, and explores potential mechanisms driving my results. Section 6 discusses the potential for reverse causality, and argues it is unlikely to be a major driver of results. Section 7 discusses implications and concludes.

2 Data

I use Understanding Society data, a large, representative, panel data set of the UK population. The data cover the years 2009–2021. Respondents are surveyed annually. The data provide information about labor market outcomes and history, health outcomes (including mental health), demographic characteristics including race, gender, marital status, and education. The data include very detailed information about a person's work-related autonomy, but respondents are only asked about work-related autonomy in even waves. There is roughly 5% sample attrition between waves, and new respondents are recruited in order to maintain the representativeness of the survey.

Mental health variables

I consider two summary measures of mental health: the GHQ12 caseness and the SF12 mental health index.

The GHQ12 caseness score is constructed from the general health questionnaire. Respondents are asked 12 questions about their current mental health symptoms, which are scored from 1 (best) to 4 (worst). The caseness score is the number of symptoms on which a person scores 3 or higher (McCabe et al. 1996). It ranges from 0 to 12, with higher numbers indicating worse

mental health symptoms. The GHQ12 caseness score has been used in various contexts to screen for mental illness (e.g., Gureje and Obikoya 1990, Anjara et al. 2020) and to measure mental health in economics research (e.g., Gathergood 2013, Belloni, Carrino, and Meschi 2022).

The SF12 mental health index is a summary of mental health status derived from the SF12 questionnaire. The SF12 involves a more comprehensive series of questions about health status. The scoring system applied to the answers gives a total mental health score which ranges between 0 (the worst possible mental health) and 100 (the best possible mental health) (Jenkinson and Layte 1997). The SF12, like the GHQ12 caseness score, is used as a screening measure for mental health problems (Kontodimopoulos et al. 2007, Tibubos and Kröger 2020), and has been used previously by economists studying mental health (e.g., Davalos and French 2011, Wallace, Nazroo, and Bécares 2016, Jolivet and Postel-Vinay 2020).

The individual questions relating to each mental health measure and scoring system for the SF12 mental health measure are shown in Appendix A. Both measures are intended to capture mental health, broadly defined. There is a -0.66 correlation between the two measures, suggesting significant overlap. However, the GHQ12 caseness covers a larger range of symptoms than the SF12, such as the effect of mental health on sleep and ability to concentrate. On the other hand, the scoring system for the SF12 places different weights on different aspects of mental health. For example, moving from the best score for self-reported energy to the worst score causes a reduction in the SF12 mental health index of 6.02, but moving from the best score for feeling calm and peaceful to the worst score causes a 10.19 reduction. Differences in the results using different measures of mental health can therefore be attributed to the fact that they measure a different but overlapping set of symptoms, and place different weights on those symptoms. Results which show an effect on the GHQ12 caseness but not the SF12 are likely to be related to especially large effects on concentration, sleep, feeling useful, feeling capable of making decisions, feeling unable to overcome difficulties, feeling unable to enjoy day-to-day activities, feeling unable to face problems, losing confidence, and thinking of oneself as worthless. Results which show an effect on the SF12 index but not the GHQ12 caseness are likely to be related to especially large effects on levels of energy, non-participation in social activities, and lack of care

in performing activities. Both measures capture feelings of strain or tension and self-reported happiness.

Work-related autonomy

I construct a set of binary variables which describe the autonomy a person has at work across several dimensions. I use binary variables because using controls with non-binary independent variables can bias OLS estimates (Goldsmith-Pinkham, Hull and Kolesár 2021).[4]

The Understanding Society data set has five questions about work-related autonomy, asked in waves 2, 4, 6, 8, and 10. The questions are as follows:

1. In your current job, how much influence do you have over what tasks you do in your job?
2. In your current job, how much influence do you have over the pace at which you work?
3. In your current job, how much influence do you have over how you do your work?
4. In your current job, how much influence do you have over the order in which you carry out tasks?
5. In your current job, how much influence do you have over the time you start or finish your working day?

The respondent is asked to choose between one of four answers: "a lot", "some", "a little", or "none".

I construct 6 autonomy variables as follows: for each autonomy question, I score a person-wave observation as 1 if they report having "a little" or "none" of this kind of autonomy, and 0 otherwise. This procedure yields 5 autonomy variables which relate to different aspects of autonomy that one might have at work. I then construct an overall autonomy variable, which acts as a summary of the amount of work-related autonomy a person has. This variable is 1

[4]Goldsmith-Pinkham, Hull and Kolesár (2021) show that if a treatment takes more than two values (i.e., more than "treated" and "untreated") and is randomly assigned conditional on controls, then regressing the dependent variable of interest on the treatment with controls does not necessarily uncover the causal effect of the treatment on the dependent variable. If, however, treatments can be measured in a binary fashion, one can recover estimates with a causal interpretation.

if a person answers "a little" or "none" to three or more of the autonomy questions, and zero otherwise.[5]

One important concern about using self-reported autonomy is justification bias, where respondents report low work-related autonomy as an explanation for their poor mental health. While, to my knowledge, there is no good test for this concern, there are three reasons to think my results are not entirely driven by justification bias. Firstly, to the extent that we can test the self-reported measures against more objective measures, there are high levels of agreement. In Appendix C, I provide suggestive evidence that self-reported autonomy does reflect objective facts about jobs by showing that low average self-reported autonomy in an occupation strongly associates with occupational characteristics which indicate low levels of autonomy (from the O*NET data set). Secondly, some research has shown that the order in which questions are asked affects the degree of justification bias (Black, Johnston, and Suziedelyte 2017): if respondents are asked about their mental health first, then their frame of mind may be affected so that they are minded to answer other questions so as to justify their previous answer. In fact, the survey asks mental health questions after the questions about working conditions. This ordering likely decreases the extent of justification bias. Thirdly, some questions about work-related autonomy (e.g., autonomy over the way in which one does their work) might be considered more subjective than others (e.g., autonomy about tasks or working hours, which are likely expressed to some degree in someone's employment contract). If my results reflected justification bias, we might expect to see larger associations between mental health outcomes and more subjective aspects of work-related autonomy. However, my results do not uniformly exhibit this pattern.

Control variables

I use a number of control variables to assess the degree of confoundedness of the relationship between mental health and work-related autonomy. I control for age at last birthday. This

[5] I assess whether results are robust to using cutoffs of one, two, four or five in appendix E (Table E1). My results are broadly consistent with my main results (Tables 3 and 4). Across all estimates, having low autonomy is associated with worse mental health, however low autonomy is defined. Furthermore, adding in new controls does not radically change any of the estimates, which is also consistent with the results in the text. In Appendix D, I assess whether redefining the individual dimensions of work-related autonomy so that a person has low autonomy only if they report having "none" over a particular aspect of work. Again, results are broadly consistent. See Section 5 for further details.

variable is important since both mental health and job experience can vary over the life cycle. The survey reports education as the highest qualification a person has received, and marital status as married, never married, divorced, or in a civil partnership. Both education and marital status are potentially correlated with both working conditions and mental health. I control for both of these variables with a full set of dummies for each value they can take. The occupation of a person's current main job is reported at the ISCO 3-digit level. Controlling for occupation means holding fixed all characteristics of jobs which vary only at the occupation level (these characteristics might include, for example, the level of physical risk or regularity of interaction with other people). Wave 3 of the Understanding Society data reports a person's score on the "big five" personality indices.[6] Personality variables may be correlated with both job choice and mental health. I assume that personality is unchanged over time and assign a person's wave 3 scores on the personality indices to all other waves in which they appear.[7] For those in work, the data report labor income. Controlling for labor income addresses the concern that high or low autonomy jobs may simply be higher or lower paying. I use log labor income expressed in 2015 GBP. The survey also reports how many biological children a respondent has living with them. I use a dummy variable for whether a person has biological children living with them, since parental status can affect both mental health and the choice of job.

Sample construction and statistics

I limit the sample to those who are continuously in work (that is, report being employed in every survey wave in which they are interviewed). I make this decision for two reasons. Firstly, including those who move in and out of work could create a selection problems: if employment and mental health are jointly determined, and those entering the labor force disproportionately work in jobs with, say, low levels of autonomy, then selection into employment by mental health status could generate a spurious relationship between mental health and autonomy. Secondly, amongst those who experience periods out of work, unemployment may confound work-related autonomy if transitions from high autonomy to low autonomy are correlated with an intervening

[6] The big five personality indices are openness, conscientiousness, agreeableness, neuroticism, and extraversion.

[7] One concern may be that personality may be malleable and correlated with mental health. If so, personality variables may not be useful controls. However, my preferred specification includes person-specific fixed effects, which absorb the personality measures (imputed under the assumption they are time-invariant).

period of unemployment.[8]

I drop all observations which do not report values for any of the controls, so that any change in the point estimates and R-squared when controls are added entirely reflect the effect of additional controls and not changes in the sample. Since the autonomy variables only appear in even waves, I only use data from even waves of the survey.[9] My main sample consists of observations from even waves of people who continuously work which report a value for all control variables. I have $33,563$ person-wave observations of $9,744$ unique individuals.[10]

Panel A of Table 1 presents summary statistics for variables of interest. The GHQ12 caseness varies between 0 and 12. Its mean is relatively low, with the average person having around 1.5 poor mental health symptoms. The SF12 ranges between 0 and 75.5 in my sample (though the theoretical maximum is 100). For most of the autonomy variables, over half of people score 0 (i.e., have high autonomy). The exception is autonomy over work hours, where over half of people score 1 (i.e., low autonomy over work hours). 20% of people score 1 on the overall autonomy index, that is, they have low autonomy on three or more dimensions. Finally, since my identification strategy relies heavily on within-person variation in autonomy, I calculate the within-person standard deviation for each variable. For all variables, there remains substantial variation after person fixed effects are taken out.

In Panel B of Table 1, I present the correlation matrix for each individual component of work-related autonomy. All correlations are positive, suggesting that that jobs which offer high autonomy on one dimension offer higher autonomy over other dimensions. Low autonomy over work hours has the lowest correlations with other aspects of autonomy. The moderate correlations between different aspects of autonomy might suggest concerns about imperfect multi-colinearity leading to imprecise regression estimates. I assess this possibility by calculating Variance Inflation Factors (presented in Appendix B). In general I find the loss of precision attributed to the correlation between autonomy variables is small.

[8] Appendix G shows the results when including all observations of workers in my sample; Appendix H shows results when including observations of people who do not report personality scores.

[9] Note, however, that scores on individuals' personality variables are assigned their values in wave 3.

[10] Additionally, since lagged mental health is a control variable I exclude all observations which do not report the lagged dependent variable in each regression of that dependent variable. The sample therefore differs across dependent variables, but not across specifications for a given dependent variable.

Table 2 shows how average autonomy differs across the 15 most common occupations in my data (where occupation is defined at the 3-digit ISCO code level). These 15 occupations account for 58% of employment in my sample.[11] While levels of autonomy differ by occupation, there is clear evidence of within-occupation variation. For example, drivers have the lowest average overall autonomy. However, over 60% of them do not have low autonomy. Additionally, disaggregating autonomy over aspects of one's job reveals a more nuanced picture of work-related autonomy. While some occupations tend to have high overall autonomy, they can have low autonomy over certain aspects of work. For example, high-school teachers have relatively high overall autonomy, but have the lowest autonomy over work pace. This observation underscores the importance of assessing different aspects of work-related autonomy.

3 Association between mental health and autonomy

In this section, I estimate the relationship between work-related autonomy and mental health. I run a series of regressions of the following type:

$$\text{mental\_health}_{it} = \text{low\_autonomy}'_{it}\beta + X'_{it}\gamma + \tau_t + \mu_i + \epsilon_{it} \tag{1}$$

where i indexes individual and t indexes survey wave. Here $\text{mental\_health}_{it}$ is either the GHQ12 caseness or the SF12 index for person i at time t; low_autonomy_{it} is either my summary index measure of having low work-related autonomy, or a vector of measures of work-related autonomy for person i at time t (i.e., a dummy for whether a person has low autonomy over job tasks, a dummy for whether she has low autonomy over work pace, etc.). X_{it} is a vector of controls for person i at time t. τ_t are wave fixed effects and included in every specification. μ_i are person fixed effects, which are omitted in some specifications. ϵ_{it} is the OLS residual. β, the coefficients of interest, give the conditional association between mental health outcomes and work-related autonomy.

Tables 3 and 4 show the results of these exercises, separately for men and women. In each

[11] I have calculated similar statistics for every occupation in the sample and they are available upon request.

specification, I control for wave fixed effects. The first and fifth columns show the association between a measure of low work-related autonomy and a measure of mental health, conditional on wave fixed effects. In the second and sixth columns, I control for time-varying controls. I control for age, marital status, education, and occupation using dummy variables for each possible value the variable can take. I include a dummy variable for whether a person has biological children living in the household. In the third and seventh columns I control for person fixed effects, leveraging within-person variation in autonomy and mental health. In the fourth and eighth columns I add controls for all individual-level time-varying confounders.

Before discussing the results in Tables 3 and 4, it is informative how point estimates change when controls are added. Therefore, to complement Tables 3 and 4, Figures 1 to 8 show in detail how point estimates on the low work-related autonomy variables and the R-squared change as additional variables are included as controls. Some specifications exclude person fixed effects but control for variables which vary at the individual level but not over time, such as personality. The results from these specifications indicate which individual characteristics are important in explaining mental health, e.g., if the estimates are attenuated to a large extent and the R-squared increased by the inclusion of an individual-level control, then this result suggests that workers in low autonomy occupations are selected on this variable. I control for personality variables using dummy variables for each possible value the variable can take. I control for labor income using the log of real labor income. Once education, marital status, and age are controlled for, including labor income does not lead to a large increase in the R-squared.[12] Person fixed effects absorb large percentages of the variation in the dependent variable, absorbing notably larger percentages of variation than variables such as personality, occupation and lagged mental health.[13] Notably, there does not appear to be large degrees of selection on any observable

[12]Labor income might be considered an endogenous, or post-determined variable (i.e., affected by both mental health and work-related autonomy). Controlling for post-determined variables, or "colliders", can bias estimates (Elwert and Winship 2014). Although specifications which include labor income as a control should not be interpreted as causal, I include labor income as a control in some specifications for two reasons. Firstly, when using autonomy as a predictive variable, it can be useful to include endogenous controls in order to test whether autonomy provides additional information beyond these controls. Secondly, it can be informative how the coefficient on autonomy changes as labor income is included as a control. In the estimates studied here, the fact that there is a small change in the R-squared and only a small change in the coefficient when labor income is included as a control might suggest that income has small additional explanatory power over mental health compared to work-related autonomy. This observation is consistent with the idea that observed mental health gradients in income may in fact by explained by differences in working conditions across income categories.

[13]Note that while I assess sensitivity to controlling for lagged mental health, I do not control for lagged mental

variables.

Lower overall autonomy is associated with worse mental health in all specifications. For men, moving from a high autonomy job to a low autonomy job is associated with an increase in the GHQ12 caseness score of around 0.44, and a decrease in the SF12 index of around 1.8. For women, the corresponding results are around a 0.51 increase in the caseness score and a 1.3 reduction in the SF12 index. Including controls generates a large increase in the R-squared, but comparatively small changes in the coefficients. My preferred specification is in column 4 of Tables 3 and 4 and includes person fixed effects, wave fixed effects and controls for education, marital status, occupation, and having children.[14] In this specification, I leverage within-person, within-occupation variation in work-related autonomy. The estimated association remains statistically significant. The corresponding estimated associations are an increase in the caseness score of 0.41 and 0.397 for men and women, respectively, and a reduction in the SF12 index of 1.3 for men and 0.96 for women. Note that for my preferred specification, the estimated associations are all between 0.1 and 0.15 of a standard deviation of the dependent variable. The associations are therefore of a comparable magnitude whether the GHQ12 caseness or the SF12 are used.

Turning to specifications which examine different aspects of autonomy, low autonomy over job tasks associates significantly with worse mental health in most specifications, with the exception of the SF12 index for men (where is it only significant at the 10% level). This result suggests an association with symptoms of mental illness present in the GHQ12 caseness measure but not measured by the SF12 index.[15] This result is robust to various control sets. Low autonomy over work pace is consistently associated with worse mental health for men, but is attenuated by controls and is only significant at the 10% level in my preferred specification for women.

health in my main specification which includes person fixed effects. This is because controlling for person fixed effects and lagged dependent variables can lead to bias in OLS estimators (Nickell 1981).

[14] I do not include labor income in my preferred specification, because one may argue that it is a post-determined variable (see footnote 12). Including labor income as a control in my preferred specification, I estimate coefficients on the low autonomy variable of 0.411 (0.00) for men using the GHQ12 caseness, 0.371 (0.00) for women using the GHQ12 caseness, -1.23 (0.00) for men using the SF12 index, and -0.884 (0.00) for women using the SF12 index (p-values are in parentheses). Including labor income would therefore not affect my conclusions significantly. While education is explained to a large degree by person-fixed effects, around 5% of my sample changes their education (likely by gaining a new qualification) at some point during the panel. Education is therefore not perfectly explained by person fixed effects.

[15] See section 2 for a discussion of these symptoms.

In my preferred specification, women's mental health is significantly associated with autonomy over work hours. However, the association between low autonomy over work hours and worse women's mental health is only statistically significant when both person fixed effects and time-varying controls are included. This pattern indicates that women in jobs with low autonomy over work hours are selected for time-varying factors correlated with worse mental health. For low autonomy over work manner, point estimates always imply an association between low autonomy and poor mental health, but the association is not generally statistically significant in my preferred specification.

My results confirm a robust relationship between work-related autonomy and mental health. Specifically, exploiting within-person, within-occupation variation in work-related autonomy with controls for marital status, education, having biological children, and age, lower work-related autonomy is associated with worse mental health. Notably, in many cases, the addition of controls does not attenuate the relationship to a large degree, despite a large increase in the R-squared.

4 Towards causal effects

The robust associations between mental health outcomes and autonomy are consistent with low work-related autonomy causing worse mental health. However, it is possible that there are unobserved confounders which explain the association. There are multiple possible selection effects, many of which I am able to control for. Work-related autonomy is a non-pecuniary amenity which may be offered only to higher productivity workers, or workers may otherwise select into high autonomy jobs based on personality traits or preferences. Both of these mechanisms are addressed by the use of person fixed effects. Secondly, reductions in work-related autonomy may be correlated with reductions in economic security or downward mobility, i.e., periods of unemployment or lower status jobs. I partially address this concern by estimating effects in a sample of people who continuously work, and controlling for occupation fixed effects which may capture a subset of internal promotions and demotions. Additionally, in section 6, I restrict my sample to only those who never change their employer, and find similar results.

Thirdly, changes in family composition may be closely correlated with job choice and mental health. I control for this explicitly with variables for having children and marital status. A final source of bias I can address is occupation-level changes which might be correlated with autonomy. A particular industry may experience regulation, technology and practices which drive both autonomy and other working conditions. My use of occupation fixed effects allows me to account for this concern.

Any remaining confounders therefore have the following properties: they differ within individuals across time; they are not closely correlated with changes in family composition; and they are idiosyncratic to broader occupational characteristics. Crucially, where coefficients are relatively stable across specifications, my results indicate that remaining confounders are not particularly highly *correlated* with my controls. Candidate examples of confounders which might explain my estimates include the profitability of a company, which might cause employers to change working conditions and also may be correlated with worsening mental health of employees as they fear losing their jobs. There may be other time-varying characteristics of individuals such as substance use, or time-varying preferences, which are correlated with both mental health and the type of job a person does.

In the absence of clearly exogenous variation in a person's work-related autonomy, I use Oster's (2019) method of deriving the causal effect of a treatment under assumptions about the behavior of confounders. Oster shows that under assumptions about the explanatory power of remaining (unobserved) confounders, and the correlation of those confounders with the treatment variable of interest, one can uncover the omitted variable bias in the OLS estimator with only observed confounders. By defining a reasonable range of assumptions, one can then place bounds on the likely causal effect.

Specifically, let A be the treatment of interest (in this case, a measure of work-related autonomy), W_1 be a projection of mental health onto the observable controls, and W_2 be a projection of mental health onto unobserved confounders. Then given:

1. An assumption about the R-squared which would obtain in a regression with controls for all confounders (the R^2_{MAX}), and

2. A parameter, δ, which describes how similar the relationship between the treatment and unobserved confounders is to the relationship between the treatment and existing controls:

$$\delta = \frac{COV(A, W_2)/VAR(W_2)}{COV(A, W_1)/VAR(W_1)} \tag{2}$$

Define:

$$\hat{\beta} - \nu(\delta, R^2_{\text{MAX}}) \rightarrow \beta \tag{3}$$

where $\hat{\beta}$ is the OLS estimator with observable controls, β is the true treatment effect, and ν is the bias due to ommitted variables.

ν is a function of δ and R^2_{MAX}. Conditional on δ and R^2_{MAX}, ν is greater the more inclusion of observable controls attenuates the coefficient on the treatment, and smaller the more those same observable controls increase the R-squared. Intuitively, if observable controls move the OLS coefficient by a small amount despite a large increase in the R-squared, additional controls which behave similarly to observable controls would lead to a small additional change in the OLS coefficient for a given R-squared increase.[16] I use the $\hat{\beta}$ estimated using the richest OLS regression, including controls for person fixed effects, occupation dummies, education and marital status dummies, and wave fixed effects.

This method provides a mapping from our assumptions about how unobservable confounders behave to the causal effect of interest. It is a formalization of the idea that if there are few additional confounders, and if they are confounding to the same degree as, or less than, the existing controls, then the causal effect is close to the OLS estimate; on the other hand, as the number of unobservable confounders increases, and the correlation between the unobservable confounders and the treatment is high, then the true causal effect will tend to be very different

[16] ν is the root of a cubic function of R^2_{MAX}, δ, $\hat{\beta}$, the R-squared of a "short regression" of the dependent variable on the treatment, the coefficient on the treatment in this short regression, the variance of the dependent variable, the share of the variance of the treatment which is explained by existing controls, and the variance of the treatment. If there is more than one real root of the equation, Oster proposes selecting solutions based on the sign of $-\nu$, i.e., if one assumes that additional confounders have a correlation with the treatment which has the same sign as the correlation between the treatment and the observable controls, $-\nu$ has the same sign as the difference between $\hat{\beta}$ and the OLS estimator of the short regression. If there are multiple real roots which meet this criterion, she suggests selecting the smallest root in absolute terms.

to the OLS estimate.

I set values of δ equal to -1.3, -1.1, -0.9, 0.9, 1.1, and 1.3. $-1 \leq \delta \leq 1$ corresponds to the assumption that unobservable confounders are not more important sources of selection bias than those I have already controlled for (Altonji, Elder, and Taber 2005).[17] Although setting $\delta = 1$ might seem to be a natural choice, corresponding to the assumption that additional confounders are as correlated with the treatment as observable controls, Masten and Poirier (2022) show that there can be an asymptote in ν at $\delta = 1$. I therefore exclude 1 (and -1) from the set of values of δ I consider. Setting a positive δ corresponds to the assumption that unobserved confounders push the coefficient in the same direction as the observed confounders, while setting δ to be negative corresponds to the assumption that unobserved confounders push the coefficient in the opposite direction. The majority of research which uses this method (e.g., Aizer, Devereux, and Salvanes 2022, Egan, Matvos, and Seru 2022) assumes $\delta > 0$, i.e., selection on unobservables is in the same direction as selection on observables. However, since in section 3, I find evidence of positive and negative selection on observables, I allow for both positive and negative values of δ.

The R^2_{MAX} corresponds to the maximum percentage of the variation in the dependent variable which can be explained by a combination of the treatment and all of its confounders. By definition the most conservative assumption is $R^2_{\text{MAX}} = 1$. This assumption corresponds to the claim that mental health is fully explained by the treatment and confounders. It is therefore a very extreme assumption. Instead, Oster (2019) recommends setting R^2_{MAX} equal to the R-squared of the regression with all observable controls scaled by a factor greater than 1. Specifically, she suggests a ratio of 1.3.[18] I vary the R-squared ratios between 1.1 and 1.3, in order to explore how important this assumption is for conclusions about the causal effect.

I present estimated causal effects of low autonomy on the GHQ12 caseness and the SF12

[17] I calculate the value of δ implied by observable controls in my main regressions. I derive estimates between 0.16 and -0.35. Thus, 1 and -1 appear to be extreme values of δ in my setting.

[18] A ratio of 1.3 is relatively extreme. Oster (2019) shows that using the data from randomized controlled trials published in top 5 journals, applying this procedure with a maximum R-squared equal to 1.3 times the R-squared of a regression of the outcome variable on all observables and a δ coefficient of 1 would be sufficient to conclude that the causal effect is confounded in 10% of cases. Several studies use 1.3 as the ratio of the maximum R-squared to observed R-squared (e.g., Bursztyn et al. 2020, Campos-Mercade et al. 2021, Aizer, Devereux, and Salvanes 2022, Egan, Matvos, and Seru 2022).

index under different assumptions about selection on unobservables (δ) and the maximum R-squared for men and women in Tables 5 to 8. My assumptions about the maximum R-squared are multiples of the R-squared of my preferred specification (including wave fixed effects, education and marital status fixed effects, occupation fixed effects, person fixed effects, and having biological children in the household). Therefore, because the R-squared of the models which use the SF12 as a dependent variable are larger, the max R-squared assumption for the causal effect of autonomy on the SF12 measure is larger. Standard errors are calculated through block bootstrapping.[19]

I present a range of different assumptions, some of which are relatively extreme: although I show results with $\delta = 1.3$ and $\delta = -1.3$ a less conservative assumption is that $-1.1 \leq \delta \leq 1.1$, which implies that unobserved confounders have less than 10% more covariance with the treatment than observed confounders in absolute terms. I therefore analyze the range of causal effects which exist under the assumption that $-1.1 \leq \delta \leq 1.1$, before discussing the implications of relaxing the range of assumptions to $-1.3 \leq \delta \leq 1.3$.

Under the assumption that $-1.1 \leq \delta \leq 1.1$, there is a causal effect of low overall work-related autonomy on the GHQ12 caseness for both men and women. There is a causal effect of low autonomy on the SF12 unless $\delta \geq 1.1$ and unobservable confounders explain an additional 30% of the variation in the SF12 compared to the most saturated regression. In all cases, low overall autonomy leads to worse mental health. Having a job which scores low on autonomy on three or more dimensions causes between 0.38 and 0.43 additional mental health symptoms (the GHQ12 index) and a decline of between 0.6 and 1.5 on one's SF12 mental health score for men; for women, it causes between 0.27 and 0.45 additional mental health symptoms and a decline in their SF12 score of between 0.56 and 1.1. As one takes an extreme view that the unobserved confounders could be as much as 30% more correlated with the treatment than the observed confounders, then the range of potential causal effects increases. However, even under these assumptions, I find a statistically significant effect of overall low autonomy on men's GHQ12 scores, of between 0.37 and 0.43, and an effect of overall low autonomy on women's GHQ12 scores of between 0.36 and 0.46.

[19] I use a block bootstrap which samples unique individuals. I use 1000 draws.

For individual components of the autonomy index, I again assess the existence of causal effects under the assumption that $-1.1 \leq \delta \leq 1.1$. Overall, results are significantly less robust for individual components of autonomy. For men, low autonomy over job tasks, work manner, and task order causes a worsening of mental health under all assumptions, but these effects are not generally statistically significant under the assumption of an R-squared of 30% higher than in my preferred regression and a δ coefficient of 1.1. The effect of low autonomy over work hours on men's GHQ12 caseness score has an inconsistent sign and is not statistically significant under the assumption of a negative δ. For women, there is an adverse effect of low autonomy over job tasks on women's mental health except when $\delta \geq 1.1$ and the R-squared is 30% higher than in my preferred specification (for the SF12). There is an adverse causal effect of low autonomy over work hours on women's mental health as measured by the GHQ12 caseness and the SF12 index. The effect is an increase of between 0.16 and 0.48 symptoms of mental illness and a decline of between 0.43 and 1.6 on the SF12 index. This result is robust to loosening the bounds on δ to 1.3 and -1.3, but the range of causal effects increases to between a 0.16 and 0.64 increase in symptoms of mental illness and a decline of between 0.23 and 2.2 on the SF12 index.

In order to summarize the range of results the Oster correction supports, in Figure 9 I plot bounds under different assumptions for each dependent and independent variable. The black circles and green triangles can be understood as bounds under the assumption that $|\delta| \leq 1.1$ and the R-squared ratio is less than 1.3. In addition, the red horizontal lines relax the assumption on the δ to $|\delta| \leq 1.3$. Finally the error bars, represented by the black vertical lines, plot out the range of values which are within the 95% confidence interval for some assumption about the δ and the R-squared.

To give a sense of the relative magnitude of my results, unemployment has been estimated to increase the GHQ12 caseness by 0.87 (Gathergood 2013). Rose (2020) finds that the short-run effect of retirement on mental health is a decrease of around 0.06 in the caseness score. This suggests that the effect of low overall autonomy could be as large as half the effect of unemployment on mental health, and somewhat larger than the effect of retirement. Wallace, Nazroo and Bécares (2016) estimate an effect of racial discrimination on the SF12 index of -1.96,

and an 8.26 decline for multiple exposures. My estimated effects are much smaller. Turning to other studies investigating the effects of working conditions, Belloni, Carrino, and Meschi (2022) find that the effect of a one-standard deviation increase in the "skills and discretion" index on the caseness is a 0.078 decrease for women. My estimates imply a slightly larger effect of 0.08 for women.[20] They find an insignificant effect of skills and discretion on men's mental health. The skills and discretion index is the closest variable to work-related autonomy in their paper, but we should not expect their estimates to map precisely to mine: skills and discretion include features of work other than autonomy, such as the opportunity to carry out complex tasks. Additionally, Belloni, Carrino and Meschi (2022) exploit occupation-level changes in skills and discretion amongst those who never change occupation, so it is possible that a local treatment effect in a differently selected population will lead to a different estimate.

Overall, my results suggest that an adverse causal effect of low work-related autonomy on mental health exists under a reasonable range of assumptions about unobservable variables. The magnitude of the effect could be as large as half the magnitude of the effect of unemployment on mental health. Autonomy over job tasks and, for women, work hours appear to be the most important dimensions of autonomy for mental health.

5 Robustness tests and mechanisms

I assess the robustness of my baseline results to different sample restrictions and variable definitions.

Appendix D re-estimates my main results with a different operationalization of my main work-related autonomy variables: for this set of estimates, I define a person as having low autonomy over a particular aspect of work if they report having "none" of this kind of autonomy. My method of combining individual aspects of work-related autonomy together is unchanged, i.e., a person has low overall work-related autonomy if they have low autonomy over three or more aspects of work. My results are consistent with the results in my main specification: there is a

[20] I calculate this effect by multiplying my lowest estimated treatment effect by the standard deviation of the autonomy index, 0.40.

consistent association between low work-related autonomy and worse mental health, which is reasonably stable as new controls are added. One important caveat is that for this measurement of work-related autonomy there is no statistically significant association between low autonomy over work hours and women's SF12 scores in my preferred specification.

Appendix E shows how associations between mental health and low overall autonomy depend on the definition of this variable. I re-estimate the association between low overall work-related autonomy and mental health, separately for men and women, where low overall work-related autonomy is defined variously as as having low autonomy across one, two, four, and five dimensions of autonomy. Across all estimates, low work-related autonomy is associated with worse mental health. Adding controls has a small effect on estimates.

Appendix F explores how using Principal Component Analysis (PCA) to define my overall autonomy index affects the results. The drawback of using PCA is that Principal Components are typically continuous variables (see footnote 4). However, using PCA serves as a useful robustness test. I scale the first Principal Component to have the same variance as my overall work-related autonomy variable. Although the resulting point estimates are larger in absolute terms, they show a similar overall pattern to my baseline results.

Appendix G reports results of the same analysis but on a larger sample, including all observations of current workers instead of those who continuously work. I derive similar point estimates for regressions which include the full set of controls, but controls play a larger role in reducing the association. This suggests that while entry and exit from different types of work by workers with different amounts of mental health symptoms generates greater associations between mental health and work-related autonomy, a greater portion of this variation can be explained by controls.

Finally, in Appendix H, I re-estimate my baseline results in a larger sample which includes observations of people without responses to the personality variables (i.e., those people not in wave 3). Including these observations increases the sample size significantly, to over 17,000 for men and over 18,000 for women. However, the results show a consistent pattern with my baseline results, and the point estimates are very close.

5.1 Attrition bias

Attrition is significant in my data set. A person attrits after within two waves withing being observed with 18.5% probability. One may therefore be concerned about bias being introduced if attrition is correlated with mental health.

In order to address this concern, I follow others (e.g., Heller-Sahlgren 2017) in using inverse-probability weighting to correct for attrition bias. This procedure weights the sample by the inverse of the probability of them appearing in the sample, i.e., it increases the relative weight given to those who would be likely to attrit. This procedure corrects for attrition bias under the assumption that these variables explain the portion of attrition which is correlated with treatment (Wooldridge 2002).

To estimate the probability that a person attrits, I model the probability of attrition as a probit model of age, sex, education dummies, marital status, labor income, having children, personality types and occupation at a one-digit level.[21] In order to re-estimate my results with inverse probability weighting, I have to drop wave 2 from the sample, because by definition I cannot observe who would be in wave 2 if they had not attritted. Changing the sample necessarily affects the point estimates slightly. I then re-estimate my preferred specification for all measures of autonomy, men and women, and both measures of mental health, both with and without inverse probability weighting.

I include the results as Table 9. Note that in general, the inverse probability weighted measures of average mental health are not notably different, suggesting that the sample does not strongly select on mental health. Inverse probability weighting does not affect point estimates by a large amount. Additionally, it does not push point estimates in a uniform direction (i.e., some of the inverse probability-weighted estimates are closer to zero and some are not). These results suggest that attrition bias is likely to be small and likely does not overturn my results.

[21] Note that I do not control for person fixed effects since parameters in non-linear regression are not consistent unless the sample size grows at a faster rate than all parameters as the sample size increases.

5.2 The COVID-19 pandemic

As I have previously alluded to, the salience of work-related autonomy may have increased during the COVID-19 pandemic, as many employees used the opportunity to work from home. The relationship between work-related autonomy and mental health may therefore be mediated by the pandemic.

One potential concern is that the COVID-19 pandemic may be an omitted variable which biases my estimates. Since I include wave fixed effects which control for time-varying factors, this effect is unlikely to have a significant effect on my estimates.

Another possibility is that the relationship between mental health and work-related autonomy may have changed during the period of the pandemic. In order to assess this possibility, I re-estimate my preferred specification and interact work-related autonomy with a dummy for the pandemic and post-pandemic period:

$$\text{mental\_health}_{it} = \text{low\_autonomy}'_{it}\beta + \mathbb{1}(\text{year} > 2019) \times \text{low\_autonomy}'_{it}\alpha + X'_{it}\gamma + \tau_t + \mu_i + \epsilon_{it} \quad (4)$$

β is the association between mental health and work-related autonomy in the period before 2020, and α is the difference between association in the period after 2019 and the period before 2020. Other terms have the same interpretation as in equation 1.

Table 10 presents estimated β and α parameters. The associations between low overall autonomy and mental health in the period before 2020 are similar to the estimates in my preferred specification. The estimates of the difference between the association after 2019 are imprecisely estimated, and do not have a uniform sign, i.e., I cannot say whether the association between mental health and low work-related autonomy was stronger or weaker after 2019.

5.3 Part-time work

It is possible that the association between work-related autonomy and mental health might depend on the number of hours worked: part-time workers may experience a different relationship between work-related autonomy and mental health. For men, I do not have the statistical power

to assess this possibility: less than 5% of men in my sample work part time.

For women, I assess the possibility by re-estimating my preferred specification, interacting the autonomy variables with a dummy for part-time work (analogously to equation 4). I present the results in 11. Interaction terms are generally imprecise and not statistically significant. However, the signs are consistent with the association being smaller in absolute terms for part-time workers. For example, the association between low overall work-related autonomy and the GHQ12 caseness is 0.44 for full-time workers, and $0.44 - 0.158 = 0.282$ for part-time workers. These results are consistent with work-related autonomy having a smaller effect on mental health for workers who work fewer hours (i.e., have less exposure to low work-related autonomy).

5.4 Explaining divergent results for autonomy over working hours for men and women

A stylized result of this research is that low autonomy over work hours has an association with worse mental health for women, and this result is plausibly causal, but that this does not hold for men. One important rejoinder is that this results does not hold in all robustness tests: for example, when I redefine low autonomy as referring only to a situation where the level of autonomy is "none", I do not estimate a statistically significant negative association between low autonomy over work hours and women's SF12 scores. Additionally, when I drop wave 2 in order to estimate the inverse-probability weights, the association reduces and is only statistically significant at the 10% level for the GHQ12 caseness. These observations should temper our certainty about these results.

It is nevertheless important to test whether there are any good explanations for why women and men respond differently to autonomy over work hours, since these explanations could be informative about the likely mechanisms.

One possibility is that autonomy over work hours is more valuable for part time workers, and women are more likely to work part time. However, the results presented in Section 5.3 suggest that the association between autonomy over work hours and mental health is *smaller* when

women work part time than full time. This explanation therefore seems unlikely to explain the divergent results.

Secondly, we might reason that differing reactions to children might explain the divergent response. Drawing on Goldin (2014), we might argue that women place a higher value on flexibility over hours when children are present than men, because they perform a higher share of childcare. Work which offers high levels of autonomy over hours might be considered less "greedy" (Goldin 2021), and women's preferences for it could be reflected in an association between this autonomy and their mental health.

If this hypothesis is true, then we would expect to see significant interactions between work-related autonomy over hours and the presence of children, for women but not for men. In order to assess this, I re-estimate my preferred specifications, interacting autonomy variables with a dummy for whether the respondent has children. The interaction between autonomy over work hours and having children is small and insignificant for both women and men for both dependent variables.[22] This fact suggests that the divergent results for the association between autonomy over hours for men and women are unlikely to be explained by differences in men and women's preferences in the presence of children.

A third explanation might be differences in the distribution of personality types between men and women. For example, conscientious people might benefit more from autonomy over working hours than people who are less conscientious, and if women are more conscientious than men on average, then this might explain their divergent responses.

In order to investigate this possibility, I re-estimate my preferred specification, interacting work-related autonomy with personality scores.[23] Results are presented in Table 12. Most estimates are not statistically significant, but they suggest that agreeable people generally have a smaller association between autonomy over hours and mental health, open people generally have a

[22]The estimated interactions terms are 0.001 (1.00) for women when the GHQ12 caseness is the dependent variable, 0.357 (0.33) for women when the SF12 is the dependent variable, -0.008 (0.95) for men when the GHQ12 caseness is the dependent variable, and 0.214 (0.55) for men when the SF12 is the dependent variable. P-values are shown in parentheses.

[23]In order to keep estimates precise, I treat the personality variables are cardinal measures in this exercise. I also re-center the personality variables around their median, so that personality variables being equal to zero corresponds to a person having the median score on this personality score.

larger association, and neurotic men have a smaller association between autonomy over hours and mental health, but neurotic women have larger absolute associations. At median scores for each personality variable, having low autonomy over work hours is associated with 1.3 additional symptoms of mental illness for women, and a decline of 0.38 on the SF12 index. For men, the corresponding numbers are 0.093 and 0.31, which are smaller absolute associations. However, the associations when people have median personality scores are more similar for men and women than in my main specification, suggesting that differences in the distribution of personality explain some of the differences in the associations between autonomy over working hours and mental health for men and women.

Further, in Panel B of Table 12 I provide an "attribution" of how different personality scores contribute to differences in associations between autonomy over hours and mental health for men and women. Letting β be the association between work-related autonomy and mental health in my preferred specification, β' be the association between work-related autonomy and mental health in a specification which includes interactions between personality scores and autonomy over working hours, p be a vector of personality variables, and δ be the coefficients on the interaction terms, then:

$$\beta \approx \beta' + \delta' \bar{p} \tag{5}$$

$\bar{p}$ is the mean value of the personality scores in the sample. I use this relationship to explain why there is a larger difference in the association between autonomy over working hours and mental health between men and women in my preferred specification. We can see that the primary factor which increases the (absolute) association between autonomy over hours and mental health is women's higher than average neuroticism. On the other hand, for men there is a small reduction in the absolute association for men from the effect of neuroticism.

This exercise suggests that personality differences between men and women might partially explain why men and women experience different associations between autonomy over working hours; specifically, the differential relationship between neuroticism and the association between autonomy over working hours and mental health for men and women mechanically explains why women experience a larger association between autonomy over hours and mental health.

Finally, I assess how far different patterns of occupational employment across men and women explain differential associations between autonomy over hours and mental health. For each occupation group (at the one-digit level) I re-estimate my preferred specification among observations of people who work in that occupation group. In Table 13, I plot the results in each sample, as well as the share of employment in each occupation group for men and women.[24]

Although the estimates are relatively imprecise, the results suggest that occupation mostly does not explain the differences in associations between men and women. There are no occupation groups in which the association between low autonomy over hours and men's mental health is as high as it is overall for women in my preferred specification. On the other hand, women who are senior officials, professionals, or technicians experience associations between mental health and low autonomy over hours which are comparable or larger to the average association in my preferred specification. Finally, note that in some occupations, such as skilled agriculture and machine operators, low autonomy over work hours may be associated with *better mental health*.

Overall, therefore, it seems unlikely that the differences in the associations between low autonomy over hours and mental health for men and women are driven by differential responses to having children, occupation, or prevalence of part-time work. The differences may be partially driven by different distributions of personality between men and women.

6 Reverse causality

The previous section indicates that under reasonable assumptions about the extent of confoundedness of unobservables, a causal effect exists which links levels of autonomy at work to symptoms of mental illness. Although most researchers have theorized a causal effect of work-related autonomy on mental health, it is possible that my results reflect the opposite direction of causation: an effect of mental health on work-related autonomy. There are two plausible pathways which might drive the observed effect of poor mental health on low work-related autonomy: firstly, those in poor mental health might sort into jobs which offer low levels of workplace autonomy. This sorting would happen if the value of workplace autonomy was lower

[24]Note that women's employment in skilled agriculture is too small to identify a regression coefficient.

or even negative for people in poor mental health. Secondly, managers may respond to symptoms of mental health which are noticed or reported by reducing workers' autonomy. Reducing work-related autonomy might occur because employers believe that people in poor mental health are more productive when they have less autonomy. If either of these two dynamics are at play, they could drive within-person variation in work-related autonomy which is correlated with mental health.

One reason why it is unlikely that workers with poor mental health select into occupations with lower work-related autonomy is that if this mechanism were present, the association between low work-related autonomy and poor mental health would likely be attenuated by controlling for variables such as lagged mental health and person fixed effects. However, as I show in Figures 1 to 8, controlling for person fixed effects and lagged mental health have very small effects on the estimated association between low work-related autonomy and mental health.

To further address the concern that workers may select into low-autonomy jobs in periods when their mental health is worse, I narrow my sample to only those who never change their employer during the sample period, and re-estimate the association between mental health and work-related autonomy with a full set of controls (my preferred specification). In this specification, variation in work-related autonomy comes from changes to autonomy made by the employer, rather than workers switching employer in order to optimize their autonomy. (Workers' long-term proclivity to choose jobs with a particular level of autonomy is captured by person fixed effects.) Since in this specification, workers' scope for choosing their level of work-related autonomy is reduced, we would expect the estimated association to be attenuated if workers choose low autonomy jobs in periods when they have poor mental health. Table 14 shows the results. Point estimates are of the same sign and broad magnitude as my preferred specification in the main sample, and are not generally attenuated. It is therefore unlikely that reverse causality where workers in poor mental health move to jobs with low levels of work-related autonomy is a significant driver of my main results.

On the other hand, it may be that the estimated associations are driven by employers imposing lower work-related autonomy in periods where workers have worse mental health. Again, if

employers' adjustment of working conditions to workers mental health is not immediate, then controls such as person fixed effects and lagged mental health should significantly attenuate the observed association. The fact that the observed association is only marginally attenuated by controls therefore suggests that if employers restrict autonomy in periods when they have worse mental health, then this effect likely occurs quickly after a deterioration in mental health.

I argue it is likely that adjustments employers might be required to make in response to an employee experiencing mental illness are as likely to increase as decrease workplace autonomy. UK disability law (e.g., the 2010 Equality Act) requires employers to make "reasonable adjustments" for disabled employees, which includes employees with mental illnesses (Lockwood, Henderson, and Thornicroft 2012). Most legal guidance on what these adjustments might entail suggests adjustments such as more flexible work structures, changes in working environments which might include working from home, and a greater emphasis on specific goal-setting and feedback (Bell 2015). Except for the latter, these adjustments mostly *increase* work-related autonomy. It is unlikely that overall, employer adjustments for those with mental illness would systematically drive work-related autonomy downward. If legally mandated employer adjustments to working conditions in response to changes in mental health drive my results, then the causal effect is likely *greater* in absolute terms than the OLS estimates.

Appendix I studies the path of mental health around transitions between high and low autonomy work. If changes in mental health precede changes in work-related autonomy, then this may be evidence that changes in mental health affect work-related autonomy (Boyce and Oswald 2012). I find that, overall, most of the change in mental health when a person's work-related autonomy changes occurs in the same period as the change in working conditions, albeit there is some evidence that women's mental health improves in anticipation of improvements in work-related autonomy. However, we should be cautious in drawing conclusions about the direction of causality from this result, because the precise ordering of changes in autonomy and mental health are obscured by the two-year period between each observation.

7 Discussion and conclusion

This paper studies the relationship between work-related autonomy and mental health outcomes in the UK. I use the Understanding Society data set, which has two different summary measures of mental health and measures of autonomy which disaggregate work-related autonomy into five components.

I estimate the association between autonomy on mental health using OLS, controlling for an increasingly large set of variables. Lower levels of overall work-related autonomy are robustly associated with worse mental health, as measured by both the GHQ12 caseness and the SF12 mental health index. I find little evidence of selection on observable covariates. Amongst individual components of the autonomy index, the most robust relationships are between low autonomy over job tasks and mental health.

Secondly, I use Oster's (2019) method to investigate the causal effect of autonomy at work on mental health under different assumptions about 1) the extent of selection on unobservables relative to selection on observables and 2) the percentage of variation in the dependent variable (mental health) explained by the conjunction of the treatment, observable confounders and unobservable confounders. I argue that overall, having low overall autonomy at work likely causes an increase of between 0.38 and 0.43 negative mental health symptoms, or between a 0.59 and 1.54 reduction in the SF12 measure of mental health for men. For women, having low autonomy across 3 or more dimensions causes an increase of between 0.27 and 0.45 symptoms of mental illness and a decline in the SF12 index of between 0.56 and 1.1. Turning to specific aspects of autonomy, I find that there is an effect of having low autonomy over job tasks on mental health, and that autonomy over work hours affects women's mental health.

I explore robustness of my results to different variable definitions, different sample restrictions, and correcting for attrition bias. I also assess how far my results may be driven by the COVID-19 pandemic, finding that there is no consistent difference in association during the pandemic. I find suggestive evidence that the association between work-related autonomy and mental health is attenuated for women who work part-time. I also explore explanations for why women and men experience different associations between mental health and autonomy over hours. I find it

is unlikely to be explained by differential use of part-time work, differential responses to having children, or different occupation choices. The divergence may be partially explained by the distribution of personality types among men and women.

Finally, I discuss the potential for reverse causality. One way that reverse causality could occur is if employees in poor health are more likely to choose jobs where they have low work-related autonomy. I test for this kind of sorting by restricting my sample to only those workers who never change employers. I find results of a comparable magnitude to my main results, making it unlikely that my main results are driven by workers choosing low-autonomy jobs with new employers when they are in poor mental health. I further argue that it is unlikely that employers systematically restrict the autonomy of employees in poor mental health because the adjustments employers are required to make under UK law for those with poor mental health are as likely to involve granting employees more work-related autonomy as they are to require restrictions.

In terms of policy implications, my results are relevant to employers, healthcare providers, researchers and governments who often screen for mental health conditions and target interventions using predictors of poor health, such as having children (Obstetricians, Gynecologists, et al. 2023), alcohol use (Garnett et al. 2021), recent unemployment (Caplan et al. 1989), retirement (Rodríguez-Monforte et al. 2020), and incarceration (Ford et al. 2007). Additionally, certain policies target interventions to high-risk workers, such as night shift workers[25] and healthcare workers (De Kock et al. 2022). My results indicate that low work-related autonomy, especially over job tasks, should also be considered an important risk factor for poor mental health. Furthermore, low work-related autonomy is a predictor of poor mental health which provides significant new information beyond common risk factors e.g., marital status and having children. My results provide a case for using certain working conditions as key screening criteria for mental health conditions in primary care.

Secondly, workplace interventions which screen for anxiety and depression and promote mental health can lead to net cost savings for employers by raising productivity and reducing sick days (Knapp, McDaid, and Parsonage 2011). My results suggest that workplaces where employ-

[25] `https://www.gov.uk/night-working-hours/health-assessments`.

ees are not offered high levels of work-related autonomy may particularly benefit from these interventions.

Thirdly, to the extent that the relationship is causal, my results have numerous implications for the relationship between mental health and labor markets. Firstly, where workers value non-pecuniary characteristics of their work, inequality can be mis-stated by simply observing income or wealth (Maestas et al. 2023). In my data set, both men and women who work in low-autonomy jobs have labor income that is around 27% lower than their counterparts in high-autonomy jobs. Accounting for inequality in the mental health effects of employment therefore increases estimates of overall inequality. Furthermore, inequality in workplace flexibility could contribute to mental health inequality.

Finally, given the presence of a primarily state-funded healthcare system in the UK, low levels of workplace autonomy constitute a negative externality: neither workers nor firms have an incentive to account for the monetary cost of mental illness arising from working conditions. The cost of medical services for people in the UK with depression and anxiety is forecast to rise to GBP 5 billion by 2026 (McCrone et al. 2008), over 2% of total NHS spending. To the extent that working conditions are a contributing factor to poor mental health, their potential public cost is large.

References

Aizer, Anna, Paul Devereux, and Kjell Salvanes (2022). "Grandparents, moms, or dads? why children of teen mothers do worse in life". In: *Journal of Human Resources* 57.6, pp. 2012–2047.

Aloisi, Antonio and Valerio De Stefano (2022). "Essential jobs, remote work and digital surveillance: Addressing the COVID-19 pandemic panopticon". In: *International Labour Review* 161.2, pp. 289–314.

Altonji, Joseph G, Todd E Elder, and Christopher R Taber (2005). "Selection on observed and unobserved variables: Assessing the effectiveness of Catholic schools". In: *Journal of political economy* 113.1, pp. 151–184.

Anjara, SG et al. (2020). "Using the GHQ-12 to screen for mental health problems among primary care patients: psychometrics and practical considerations". In: *International journal of mental health systems* 14.1, pp. 1–13.

Bain, Peter and Phil Taylor (2000). "Entrapped by the 'electronic panopticon'? Worker resistance in the call centre". In: *New technology, work and employment* 15.1, pp. 2–18.

Bell, Mark (2015). "Mental health at work and the duty to make reasonable adjustments". In: *Industrial Law Journal* 44.2, pp. 194–221.

Belloni, Michele, Ludovico Carrino, and Elena Meschi (2022). "The impact of working conditions on mental health: novel evidence from the UK". In: *Labour Economics*, p. 102176.

Bentley, Rebecca J et al. (2015). "A longitudinal analysis of changes in job control and mental health". In: *American Journal of Epidemiology* 182.4, pp. 328–334.

Black, Nicole, David W Johnston, and Agne Suziedelyte (2017). "Justification bias in self-reported disability: New evidence from panel data". In: *Journal of Health Economics* 54, pp. 124–134.

Bond, Frank W and Paul E Flaxman (2006). "The ability of psychological flexibility and job control to predict learning, job performance, and mental health". In: *Journal of Organizational Behavior Management* 26.1-2, pp. 113–130.

Bond, Frank W, Paul E Flaxman, and David Bunce (2008). "The influence of psychological flexibility on work redesign: mediated moderation of a work reorganization intervention." In: *Journal of applied psychology* 93.3, p. 645.

Boyce, Christopher J and Andrew J Oswald (2012). "Do people become healthier after being promoted?" In: *Health economics* 21.5, pp. 580–596.

Burgess, John and Julia Connell (2004). "Emerging developments in call centre research". In: *Labour & Industry: a journal of the social and economic relations of work* 14.3, pp. 1–13.

Bursztyn, Leonardo et al. (2020). *Misinformation during a pandemic*. Tech. rep. National Bureau of Economic Research.

Campos-Mercade, Pol et al. (2021). "Prosociality predicts health behaviors during the COVID-19 pandemic". In: *Journal of public economics* 195, p. 104367.

Caplan, Robert D et al. (1989). "Job seeking, reemployment, and mental health: a randomized field experiment in coping with job loss." In: *Journal of applied psychology* 74.5, p. 759.

Carrino, Ludovico, Karen Glaser, and Mauricio Avendano (2020). "Later retirement, job strain, and health: evidence from the new state pension age in the United Kingdom". In: *Health economics* 29.8, pp. 891–912.

Chen, M Keith et al. (2019). "The value of flexible work: Evidence from Uber drivers". In: *Journal of political economy* 127.6, pp. 2735–2794.

Coad, Alex and Martin Binder (2014). "Causal linkages between work and life satisfaction and their determinants in a structural VAR approach". In: *Economics Letters* 124.2, pp. 263–268.

Davalos, Maria E and Michael T French (2011). "This recession is wearing me out! Health-related quality of life and economic downturns." In: *Journal of Mental Health Policy and Economics*.

De Kock, Johannes H et al. (2022). "Brief digital interventions to support the psychological well-being of NHS staff during the COVID-19 pandemic: 3-arm pilot randomized controlled trial". In: *JMIR mental health* 9.4, e34002.

Dong, Rui et al. (2021). “The nonlinear consequences of working hours for job satisfaction: The moderating role of job autonomy”. In: *Current Psychology*, pp. 1–22.

Dube, Arindrajit, Suresh Naidu, and Adam D Reich (2022). *Power and Dignity in the Low-wage Labor Market: Theory and Evidence from Wal-Mart Workers*. Tech. rep. National Bureau of Economic Research.

Egan, Mark, Gregor Matvos, and Amit Seru (2022). “When Harry fired Sally: The double standard in punishing misconduct”. In: *Journal of Political Economy* 130.5, pp. 1184–1248.

Elwert, Felix and Christopher Winship (2014). “Endogenous selection bias: The problem of conditioning on a collider variable”. In: *Annual review of sociology* 40, pp. 31–53.

Ford, Julian D et al. (2007). “Development and validation of a brief mental health screening instrument for newly incarcerated adults”. In: *Assessment* 14.3, pp. 279–299.

Garnett, Claire et al. (2021). “Evaluating the effectiveness of the smartphone app, Drink Less, compared with the NHS alcohol advice webpage, for the reduction of alcohol consumption among hazardous and harmful adult drinkers in the UK at 6-month follow-up: protocol for a randomised controlled trial”. In: *Addiction* 116.2, pp. 412–425.

Gathergood, John (2013). “An instrumental variable approach to unemployment, psychological health and social norm effects”. In: *Health economics* 22.6, pp. 643–654.

Goldin, Claudia (2014). “A grand gender convergence: Its last chapter”. In: *American Economic Review* 104.4, pp. 1091–1119.

— (2021). *Career and family: Women’s century-long journey toward equity*. Princeton University Press.

Goldsmith-Pinkham, Paul, Peter Hull, and Michal Kolesár (2021). “On estimating multiple treatment effects with regression”. In: *arXiv preprint arXiv:2106.05024*.

Gureje, Oye and B Obikoya (1990). “The GHQ-12 as a screening tool in a primary care setting”. In: *Social psychiatry and psychiatric epidemiology* 25.5, pp. 276–280.

Hansen, Stephen et al. (2023). *Remote Work across Jobs, Companies, and Space*. Tech. rep. National Bureau of Economic Research.

Hardy, Wojciech (2016). *Hardy, 2006*. https://ibs.org.pl/en/resources/occupation-classifications-crosswalks-from-onet-soc-to-isco/. Accessed: 2021-08-05.

He, Haoran, David Neumark, and Qian Weng (2021). "Do workers value flexible jobs? A field experiment". In: *Journal of Labor Economics* 39.3, pp. 709–738.

Heller-Sahlgren, Gabriel (2017). "Retirement blues". In: *Journal of health economics* 54, pp. 66–78.

Jenkinson, Crispin and Richard Layte (1997). "Development and testing of the UK SF-12". In: *Journal of health services research & policy* 2.1, pp. 14–18.

Johannsen, Rebecca and Paul J Zak (2020). "Autonomy raises productivity: An experiment measuring neurophysiology". In: *Frontiers in Psychology* 11, p. 963.

Jolivet, Grégory and Fabien Postel-Vinay (2020). "A structural analysis of mental health and labor market trajectories". In.

Karasek Jr, Robert A (1979). "Job demands, job decision latitude, and mental strain: Implications for job redesign". In: *Administrative science quarterly*, pp. 285–308.

Knapp, Martin, David McDaid, and Michael Parsonage (2011). "Mental health promotion and mental illness prevention: The economic case". In.

Kontodimopoulos, Nick et al. (2007). "Validity of SF-12 summary scores in a Greek general population". In: *Health and quality of life outcomes* 5.1, pp. 1–9.

Kubicek, Bettina, Matea Paškvan, and Johanna Bunner (2017). "The bright and dark sides of job autonomy". In: *Job demands in a changing world of work: Impact on workers' health and performance and implications for research and practice*, pp. 45–63.

Le Grand, Julian (2003). *Motivation, agency, and public policy: of knights and knaves, pawns and queens*. OUP Oxford.

Lockwood, Graeme, Claire Henderson, and Graham Thornicroft (2012). "The Equality Act 2010 and mental health". In: *The British Journal of Psychiatry* 200.3, pp. 182–183.

Lyness, Karen S et al. (2012). "It's all about control: Worker control over schedule and hours in cross-national context". In: *American Sociological Review* 77.6, pp. 1023–1049.

Maestas, Nicole et al. (2023). “The value of working conditions in the United States and implications for the structure of wages”. In: *American Economic Review* 113.7, pp. 2007–2047.

Mas, Alexandre and Amanda Pallais (2017). “Valuing alternative work arrangements”. In: *American Economic Review* 107.12, pp. 3722–3759.

Masten, Matthew A and Alexandre Poirier (2022). “The effect of omitted variables on the sign of regression coefficients”. In: *arXiv preprint arXiv:2208.00552*.

McCabe, Christopher J et al. (1996). “Measuring the mental health status of a population: A comparison of the GHQ–12 and the SF–36 (MHI–5)”. In: *The British Journal of Psychiatry* 169.4, pp. 517–521.

McCrone, Paul et al. (2008). “Paying the price”. In: *The cost of mental health care in England to* 2026, pp. 1–165.

Michaud, Amanda and David Wiczer (2018). “Occupational hazards and social disability insurance”. In: *Journal of Monetary Economics* 96, pp. 77–92.

Nickell, Stephen (1981). “Biases in dynamic models with fixed effects”. In: *Econometrica: Journal of the econometric society*, pp. 1417–1426.

Obstetricians, American College of, Gynecologists, et al. (2023). “Screening and diagnosis of mental health conditions during pregnancy and postpartum (Clinical Practice Guideline No. 4)”. In: *Obstetrics & Gynecology* 141.6, pp. 1232–1261.

Oster, Emily (2019). “Unobservable selection and coefficient stability: Theory and evidence”. In: *Journal of Business & Economic Statistics* 37.2, pp. 187–204.

Park, Rhokeun and Soo Jung Jang (2017). “Mediating role of perceived supervisor support in the relationship between job autonomy and mental health: Moderating role of value–means fit”. In: *The International Journal of Human Resource Management* 28.5, pp. 703–723.

Park, Rhokeun and Deborah Searcy (2012). “Job autonomy as a predictor of mental well-being: The moderating role of quality-competitive environment”. In: *Journal of Business and Psychology* 27, pp. 305–316.

Ravesteijn, Bastian, Hans van Kippersluis, and Eddy van Doorslaer (2018). “The wear and tear on health: What is the role of occupation?” In: *Health economics* 27.2, e69–e86.

Rodríguez-Monforte, Miriam et al. (2020). “Interventions across the retirement transition for improving well-being: a scoping review”. In: *International Journal of Environmental Research and Public Health* 17.12, p. 4341.

Rose, Liam (2020). “Retirement and health: Evidence from England”. In: *Journal of Health Economics* 73, p. 102352.

Schreurs, Bert et al. (2010). “Job insecurity and employee health: The buffering potential of job control and job self-efficacy”. In: *Work & Stress* 24.1, pp. 56–72.

Stansfeld, Stephen A, Rebecca Fuhrer, Jenny Head, et al. (1997). “Work and psychiatric disorder in the Whitehall II Study”. In: *Journal of psychosomatic research* 43.1, pp. 73–81.

Stansfeld, Stephen A, Rebecca Fuhrer, Martin J Shipley, et al. (1999). “Work characteristics predict psychiatric disorder: prospective results from the Whitehall II Study.” In: *Occupational and environmental medicine* 56.5, pp. 302–307.

Tibubos, Ana N and Hannes Kröger (2020). “A cross-cultural comparison of the ultrabrief mental health screeners PHQ-4 and SF-12 in Germany.” In: *Psychological Assessment* 32.7, p. 690.

Van Yperen, Nico W and Tom AB Snijders (2000). “A multilevel analysis of the demands–control model: Is stress at work determined by factors at the group level or the individual level?” In: *Journal of occupational health psychology* 5.1, p. 182.

Wallace, Stephanie, James Nazroo, and Laia Bécares (2016). “Cumulative effect of racial discrimination on the mental health of ethnic minorities in the United Kingdom”. In: *American journal of public health* 106.7, pp. 1294–1300.

Ware Jr, John E, Mark Kosinski, and Susan D Keller (1996). “A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity”. In: *Medical care*, pp. 220–233.

Woodcock, Jamie and Mark Graham (2019). “The gig economy”. In: *A critical introduction. Cambridge: Polity*.

Wooldridge, Jeffrey M (2002). “Inverse probability weighted M-estimators for sample selection, attrition, and stratification”. In: *Portuguese economic journal* 1.2, pp. 117–139.

Table 1: Summary statistics of key variables

Panel A: summary statistics

	Mean	Standard deviation	Min	Max	Within-person standard deviation
GHQ12 caseness	1.459	2.686	0	12	1.853
SF12	49.882	8.778	0	75.5	6.583
Low overall autonomy	0.199	0.399	0	1	0.312
Low autonomy over job tasks	0.257	0.437	0	1	0.337
Low autonomy over work pace	0.244	0.430	0	1	0.321
Low autonomy over work manner	0.156	0.363	0	1	0.278
Low autonomy over task order	0.164	0.370	0	1	0.287
Low autonomy over work hours	0.527	0.499	0	1	0.407

Panel B: correlations between aspects of work-related autonomy

	Low autonomy over job tasks	Low autonomy over work pace	Low autonomy over work manner	Low autonomy over task order	Low autonomy over work hours
Low autonomy over job tasks	1	0.482	0.502	0.465	0.312
Low autonomy over work pace		1	0.545	0.477	0.307
Low autonomy over work manner			1	0.596	0.284
Low autonomy over task order				1	0.301
Low autonomy over work hours					1

Notes: The sample is constructed from observations in the even waves of the Understanding Society survey of people who report being in work in every wave in which they are observed. Low autonomy over job tasks, work pace, work manner, task order and work hours is scored 1 if a person reports having either a little autonomy or no autonomy on this dimension, and 0 otherwise. I define overall low autonomy as being equal to 1 if a person scores 1 (low) on 3 or more aspects of workplace autonomy. The GHQ12 caseness is the number of negative mental health symptoms a person has. The SF12 index scores the mental health of a person between 0 (worst) and 100 (best) based on their answers to a health survey. Within-person standard deviation is the standard deviation of the variable once a person-fixed effect is taken out.

Table 2: Autonomy scores across different occupations

Occupation	Low overall autonomy	Low autonomy over job tasks	Low autonomy over work pace	Low autonomy over work manner	Low autonomy over task order	Low autonomy over work hours
Other Specialist Managers	0.041	0.084	0.110	0.035	0.033	0.232
Production and Operation Managers	0.044	0.073	0.119	0.035	0.032	0.301
Architects, Engineers, and Related Professions	0.057	0.147	0.147	0.062	0.038	0.245
Finance and Sales Associate Professionals	0.066	0.149	0.165	0.061	0.052	0.259
Numerical Clerks	0.123	0.263	0.172	0.106	0.085	0.420
Other Clerks	0.128	0.217	0.164	0.113	0.085	0.353
Housekeeping and Restaurant Service Workers	0.186	0.310	0.229	0.177	0.141	0.391
Nursing and Midwifery Professionals	0.232	0.247	0.330	0.176	0.153	0.641
High-school Teachers	0.269	0.273	0.401	0.151	0.220	0.778
Personal Care and Related Workers	0.310	0.369	0.330	0.266	0.252	0.704
Salespeople and Demonstrators	0.313	0.326	0.339	0.225	0.272	0.788
Domestic Helpers, Cleaners and Launders	0.314	0.356	0.328	0.268	0.276	0.747
Porters and Doorkeepers	0.385	0.435	0.386	0.329	0.309	0.738
Client Information Clerks	0.397	0.545	0.344	0.294	0.389	0.650
Motor Vehicle Drivers	0.399	0.486	0.383	0.338	0.346	0.732

Notes: This table shows the average value of workplace autonomy variables by the 15 most common (3-digit ISCO) occupations. Low autonomy over job tasks, work pace, work manner, task order, and work hours score 1 if a person reports having either a little autonomy or no autonomy on this dimension, and 0 otherwise. I define overall low autonomy as being equal to 1 if a person scores 1 on 3 or more aspects of workplace autonomy.

Table 3: The association between low autonomy and men's mental health

	Panel A: effect on GHQ12 caseness							
Low autonomy:								
overall	0.444***	0.544***	0.421***	0.414***				
	(0.053)	(0.072)	(0.077)	(0.078)				
over job tasks					0.207***	0.273***	0.234***	0.214***
					(0.059)	(0.067)	(0.07)	(0.07)
over work pace					0.398***	0.385***	0.283***	0.286***
					(0.061)	(0.07)	(0.071)	(0.071)
over work manner					0.128	0.073	0.12	0.127
					(0.08)	(0.095)	(0.097)	(0.098)
over task order					0.07	0.173**	0.148	0.146
					(0.074)	(0.087)	(0.094)	(0.096)
over work hours					-0.119***	-0.042	0.029	0.032
					(0.044)	(0.051)	(0.059)	(0.059)
Observations	13,847	13,847	13,847	13,847	13,847	13,847	13,847	13,847
R^2	0.005	0.044	0.517	0.527	0.011	0.05	0.519	0.529
Dep var mean	1.207	1.207	1.207	1.207	1.207	1.207	1.207	1.207
	Panel B: effect on SF12							
Low autonomy:								
overall	-1.794***	-2.082***	-1.256***	-1.262***				
	(0.187)	(0.246)	(0.228)	(0.231)				
over job tasks					-0.355*	-0.592***	-0.415*	-0.386*
					(0.206)	(0.229)	(0.214)	(0.216)
over work pace					-1.555***	-1.522***	-0.913***	-0.901***
					(0.212)	(0.239)	(0.209)	(0.212)
over work manner					-0.203	-0.099	-0.11	-0.159
					(0.281)	(0.319)	(0.31)	(0.307)
over task order					-0.751***	-1.011***	-0.72***	-0.734***
					(0.258)	(0.292)	(0.273)	(0.274)
over work hours					-0.014	-0.167	-0.196	-0.202
					(0.153)	(0.19)	(0.19)	(0.19)
Observations	13,892	13,892	13,892	13,892	13,892	13,892	13,892	13,892
R^2	0.012	0.064	0.634	0.643	0.018	0.071	0.636	0.644
Dep var mean	50.489	50.489	50.489	50.489	50.489	50.489	50.489	50.489
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person FE	N	N	Y	Y	N	N	Y	Y
Other controls	N	Y	N	Y	N	Y	N	Y

Notes: The table presents results from regressions of measures of mental health on measures of work-related autonomy, with various controls (as in Equation 1), amongst men. Standard errors are clustered at the individual level. Other controls include education, marital status, and occupation, which I control for using a full set of dummies for each value those variables can take, and whether the respondent has biological children living with them. While education is explained to a large degree by person-fixed effects, around 5% of my sample changes their education (likely by gaining a new qualification) at some point during the panel. Education is therefore not perfectly explained by person fixed effects. *p<0.1; **p<0.05; ***p<0.01

Table 4: The association between low autonomy and women's mental health

	Panel A: effect on GHQ12 caseness							
Low autonomy:								
overall	0.506***	0.599***	0.387***	0.397***				
	(0.056)	(0.073)	(0.072)	(0.072)				
over job tasks					0.243***	0.296***	0.277***	0.297***
					(0.064)	(0.072)	(0.071)	(0.072)
over work pace					0.222***	0.232***	0.084	0.071
					(0.067)	(0.072)	(0.07)	(0.071)
over work manner					0.365***	0.36***	0.196**	0.203**
					(0.084)	(0.095)	(0.085)	(0.085)
over task order					-0.175**	-0.114	0.026	0.027
					(0.08)	(0.088)	(0.082)	(0.083)
over work hours					0.059	0.107*	0.188***	0.196***
					(0.05)	(0.06)	(0.065)	(0.066)
Observations	15,708	15,708	15,708	15,708	15,708	15,708	15,708	15,708
R^2	0.006	0.035	0.546	0.555	0.008	0.038	0.548	0.556
Dep var mean	1.663	1.663	1.663	1.663	1.663	1.663	1.663	1.663
	Panel B: effect on SF12							
Low autonomy:								
overall	-1.295***	-1.531***	-0.978***	-0.955***				
	(0.176)	(0.226)	(0.212)	(0.212)				
over job tasks					-0.934***	-1.034***	-0.693***	-0.711***
					(0.202)	(0.223)	(0.208)	(0.209)
over work pace					-0.864***	-0.91***	-0.406**	-0.377*
					(0.211)	(0.223)	(0.201)	(0.2)
over work manner					-0.672**	-0.617**	-0.411	-0.415
					(0.266)	(0.294)	(0.26)	(0.258)
over task order					0.704***	0.497*	0.167	0.167
					(0.251)	(0.286)	(0.257)	(0.254)
over work hours					-0.046	-0.151	-0.563***	-0.552***
					(0.157)	(0.194)	(0.188)	(0.189)
Observations	15,692	15,692	15,692	15,692	15,692	15,692	15,692	15,692
R^2	0.008	0.046	0.619	0.628	0.011	0.05	0.62	0.629
Dep var mean	49.033	49.033	49.033	49.033	49.033	49.033	49.033	49.033
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person FE	N	N	Y	Y	N	N	Y	Y
Other controls	N	Y	N	Y	N	Y	N	Y

Notes: The table presents results from regressions of measures of mental health on measures of work-related autonomy, with various controls (as in Equation 1), amongst women. See notes to Table 3 for a description of the controls used. *p<0.1; **p<0.05; ***p<0.01

Table 5: Causal effects of low autonomy on the GHQ12 caseness of men under different assumptions

Delta	R-squared ratio	Low overall autonomy	Low autonomy over job tasks	Low autonomy over work pace	Low autonomy over work manner	Low autonomy over task order	Low autonomy over work hours
-1.3	1.1	0.422***	0.212***	0.317***	0.128*	0.123*	-0.013
		(0.054)	(0.048)	(0.049)	(0.069)	(0.064)	(0.04)
-1.3	1.3	0.432***	0.21***	0.356***	0.128*	0.096	-0.066*
		(0.05)	(0.046)	(0.048)	(0.068)	(0.061)	(0.036)
-1.1	1.1	0.421***	0.213***	0.313***	0.128*	0.126*	-0.008
		(0.055)	(0.049)	(0.05)	(0.069)	(0.065)	(0.041)
-1.1	1.3	0.43***	0.21***	0.349***	0.128*	0.101*	-0.057
		(0.05)	(0.046)	(0.048)	(0.068)	(0.061)	(0.036)
-0.9	1.1	0.42***	0.213***	0.309***	0.128*	0.129**	-0.001
		(0.055)	(0.049)	(0.05)	(0.07)	(0.066)	(0.042)
-0.9	1.3	0.428***	0.211***	0.341***	0.128*	0.106*	-0.046
		(0.051)	(0.046)	(0.048)	(0.067)	(0.061)	(0.036)
0.9	1.1	0.408***	0.217***	0.256***	0.127	0.171**	0.08
		(0.068)	(0.063)	(0.062)	(0.086)	(0.084)	(0.058)
0.9	1.3	0.388***	0.225**	0.152	0.126	0.272*	0.27**
		(0.098)	(0.112)	(0.097)	(0.156)	(0.155)	(0.11)
1.1	1.1	0.406***	0.217***	0.248***	0.127	0.177**	0.093
		(0.071)	(0.066)	(0.064)	(0.09)	(0.088)	(0.061)
1.1	1.3	0.378***	0.231	0.092	0.125	0.347	0.407***
		(0.115)	(0.151)	(0.122)	(0.221)	(0.217)	(0.151)
1.3	1.1	0.404***	0.218***	0.239***	0.127	0.185**	0.108*
		(0.073)	(0.07)	(0.067)	(0.094)	(0.093)	(0.065)
1.3	1.3	0.366***	0.241	0.002	0.123	0.494	0.668***
		(0.138)	(0.221)	(0.16)	(0.367)	(0.352)	(0.244)

Notes: The table shows the causal effect of work-related autonomy on men's GHQ12 caseness score under different assumptions about the importance of unobserved confounders relative to observed confounders (Oster 2019). Max R-squared is the total share of variance in the dependent variable explained by the independent variable; δ is the ratio of selection on unobservable confounders to observable confounders. Standard errors are calculated by block bootstrapping. *p<0.1; **p<0.05; ***p<0.01

Table 6: Causal effects of low autonomy on men's SF12 under different assumptions

Delta	R-squared ratio	Low overall autonomy	Low autonomy over job tasks	Low autonomy over work pace	Low autonomy over work manner	Low autonomy over task order	Low autonomy over work hours
-1.3	1.1	-1.396***	-0.377**	-1.084***	-0.173	-0.739***	-0.145
		(0.158)	(0.15)	(0.151)	(0.216)	(0.196)	(0.123)
-1.3	1.3	-1.578***	-0.366**	-1.312***	-0.188	-0.745***	-0.079
		(0.158)	(0.155)	(0.158)	(0.224)	(0.201)	(0.121)
-1.1	1.1	-1.378***	-0.378**	-1.06***	-0.171	-0.738***	-0.153
		(0.16)	(0.151)	(0.152)	(0.217)	(0.197)	(0.124)
-1.1	1.3	-1.543***	-0.368**	-1.27***	-0.186	-0.744***	-0.091
		(0.156)	(0.152)	(0.155)	(0.221)	(0.198)	(0.12)
-0.9	1.1	-1.359***	-0.379**	-1.034***	-0.169	-0.738***	-0.16
		(0.161)	(0.152)	(0.153)	(0.219)	(0.199)	(0.127)
-0.9	1.3	-1.505***	-0.37**	-1.223***	-0.182	-0.743***	-0.104
		(0.154)	(0.15)	(0.152)	(0.218)	(0.196)	(0.119)
0.9	1.1	-1.14***	-0.395**	-0.724***	-0.144	-0.728***	-0.262
		(0.2)	(0.197)	(0.184)	(0.269)	(0.255)	(0.177)
0.9	1.3	-0.776**	-0.431	-0.118	-0.081	-0.705	-0.504
		(0.305)	(0.38)	(0.304)	(0.527)	(0.506)	(0.363)
1.1	1.1	-1.109***	-0.398*	-0.677***	-0.14	-0.727***	-0.279
		(0.208)	(0.208)	(0.191)	(0.282)	(0.268)	(0.188)
1.1	1.3	-0.594	-0.455	0.239	-0.032	-0.687	-0.682
		(0.365)	(0.525)	(0.389)	(0.77)	(0.73)	(0.516)
1.3	1.1	-1.076***	-0.4*	-0.626***	-0.135	-0.725**	-0.297
		(0.216)	(0.22)	(0.2)	(0.298)	(0.284)	(0.201)
1.3	1.3	-0.36	-0.497	0.77	0.069	-0.652	-1.015
		(0.448)	(0.789)	(0.528)	(1.319)	(1.21)	(0.825)

Notes: The table presents the causal effects of work-related autonomy on the SF12 index under different assumptions amongst women. See notes to Table 5 for a full description of the method and variables. *p<0.1; **p<0.05; ***p<0.01

Table 7: Causal effects of low autonomy on women's GHQ12 caseness under different assumptions

Delta	R-squared ratio	Low overall autonomy	Low autonomy over job tasks	Low autonomy over work pace	Low autonomy over work manner	Low autonomy over task order	Low autonomy over work hours
-1.3	1.1	0.424***	0.282***	0.115**	0.253***	-0.034	0.156***
		(0.05)	(0.051)	(0.051)	(0.062)	(0.06)	(0.043)
-1.3	1.3	0.461***	0.263***	0.167***	0.31***	-0.105*	0.108***
		(0.047)	(0.05)	(0.05)	(0.065)	(0.061)	(0.039)
-1.1	1.1	0.42***	0.284***	0.109**	0.247***	-0.027	0.161***
		(0.05)	(0.051)	(0.052)	(0.063)	(0.06)	(0.044)
-1.1	1.3	0.453***	0.267***	0.158***	0.3***	-0.093	0.117***
		(0.047)	(0.05)	(0.05)	(0.064)	(0.06)	(0.039)
-0.9	1.1	0.416***	0.286***	0.103**	0.24***	-0.018	0.167***
		(0.051)	(0.052)	(0.052)	(0.063)	(0.061)	(0.045)
-0.9	1.3	0.446***	0.27***	0.147***	0.289***	-0.078	0.127***
		(0.047)	(0.049)	(0.05)	(0.063)	(0.059)	(0.04)
0.9	1.1	0.374***	0.312***	0.027	0.148*	0.091	0.236***
		(0.062)	(0.063)	(0.064)	(0.079)	(0.076)	(0.062)
0.9	1.3	0.305***	0.365***	-0.132	-0.087	0.35**	0.385***
		(0.089)	(0.102)	(0.106)	(0.161)	(0.139)	(0.111)
1.1	1.1	0.368***	0.316***	0.016	0.133	0.109	0.247***
		(0.064)	(0.066)	(0.066)	(0.083)	(0.079)	(0.065)
1.1	1.3	0.272***	0.397***	-0.235*	-0.278	0.541***	0.482***
		(0.103)	(0.13)	(0.137)	(0.241)	(0.194)	(0.145)
1.3	1.1	0.361***	0.32***	0.003	0.116	0.128	0.259***
		(0.066)	(0.069)	(0.069)	(0.088)	(0.083)	(0.069)
1.3	1.3	0.231*	0.445**	-0.401**	-0.695	0.906***	0.642***
		(0.123)	(0.175)	(0.193)	(0.501)	(0.319)	(0.206)

Notes: The table presents the causal effects of work-related autonomy on the GHQ12 caseness score under different assumptions amongst women. See notes to Table 5 for a full description of the method and variables. *p<0.1; **p<0.05; ***p<0.01

Table 8: Causal effects of low autonomy on women's SF12 under different assumptions

Delta	R-squared ratio	Low overall autonomy	Low autonomy over job tasks	Low autonomy over work pace	Low autonomy over work manner	Low autonomy over task order	Low autonomy over work hours
-1.3	1.1	-1.038***	-0.774***	-0.518***	-0.495**	0.331*	-0.404***
		(0.147)	(0.146)	(0.145)	(0.196)	(0.19)	(0.13)
-1.3	1.3	-1.153***	-0.852***	-0.688***	-0.585***	0.519***	-0.228*
		(0.144)	(0.147)	(0.147)	(0.205)	(0.197)	(0.126)
-1.1	1.1	-1.026***	-0.766***	-0.5***	-0.485**	0.31	-0.423***
		(0.149)	(0.148)	(0.146)	(0.196)	(0.191)	(0.132)
-1.1	1.3	-1.131***	-0.837***	-0.657***	-0.569***	0.485**	-0.26**
		(0.143)	(0.145)	(0.145)	(0.201)	(0.194)	(0.124)
-0.9	1.1	-1.015***	-0.757***	-0.481***	-0.474**	0.288	-0.444***
		(0.151)	(0.149)	(0.148)	(0.197)	(0.192)	(0.134)
-0.9	1.3	-1.106***	-0.822***	-0.622***	-0.551***	0.447**	-0.296**
		(0.143)	(0.144)	(0.144)	(0.198)	(0.191)	(0.124)
0.9	1.1	-0.881***	-0.65***	-0.237	-0.329	-0.003	-0.7***
		(0.185)	(0.187)	(0.184)	(0.246)	(0.238)	(0.184)
0.9	1.3	-0.666**	-0.431	0.281	0.048	-0.699	-1.251***
		(0.267)	(0.318)	(0.32)	(0.506)	(0.453)	(0.343)
1.1	1.1	-0.862***	-0.633***	-0.199	-0.304	-0.051	-0.74***
		(0.191)	(0.195)	(0.192)	(0.259)	(0.25)	(0.195)
1.1	1.3	-0.563*	-0.298	0.615	0.356	-1.214*	-1.611***
		(0.313)	(0.41)	(0.423)	(0.758)	(0.642)	(0.458)
1.3	1.1	-0.842***	-0.615***	-0.157	-0.277	-0.103	-0.784***
		(0.198)	(0.205)	(0.202)	(0.274)	(0.264)	(0.206)
1.3	1.3	-0.433	-0.096	1.155*	1.02	-2.198**	-2.205***
		(0.373)	(0.559)	(0.605)	(1.376)	(1.059)	(0.665)

Notes: The table presents the causal effects of work-related autonomy on the SF12 index under different assumptions amongst women. See notes to Table 5 for a full description of the method and variables. *p<0.1; **p<0.05; ***p<0.01

Table 9: Assessing attrition bias in estimating the association between mental health and work-related autonomy

	Men				Women			
Dependent variable:	GHQ12 caseness		SF12		GHQ12 caseness		SF12	
Low overall autonomy	0.522***	0.515***	-1.319***	-1.316***	0.539***	0.529***	-1.366***	-1.355***
	(0.098)	(0.097)	(0.292)	(0.292)	(0.093)	(0.093)	(0.272)	(0.274)
R^2	0.571	0.571	0.691	0.691	0.599	0.599	0.667	0.667
Dependent variable:	GHQ12 caseness		SF12		GHQ12 caseness		SF12	
Low autonomy over tasks	0.193**	0.186**	-0.162	-0.154	0.363***	0.364***	-0.941***	-0.931***
	(0.093)	(0.092)	(0.274)	(0.274)	(0.093)	(0.093)	(0.272)	(0.273)
Low autonomy over pace	0.364**	0.368**	-1.179***	-1.168***	0.081	0.080	-0.437*	-0.460*
	(0.090)	(0.090)	(0.262)	(0.263)	(0.088)	(0.088)	(0.256)	(0.258)
Low autonomy over manner	0.200*	0.188	-0.181	-0.151	0.288***	0.274**	-0.329	-0.305
	(0.119)	(0.118)	(0.374)	(0.374)	(0.112)	(0.112)	(0.338)	(0.339)
Low autonomy over order	0.137	0.142	-0.586*	-0.619*	0.070	0.070	0.005	0.026
	(0.121)	(0.120)	(0.347)	(0.348)	(0.107)	(0.107)	(0.324)	(0.323)
Low autonomy over hours	0.093	0.098	-0.360	-0.366	0.149*	0.148*	-0.750***	-0.749***
	(0.075)	(0.076)	(0.241)	(0.242)	(0.080)	(0.080)	(0.227)	(0.228)
R^2	0.573	0.573	0.693	0.693	0.601	0.601	0.668	0.668
Observations	10,074	10,074	10,026	10,026	11,426	11,426	11,357	11,357
Dep var mean	1.197	1.189	50.311	50.334	1.657	1.656	48.857	48.877
Inverse-probability weighted	N	Y	N	Y	N	Y	N	Y
Men	Y	Y	Y	Y	N	N	N	N
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person FE	Y	Y	Y	Y	Y	Y	Y	Y
Other controls	Y	Y	Y	Y	Y	Y	Y	Y

Notes: The table presents the effect of inverse-probability weighting the estimates in my preferred specification. I weight observations by the inverse of the probability of observation, where this probability is modeled using a probit model of age, sex, education, marital status, labor income, whether a person has children, personality, and occupation at the one-digit level. See note to Table 3 for descriptions of my main control variables. *p<0.1; **p<0.05; ***p<0.01

Table 10: The association between low autonomy and mental health mediated by the COVID-19 pandemic

	Men		Women	
Dependent variable:	GHQ12 caseness	SF12	GHQ12 caseness	SF12
	(1)	(2)	(3)	(4)
Low overall autonomy	0.420***	-1.274***	0.392***	-0.963***
	(0.077)	(0.231)	(0.073)	(0.212)
Low overall autonomy × year > 2019	0.822	3.079	-0.870	2.024
	(1.083)	(3.761)	(0.947)	(2.081)
Observations	13,847	13,892	15,708	15,692
R^2	0.531	0.643	0.555	0.628
Dep var mean	1.206	50.489	1.662	49.033
Wave	Y	Y	Y	Y
Person FE	Y	Y	Y	Y
Other controls	Y	Y	Y	Y

Notes: This Table presents results of regressions of measures of mental health on work-related autonomy, interacted with a dummy for whether the year is after 2019. See note to Table 3 for descriptions of my main control variables. *p<0.1; **p<0.05; ***p<0.01

Table 11: Associations between mental health and work-related autonomy, interactions with part-time work, women

Dependent variable:	GHQ12 caseness		SF12	
Low autonomy	0.440***		-1.213***	
	(0.093)		(0.267)	
Low autonomy × part time	-0.158		0.675*	
	(0.135)		(0.396)	
Low autonomy over job tasks		0.314***		-0.820***
		(0.095)		(0.264)
Low autonomy over job tasks × part time		-0.065		0.358
		(0.137)		(0.413)
Low autonomy over work pace		0.088		-0.348
		(0.089)		(0.254)
Low autonomy over work pace × part time		-0.050		-0.134
		(0.109)		(0.324)
Low autonomy over work manner		0.195		-0.757
		(0.178)		(0.535)
Low autonomy over work manner × part time		-0.028		0.842
		(0.178)		(0.535)
Low autonomy over task order		0.068		0.114
		(0.107)		(0.322)
Low autonomy over task order × part time		-0.071		0.134
		(0.173)		(0.527)
Low autonomy over work hours		0.235***		-0.675***
		(0.081)		(0.227)
Low autonomy over work hours × part time		-0.165		0.388
		(0.125)		(0.369)
Observations	15,551	15,551	15,539	15,539
R^2	0.552	0.553	0.630	0.631
Dep var mean	1.647	1.647	49.022	49.022
Wave	Y	Y	Y	Y
Person FE	Y	Y	Y	Y
Other controls	Y	Y	Y	Y

Notes: The Table shows the results of interacting autonomy variables in my preferred specification with a dummy for working part time, among women. See Table 3 for a description of key control variables. *p<0.1; **p<0.05; ***p<0.01

Table 12: The mediating effect of personality on associations between mental health and autonomy over work hours

Panel A: Associations between mental health and autonomy over work hours				
	Men		Women	
Dependent variable:	GHQ12 caseness	SF12	GHQ12 caseness	SF12
	(1)	(2)	(3)	(4)
Low work hours autonomy	0.093	-0.310	0.130*	-0.380*
	(0.071)	(0.240)	(0.076)	(0.225)
Low hours autonomy × agreeableness	-0.050	0.037	-0.185**	0.254
	(0.063)	(0.218)	(0.079)	(0.223)
Low hours autonomy × extraversion	0.038	0.065	0.060	0.126
	(0.053)	(0.170)	(0.053)	(0.161)
Low hours autonomy × neuroticism	-0.007	0.309*	0.097	-0.326**
	(0.050)	(0.160)	(0.054)	(0.149)
Low hours autonomy × conscientiousness	-0.079	0.269	0.028	-0.237
	(0.053)	(0.177)	(0.057)	(0.163)
Low hours autonomy × openness	0.119*	-0.236	0.105	-0.145
	(0.064)	(0.216)	(0.075)	(0.213)
Observations	13,847	13,892	15,708	15,692
R^2	0.534	0.646	0.556	0.631
Dep var mean	1.187	50.534	1.642	49.045
Wave	Y	Y	Y	Y
Person FE	Y	Y	Y	Y
Other controls	Y	Y	Y	Y
Panel B: Attributing different associations by gender				
Baseline	0.093	-0.310	0.130	-0.380
Agreeableness	0.029	-0.021	0.040	-0.055
Extraversion	-0.021	-0.037	-0.016	-0.033
Neuroticism	-0.002	0.088	0.075	-0.252
Conscientiousness	0.026	-0.087	-0.015	0.128
Openness	-0.063	0.124	-0.024	0.033
Total	0.061	-0.244	0.191	-0.560

Notes: The Table shows how personality mediates the association between autonomy over hours and mental health. Panel A presents the results of interacting autonomy variables in my preferred specification with personality scores. In this specification, I subtract the median personality scores from the personality variables, so that the association between low autonomy over hours and mental health can be interpreted as the association between mental health and autonomy over working hours for someone with the median score for each personality variable. Panel B approximates the association between mental health and autonomy over hours as in Equation 5. The baseline association is the association at median personality scores, and each personality contribution is formed by the coefficient on the interaction between low hours autonomy and this personality score, multiplied by the average score of each sex on that personality. See Table 3 for a description of key control variables. *p<0.1; **p<0.05; ***p<0.01

Table 13: Associations between autonomy over work hours and mental health by one-digit occupation

Dependent variable:	GHQ12 caseness	SF12	GHQ12 caseness	SF12
Senior officials/managers	0.139	-0.428	0.644***	-0.543
	(0.154)	(0.448)	(0.222)	(0.629)
Dep var mean	1.206	50.489	1.662	49.033
Share of employment	0.203		0.132	
Professionals	0.124	-0.577	0.306	-0.763
	(0.150)	(0.419)	(0.193)	(0.540)
Dep var mean	1.206	50.489	1.662	49.033
Share of employment	0.168		0.143	
Technicians	-0.030	0.438	0.380***	-1.321***
	(0.166)	(0.531)	(0.171)	(0.461)
Dep var mean	1.206	50.489	1.662	49.033
Share of employment	0.129		0.188	
Clerical Support	-0.006	-0.182	-0.040	-0.756*
	(0.241)	(0.869)	(0.132)	(0.391)
Dep var mean	1.206	50.489	1.662	49.033
Share of employment	0.081		0.206	
Serivce and Sales	0.183	0.134*	0.056	0.169
	(0.229)	(0.710)	(0.146)	(0.423)
Dep var mean	1.206	50.489	1.662	49.033
Share of employment	0.088		0.248	
Skilled agriculture	-0.105	3.050		
	(0.409)	(4.902)		
Dep var mean	1.206	50.489		
Share of employment	0.007		0.001	
Craft and related	-0.171	-0.414	-0.162	-4.482
	(0.159)	(0.591)	(0.390)	(3.033)
Dep var mean	1.206	50.489	1.662	49.033
Share of employment	0.108		0.006	
Machine Operators	-0.037	0.890	-2.239*	4.041
	(0.149)	(0.590)	(1.151)	(2.340)
Dep var mean	1.206	50.489	1.662	49.033
Share of employment	0.107		0.014	
Elementary	-0.013	-0.166	0.118	-0.666
	(0.237)	(0.699)	(0.336)	(1.008)
Dep var mean	1.206	50.489	1.662	49.033
Share of employment	0.109		0.062	
Men	Y	Y	N	N
Wave	Y	Y	Y	Y
Person FE	Y	Y	Y	Y
Other controls	Y	Y	Y	Y

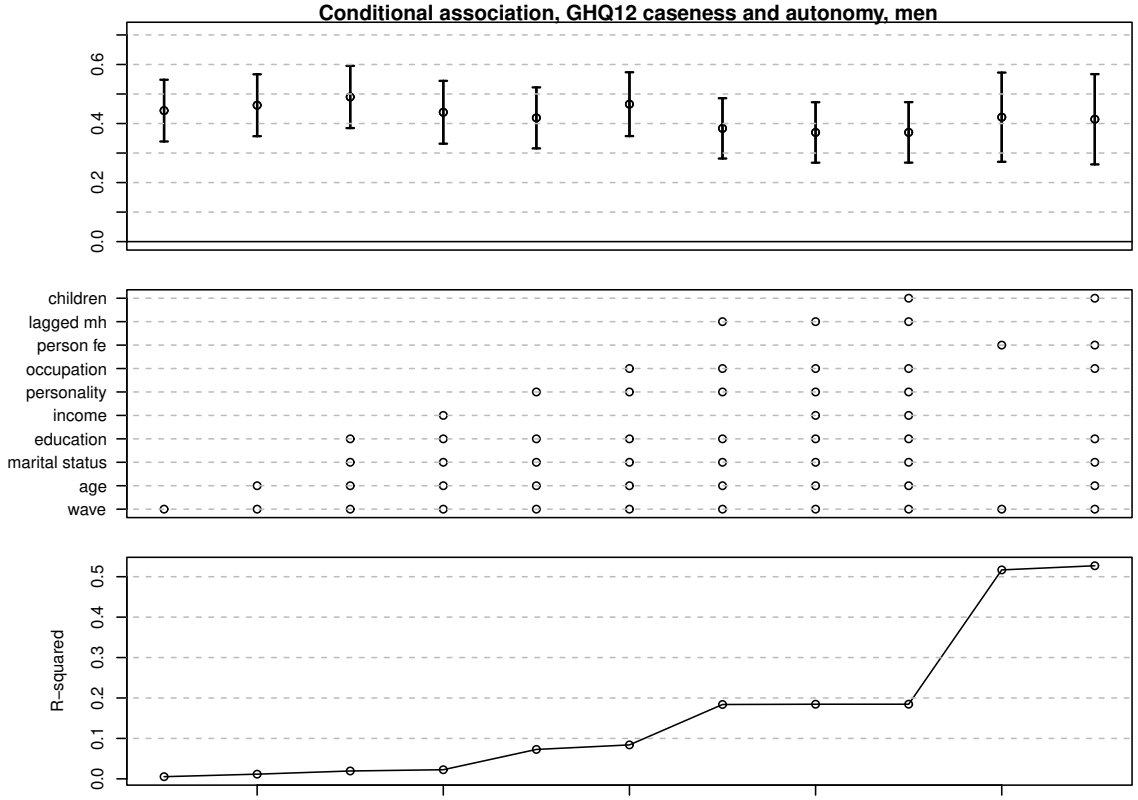
Notes: The Table shows the results of re-estimating my preferred specification among people in different occupation groups. Note that the association among women in skilled agriculture is not identified. See Table 3 for a description of key control variables. *p<0.1; **p<0.05; ***p<0.01

Table 14: The association between low autonomy and mental health for those who never change employers

	Men		Women	
Dependent variable:	GHQ12 caseness	SF12	GHQ12 caseness	SF12
	(1)	(2)	(3)	(4)
Low overall autonomy	0.393***	−1.116***	0.411***	−1.058***
	(0.072)	(0.224)	(0.072)	(0.208)
Observations	12,458	12,299	14,058	13,808
R^2	0.523	0.630	0.687	0.622
Wave	Y	Y	Y	Y
Person FE	Y	Y	Y	Y
Other controls	Y	Y	Y	Y

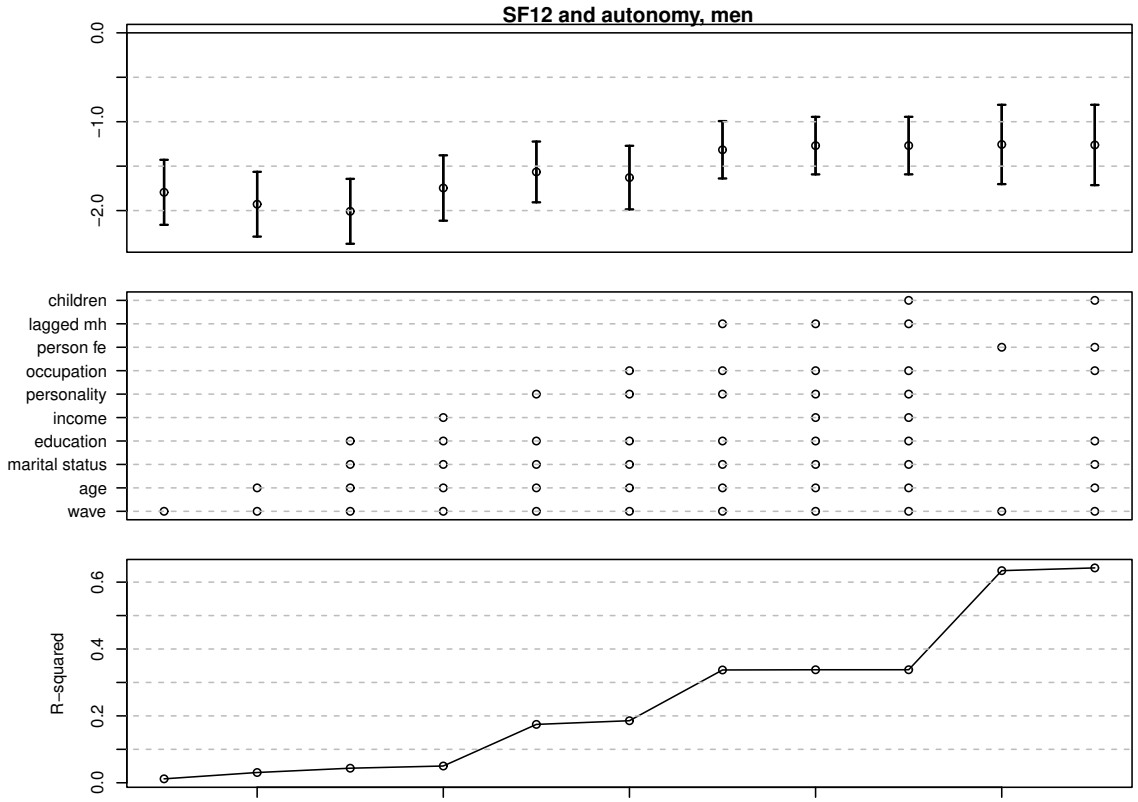
Notes: This table presents results of regressions of measures of mental health on work-related autonomy in a sample of those people who never change employer. As in equation 1, I control for person-fixed effects, wave fixed effects and controls (occupation, whether a person has biological children, education, and marital status). Standard errors are clustered at the individual level. *p<0.1; **p<0.05; ***p<0.01

Figure 1: Conditional associations between the GHQ12 caseness score and low work-related autonomy amongst men



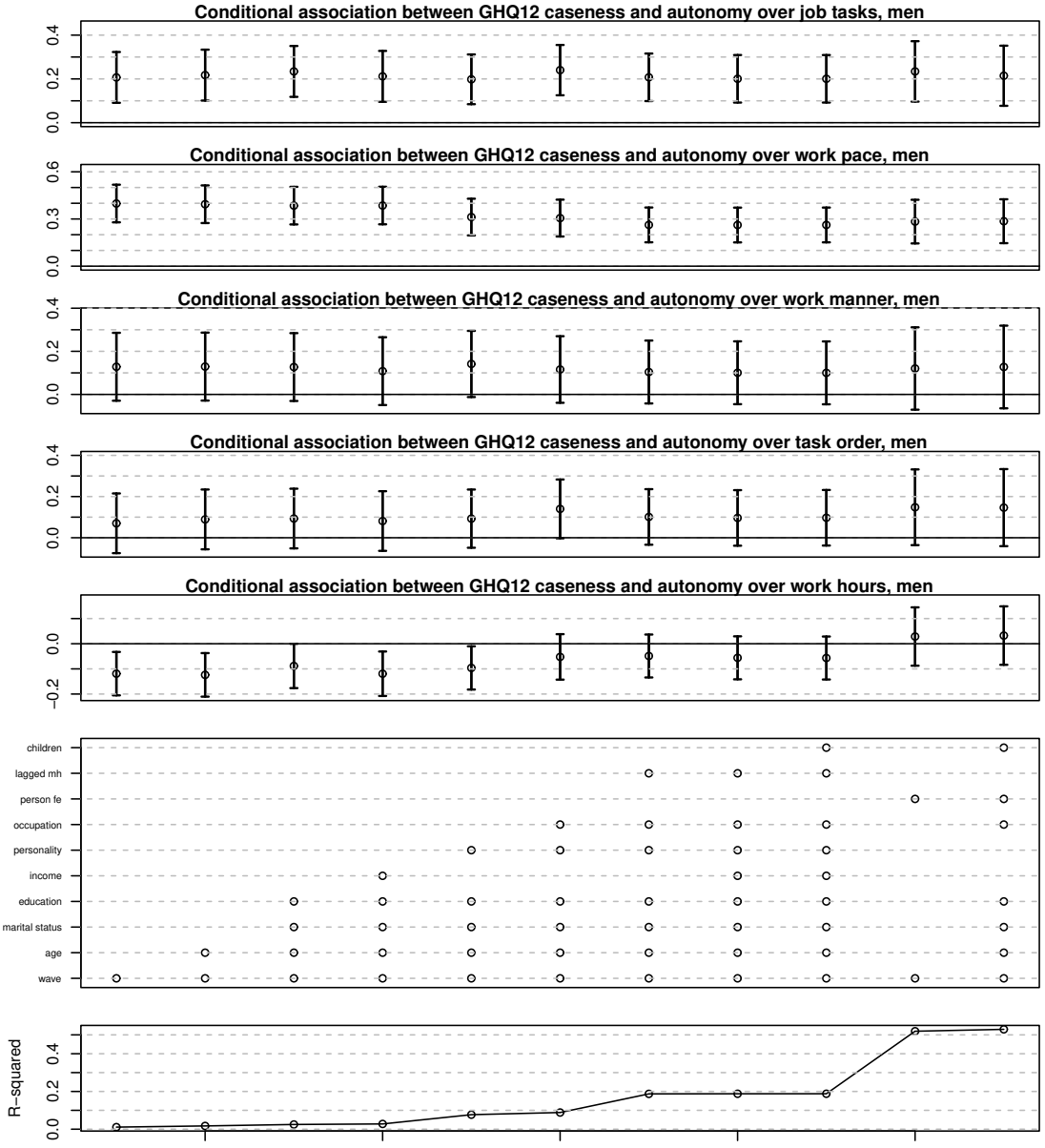
Notes: This figure shows how estimated associations between the GHQ12 caseness and having low work-related autonomy amongst men change as new controls are included. Conditional associations are estimated by regressing the GHQ12 caseness on the summary measure of autonomy, with various controls. The GHQ12 caseness is derived from the the GHQ12 survey, and is the total number of negative mental health symptoms a person has. The top panel reports coefficients on low autonomy, with 95% confidence intervals using standard errors clustered at the individual level. The middle panel shows which controls are included in each specification. The bottom panel shows the R-squared in each specification. Wave controls are a dummy for each wave of the survey. Age is age at last birthday and is controlled for with a dummy variable for each value it can take. Marital status and education are exhaustive, mutually exclusive values detailing the current marital status of a person and the highest qualification they achieve, respectively. I control for income using the log of real labor income. I control for personality using the "big five" personality traits, using a dummy for each possible combination they can take. Occupation is measured by 3-digit ISCO code. I include a dummy for each possible occupation. I control for person fixed effects with a full set of dummies. I control for children by including a dummy for whether a person has any biological children who live with them. Lagged mental health is the dependent variable the person reported in the previous wave of the survey.

Figure 2: Conditional associations between the SF12 index and low work-related autonomy amongst men



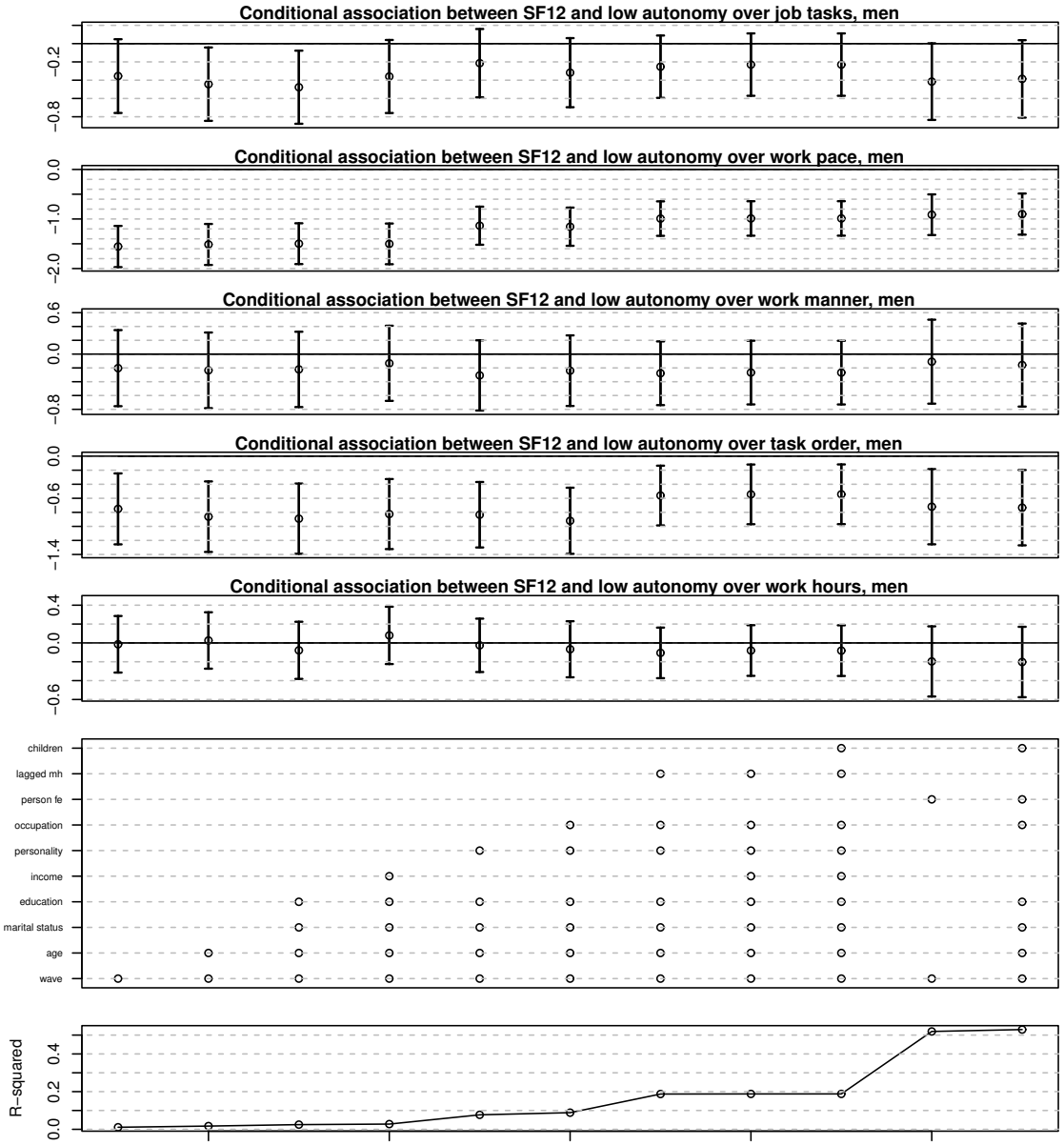
Notes: This figure shows how estimated associations between the SF12 index and levels of work-related autonomy amongst men change as new controls are included. Conditional associations are estimated by regressing the SF12 index on the summary measure of autonomy, with various controls. The SF12 index is derived from the SF12 survey, and is a weighting of scores on this index. The index varies between 0 and 100, with higher numbers indicating better mental health. The top panel reports coefficients on autonomy, with confidence intervals using standard errors clustered at the individual level. The middle panel shows which controls are included in each specification. The bottom panel shows the R-squared in each specification. Control variables are described in the note to Figure 1.

Figure 3: Conditional associations between the GHQ12 caseness score and low work-related autonomy across different dimensions amongst men



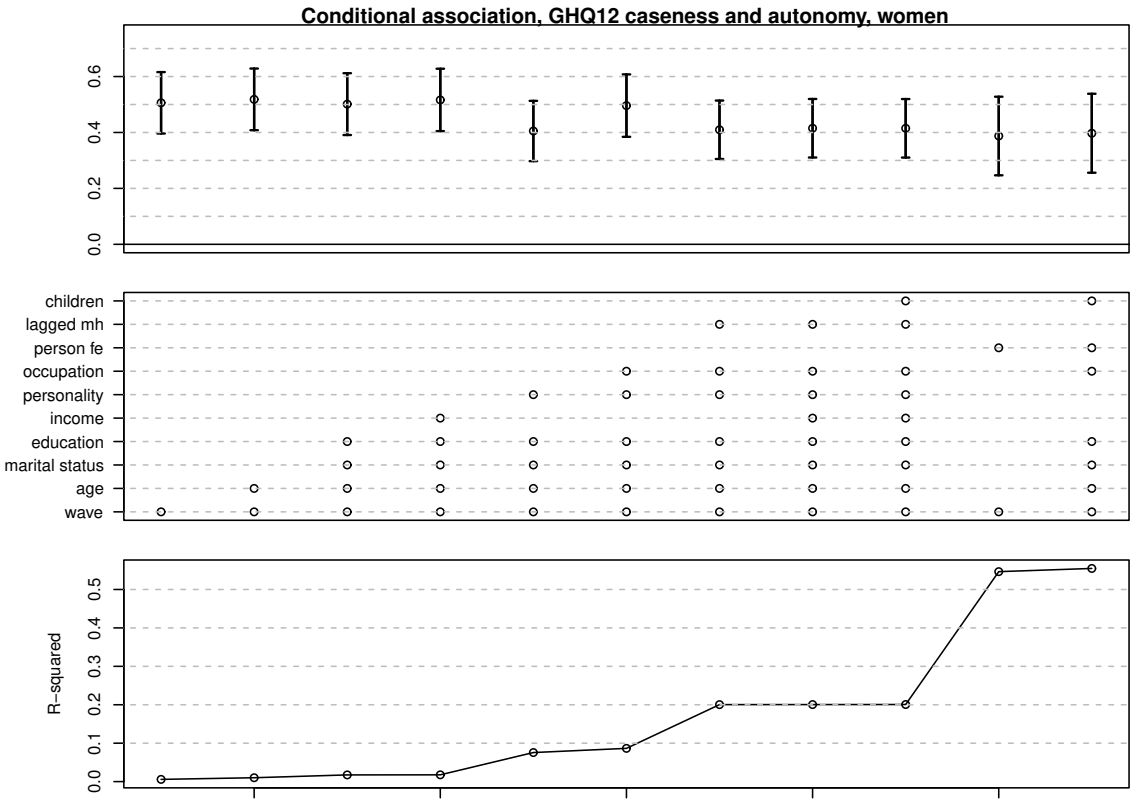
Notes: This figure shows how estimated associations between the GHQ12 caseness and levels of work-related autonomy, disaggregated across dimensions, amongst men change as new controls are included. Conditional associations are estimated by regressing the GHQ12 caseness on all measures of autonomy, with various controls. The GHQ12 caseness is described in the note to Figure 1. The top 5 panels report coefficients on autonomy, with confidence intervals using standard errors clustered at the individual level. The 6th panel shows which controls are included in each specification. The bottom panel shows the R-squared in each specification. Control variables are described in the note to Figure 1.

Figure 4: Conditional associations between the SF12 index and low work-related autonomy across different dimensions amongst men



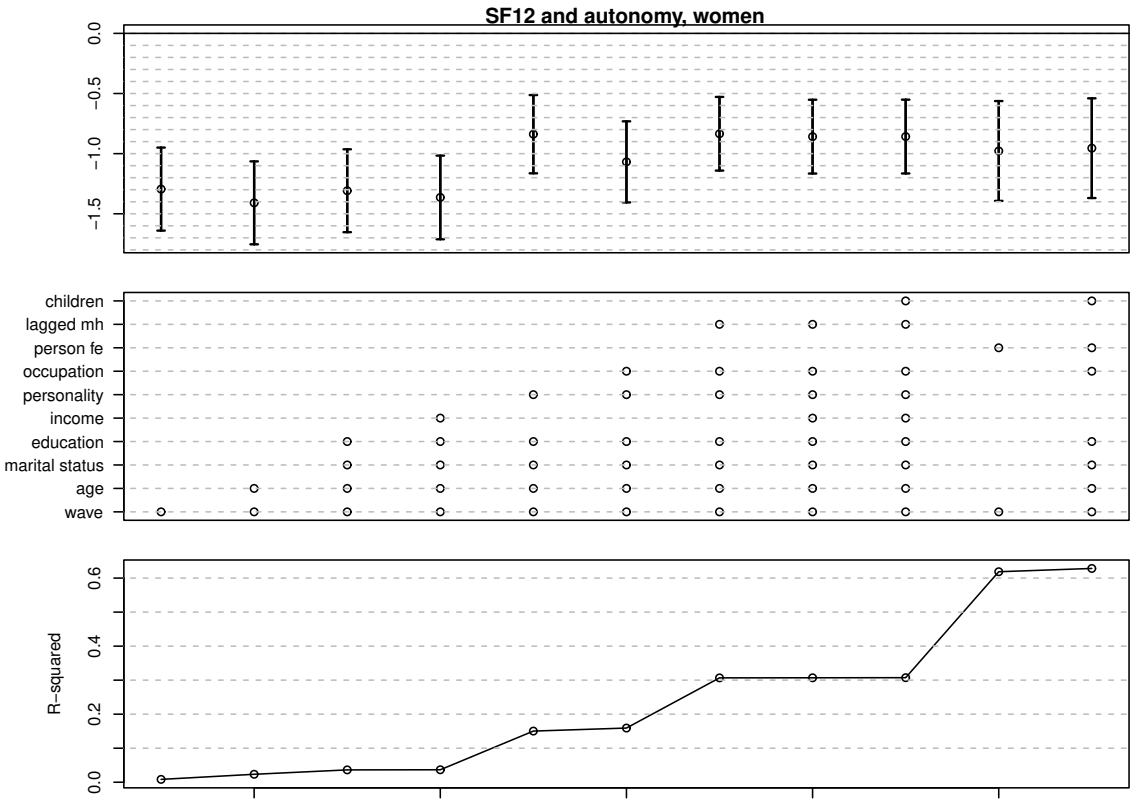
Notes: This figure shows how estimated associations between the SF12 index and levels of work-related autonomy, disaggregated across dimensions, amongst men change as new controls are included. Conditional associations are estimated by regressing the SF12 index on different measures of autonomy, with various controls. The SF12 index is described in the note to Figure 2. The top 5 panels report coefficients on autonomy, with confidence intervals using standard errors clustered at the individual level. The 6th panel shows which controls are included in each specification. The bottom panel shows the R-squared in each specification. Control variables are described in the note to Figure 1.

Figure 5: Conditional associations between the GHQ12 caseness score and low work-related autonomy amongst women



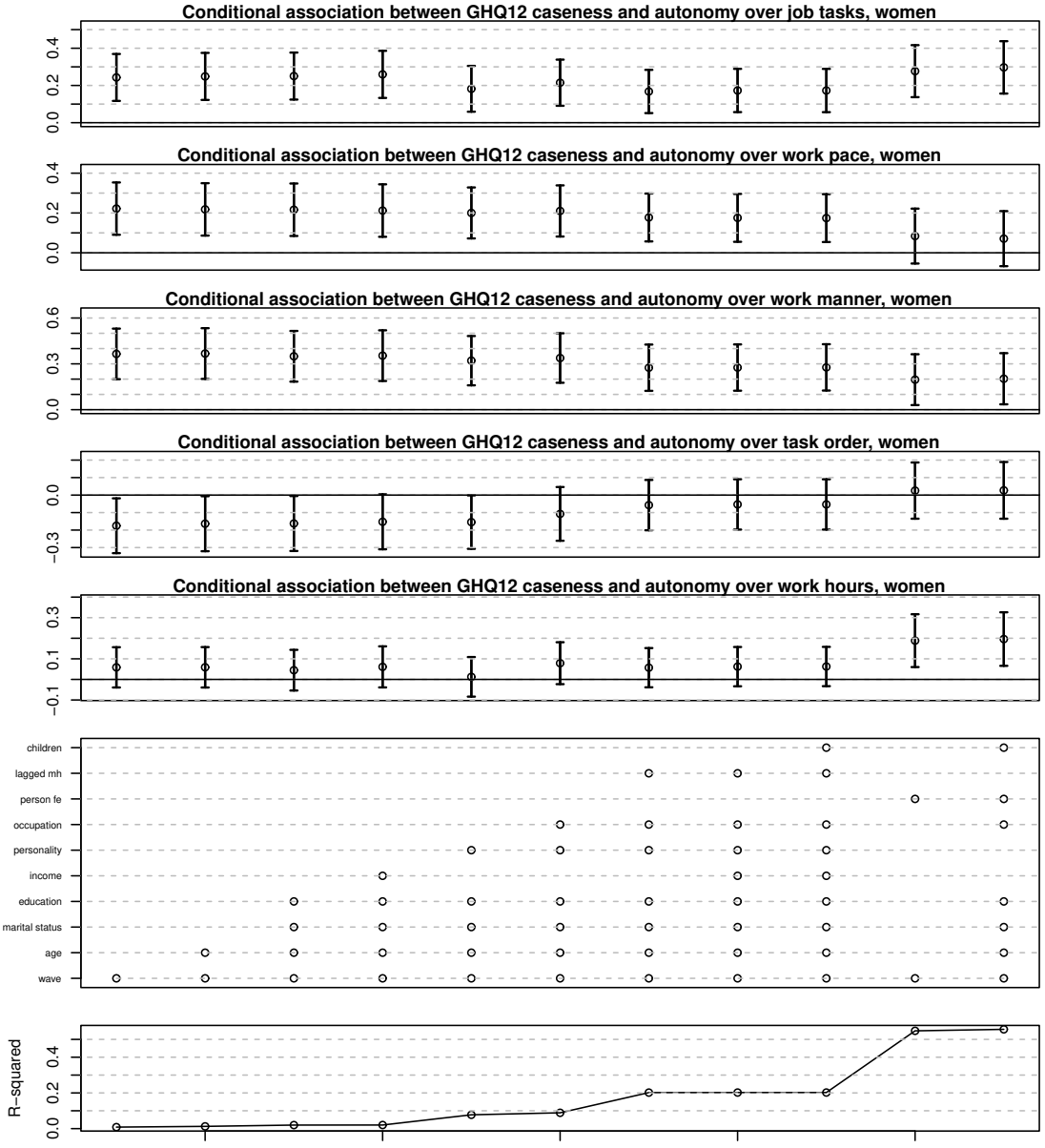
Notes: This figure shows how estimated associations between the GHQ12 caseness and having low work-related autonomy amongst women change as new controls are included. Conditional associations are estimated by regressing the GHQ12 caseness on the summary measure of autonomy, with various controls. The GHQ12 caseness is described in the note to Figure 1. The top panel reports coefficients on autonomy, with 95% confidence intervals using standard errors clustered at the individual level. The middle panel shows which controls are included in each specification. The bottom panel shows the R-squared in each specification. Control variables are described in the note to Figure 1.

Figure 6: Conditional associations between the SF12 index and low work-related autonomy amongst women



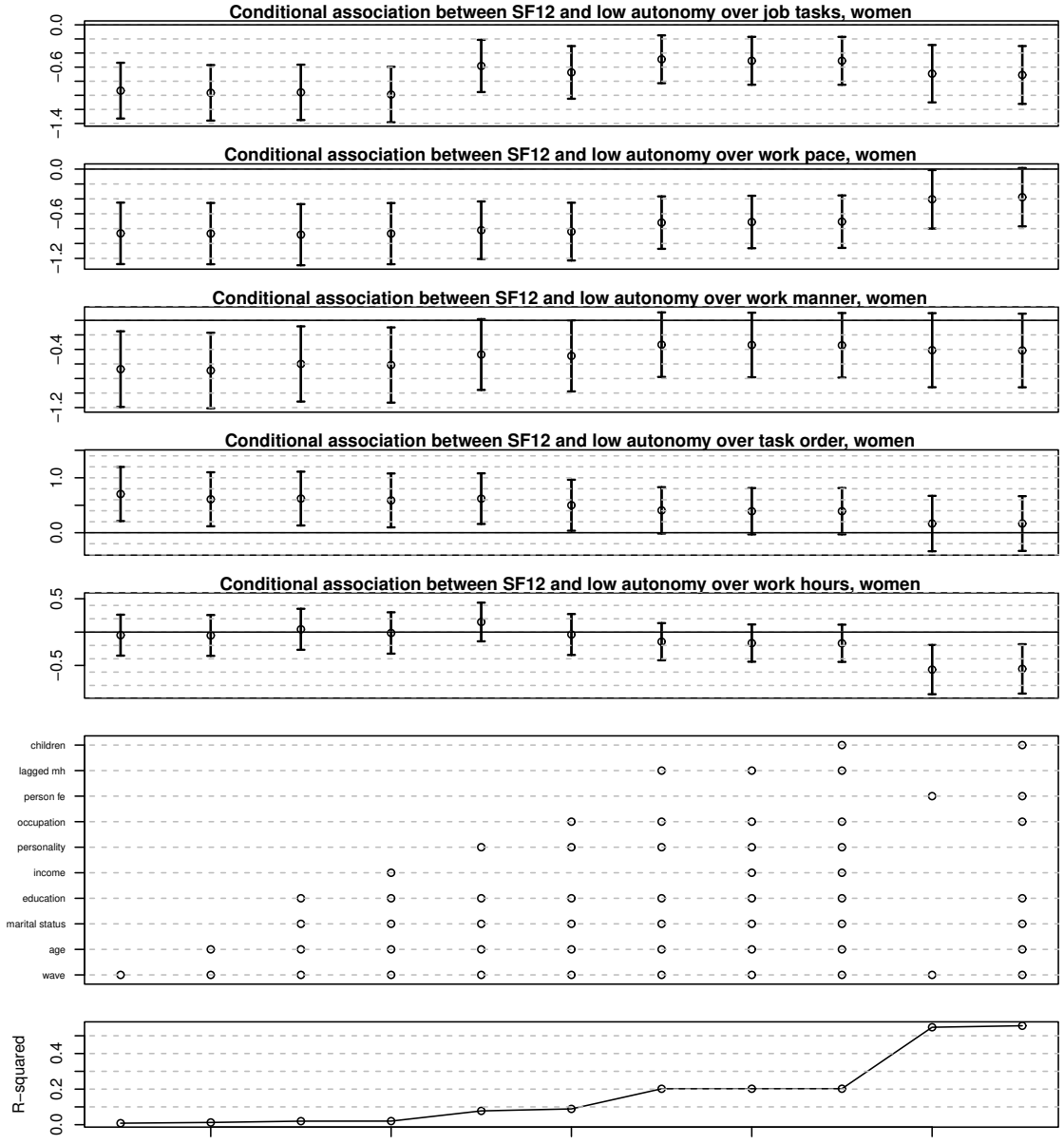
Notes: This figure shows how estimated associations between the SF12 index and having low work-related autonomy amongst women change as new controls are included. Conditional associations are estimated by regressing the SF12 index on the summary measure of autonomy, with various controls. The SF12 index is described in the note to Figure 2. The top panel reports coefficients on autonomy, with confidence intervals using standard errors clustered at the individual level. The middle panel shows which controls are included in each specification. The bottom panel shows the R-squared in each specification. Control variables are described in the note to Figure 1.

Figure 7: Conditional associations between the GHQ12 caseness score and low work-related autonomy across different dimensions amongst women



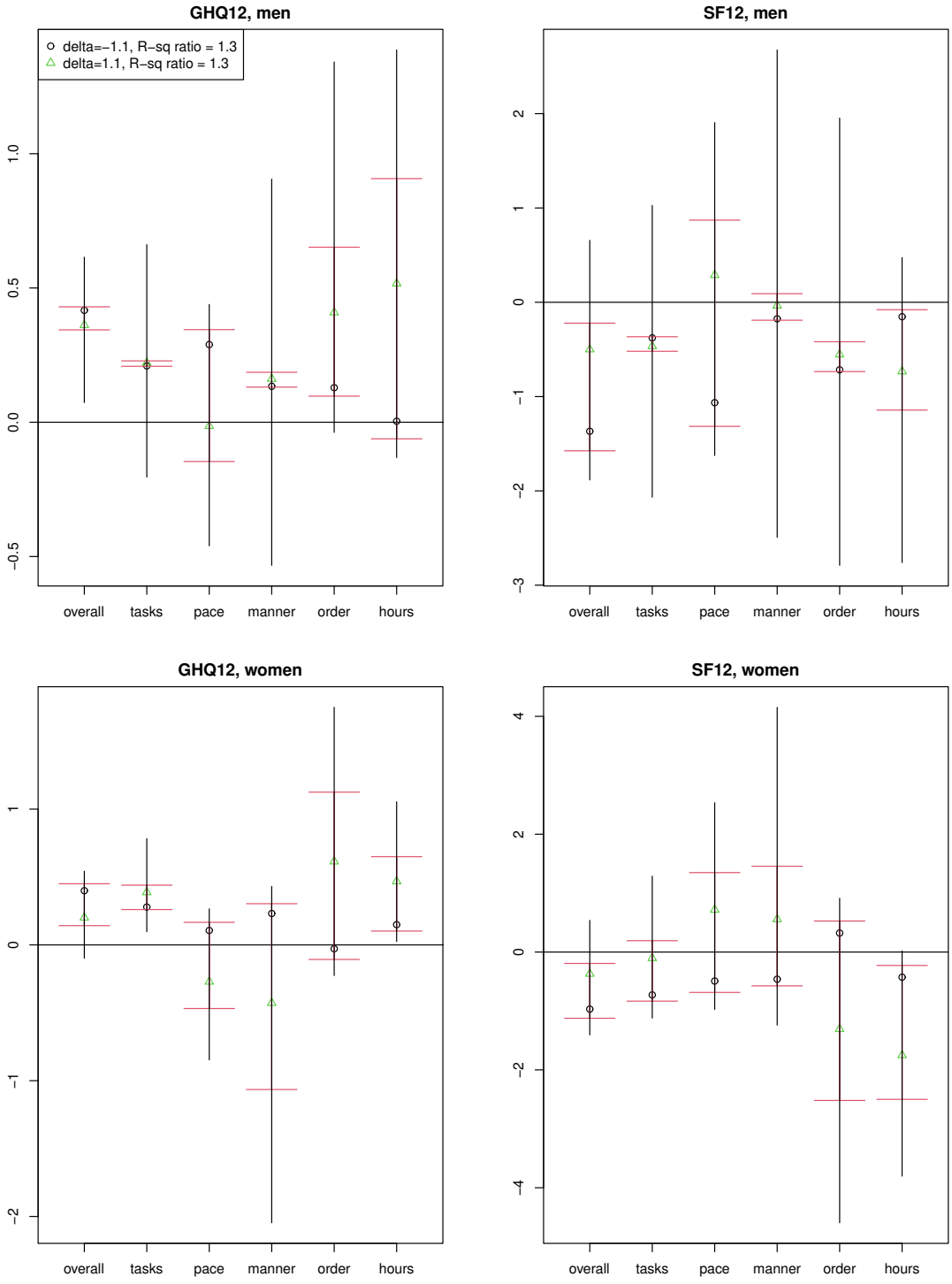
Notes: This figure shows how estimated associations between the GHQ12 caseness and having low work-related autonomy, disaggregated across multiple dimensions, amongst women change as new controls are included. Conditional associations are estimated by regressing the GHQ12 caseness on all measures of autonomy, with various controls. The GHQ12 caseness is described in the note to Figure 1. The top 5 panels report coefficients on autonomy, with confidence intervals using standard errors clustered at the individual level. The 6th panel shows which controls are included in each specification. The bottom panel shows the R-squared in each specification. Control variables are described in the note to Figure 1.

Figure 8: Conditional associations between the SF12 index and low work-related autonomy across different dimensions amongst women



Notes: This figure shows how estimated associations between the SF12 index and having low work-related autonomy, disaggregated across multiple dimensions, amongst women change as new controls are included. Conditional associations are estimated by regressing the SF12 index on different measures of autonomy, with various controls. The SF12 index is described in the note to Figure 2. The top 5 panels report coefficients on autonomy, with confidence intervals using standard errors clustered at the individual level. The 6th panel shows which controls are included in each specification. The bottom panel shows the R-squared in each specification. Control variables are described in the note to Figure 1.

Figure 9: Graphical summary of causal effects under different assumptions



Notes: This figure summarizes the causal effects of work-related autonomy on mental health under different assumptions about the behavior of unobserved confounders. The black circles show the causal effect under the assumption that δ =-1.1 and the R-squared ratio is equal to 1.3. The green triangles show the causal effect under the assumption that δ = 1.1 and the R-squared ratio is equal to 1.3. The red lines show the maximum and minimum point estimates when δ is between 1.1 and -1.1 and the R-squared ratio is between 1.3 and -1.3. The black lines show the range of causal effects which are within the 95% confidence interval for some causal estimate under one of the assumptions in Tables 5 to 8.

A Mental health variable questions and scoring

The SF12 questions are as follows:

1. In general, would you say your health is: 1) excellent 2) very good 3) good 4) fair 5) or poor?

2. Does your health now limit you in performing moderate activities? If so, how much? 1) Yes, limited a lot 2) Yes, limited a little 3) No, not limited at all

3. Does your health limit climbing several flights of stairs? 1) Yes, limited a lot 2) Yes, limited a little 3) No, not limited at all

4. 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: 1) All of the time 2) Most of the time 3) Some of the time 4) A little of the time 5) None of the time

5. 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? Were limited in the kind of work or other activities: 1) All of the time 2) Most of the time 3) Some of the time 4) A little of the time 5) None of the time

6. 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: 1) All of the time 2) Most of the time 3) Some of the time 4) A little of the time 5) None of the time

7. 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)? Did work or other activities less: 1) All of the time 2) Most of the time 3) Some of the time 4) A little of the time 5) None of the time carefully than usual

8. During the past 4 weeks, how much did pain interfere with your normal work (including

both work outside the home and housework)? 1) Not at all 2) A little bit 3) Moderately 4) Quite a bit 5) Extremely

9. How much of the time during the past 4 weeks have you felt calm and peaceful? 1) All of the time 2) Most of the time 3) Some of the time 4) A little of the time 5) None of the time

10. How much of the time during the past 4 weeks did you have a lot of energy? 1) All of the time 2) Most of the time 3) Some of the time 4) A little of the time 5) None of the time

11. How much of the time during the past 4 weeks have you felt downhearted and depressed? 1) All of the time 2) Most of the time 3) Some of the time 4) A little of the time 5) None of the time

12. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives)? 1) All of the time 2) Most of the time 3) Some of the time 4) A little of the time 5) None of the time

Initial construction of the scoring system is from a regression of a person's score on the longer 36-item index on a full set of dummies for responses to the 12-item questionnaire (Ware Jr, Kosinski, and Keller 1996). The coefficients from Ware Jr, Kosinski, and Keller's (1996) regression are reproduced in Table A1. Each answer is associated with a different score. Note that there is an omitted category associated with each answer which scores zero, and an intercept for each index. However, the Understanding Society data set produces the final index as a derived variable, which is the variable I use.

The questions used to construct the GHQ12 variables are listed below. Each question has one of four answers of varying severity. If the question is posed so that affirmative answers indicate good mental health, the answers are one of the following: "Better than usual", "Same as usual", "Less than usual", "Much less than usual". If the question is posed so that affirmative answers indicate poor mental health, the answers are one of the following: "Not at all", "No more than usual", "Rather more than usual", "Much more than usual". For each question, a respondent is

Table A1: Scoring system for SF12 indices

Question	Mental health score	Physical health score
Intercept	60.8	4.347
Moderate activities limited a lot	3.93	-7.23
Moderate activities limited a little	1.87	-3.46
Climbing several flights of stairs limited a lot	2.68	-6.24
Climbing several flights of stairs limited a little	1.43	-2.74
Accomplish less than you would like	1.44	-4.62
Limited in the kind of activities	1.67	-5.52
Pain interferes with normal work extremely	1.47	-11.26
Pain interferes with normal work quite a bit	1.77	-8.38
Pain interferes with normal work moderately	1.49	-6.51
Pain interferes with normal work a little bit	0.90	-3.8
Health in general is poor	-1.71	-10.76
Health in general is fair	-0.17	-8.070
Health in general is good	0.03	-4.304
Health in general is very good	-0.6	-1.614
Have a lot of energy none of the time	-6.02	-2.45
Have a lot of energy a little of the time	-4.89	-2.02
Have a lot of energy some of the time	-3.30	-1.162
Have a lot of energy a good bit of the time	-1.65	-1.14
Have a lot of energy most of the time	-0.92	-0.423
Health interferes with social activities all of the time	-6.30	-0.34
Health interferes with social activities most of the time	-8.26	-0.94
Health interferes with social activities some of the time	-5.63	-0.18
Health interferes with social activities a little of the time	-3.14	0.11
Didn't do activities as carefully as usual	-5.70	2.32
Felt calm and peaceful none of the time	-10.19	3.47
Felt calm and peaceful a little of the time	-7.93	2.90
Felt calm and peaceful some of the time	-6.31	2.37
Felt calm and peaceful a good bit of the time	-4.10	1.37
Felt calm and peaceful most of the time	-1.95	0.67
Felt downhearted and blue all of the time	-16.15	3.61
Felt downhearted and blue most of the time	-10.78	3.42
Felt downhearted and blue a good bit of the time	-8.10	2.34
Felt downhearted and blue some of the time	-4.59	1.28
Felt downhearted and blue a little of the time	-1.96	0.41

Notes: These are the scores given to each possible answer to the short-form survey used in calculating the SF12 health measures. The SF12 indices are calculated by summing all the numbers corresponding to a person's answers (and the intercept). The index can range between 0 and 100.

considered to have a symptom of mental illness if they respond with the least healthy or second least healthy answer (for example, “Less than usual” or “Much less than usual” if the question is phrased so that affirmative answers indicate good health and “Rather more than usual” or “Much more than usual” if the question is phrased so that affirmative answers indicate bad health). The GHQ12 caseness score uses all 12 questions, and is the sum of all symptoms for which a person reports having.

1. Have you recently been able to concentrate on whatever you’re doing?
2. Have you recently lost much sleep over worry?
3. Have you recently felt that you were playing a useful part in things?
4. Have you recently felt capable of making decisions about things?
5. Have you recently felt constantly under strain?
6. Have you recently felt you couldn’t overcome your difficulties?
7. Have you recently been able to enjoy your normal day-to-day activities?
8. Have you recently been able to face up to problems?
9. Have you recently been feeling unhappy or depressed?
10. Have you recently been losing confidence in yourself?
11. Have you recently been thinking of yourself as a worthless person?
12. Have you recently been feeling reasonably happy, all things considered?

B Variance Inflation Factors for disaggregated autonomy variables

Table B1 presents Variance Inflation Factors (VIFs) for my disaggregated autonomy variables, separately for men and women, and for each dependent variable. All are greater than one, indicating that imperfect multi-colinearity increases the standard errors. However, the extent of this inflation is relatively small (below 5). These results indicate that regressions using the autonomy variables are likely to be relatively precisely estimated.

Table B1: Variance Inflation Factors for disaggregated autonomy variables

	GHQ12 caseness, men	SF12, men	GHQ12 caseness, women	SF12, women
Low autonomy over tasks	1.548	1.544	1.527	1.523
Low autonomy over pace	1.558	1.552	1.655	1.654
Low autonomy over pace	1.857	1.845	1.884	1.880
Low autonomy over manner	1.699	1.684	1.703	1.702
Low autonomy over hours	1.188	1.185	1.158	1.156

C Relationship between work-related autonomy and O*NET occupation variables

In order to assess whether self-reported autonomy in the Understanding Society data set reflects variation in working conditions, I estimate correlations between self-reported autonomy at an occupation level and measures of occupational autonomy in the O*NET data set.

O*NET[26] provides detailed information about the content of occupations in the United States. From the "Work Context" files, I use three variables: "Freedom to make decisions" measures how much freedom typical employees in an occupation have to make decisions. "Structured vs unstructured work" measures how far typical employees can structure their own tasks, priorities and goals, with higher numbers indicating more freedom. "Pace determined by speed of

[26]O*NET 23.3 Database, by the US Department of Labor, Employment and Training Administration; `https://creativecommons.org/licenses/by/4.0/`. I use the 23.3 database, updated in May 2019.

equipment" measures how far the pace of a job is determined by the speed of equipment, with higher numbers indicating that the equipment plays a larger role in determining the pace of work. I select these variables since they are the most clearly linked to the work-related autonomy provided by an occupation. The value of each variable is equal to the average score respondents (employees or experts in an occupation) give from an ordered set scored from 1 to 5.

I use crosswalks provided by Hardy (2016) to link the SOC occupations in the O*NET data set to the ISCO88 occupations reported in Understanding Society. Since Understanding Society only reports occupations at the 3-digit level, I set the value of O*NET variables for a given 3-digit occupation as the average of the values that variable takes for the corresponding 4-digit occupations.

Table C1 shows the rank correlations between the average autonomy score and key O*NET variables for the occupations in the Understanding Society data set.[27] The rank correlation measures how far the ordinal ranking of observations of one variable explains the ordinal ranking of observations of another. For example, a rank correlation of -0.44 between freedom to make decisions and low overall autonomy suggests that 44% of the variation in the ordinal ranking of work-related autonomy can be explained by the ordinal ranking of Freedom to make decisions. Notably, there is a negative association between the freedom to make decisions and the average score for all low autonomy variables in an occupation, a negative association between scoring high for unstructured work and the average score for all low autonomy variables, and a positive association between pace being determined by the speed of equipment and the average score for all low autonomy variables. All of these associations are significant at the 1% significance level. These statistics show that self-reported autonomy is lower in occupations where employees tend to have less autonomy, and supports using the self-reported autonomy variables as my independent variables.

The strongest rank correlations are between "Structured versus unstructured work" and low overall autonomy. Since unstructured work is defined as allowing workers to structure their own tasks, priorities and goals, it is intuitive that this should have a strong correlation with

[27] I use the rank correlation instead of a the linear correlation because the O*NET variables do not have cardinal interpretations, so a linear relationship is not necessarily meaningful.

my autonomy variables. However, there is likely some measurement error introduced by the aggregation up to the 3-digit level, and the fact that the O*NET data set is based on US data, and not UK data.

Table C1: Rank correlation between average autonomy in occupations and key O*NET variables

O*NET variable	Autonomy variable	Rank Correlation	p value
Freedom to make decisions	Low overall autonomy	-0.440***	0.000
Freedom to make decisions	Low autonomy over job tasks	-0.493***	0.000
Freedom to make decisions	Low autonomy over work pace	-0.360***	0.001
Freedom to make decisions	Low autonomy over work manner	-0.363***	0.001
Freedom to make decisions	Low autonomy over task order	-0.461***	0.000
Freedom to make decisions	Low autonomy over work hours	-0.461***	0.000
Structured versus unstructured work	Low overall autonomy	-0.609***	0.000
Structured versus unstructured work	Low autonomy over job tasks	-0.627***	0.000
Structured versus unstructured work	Low autonomy over work pace	-0.500***	0.000
Structured versus unstructured work	Low autonomy over work manner	-0.531***	0.000
Structured versus unstructured work	Low autonomy over task order	-0.670***	0.000
Structured versus unstructured work	Low autonomy over work hours	-0.605***	0.000
Pace Determined by speed of equipment	Low overall autonomy	0.495***	0.000
Pace Determined by speed of equipment	Low autonomy over job tasks	0.548***	0.000
Pace Determined by speed of equipment	Low autonomy over work pace	0.356***	0.001
Pace Determined by Speed of equipment	Low autonomy over work manner	0.409***	0.000
Pace Determined by Speed of equipment	Low autonomy over task order	0.576***	0.000
Pace Determined by Speed of equipment	Low autonomy over work hours	0.563***	0.000

Notes: the Table shows the rank correlations between the average autonomy in an occupation and selected O*NET variables. ISCO88 occupations are defined at the 3-digit level. I use the average autonomy of people who report working in an occupation, and the average score on the O*NET variables of 4-digit occupations within the category. I convert the SOC occupations reported in the O*NET data to the ISCO88 by using crosswalks provided by Hardy (2016). *p<0.1; **p<0.05; ***p<0.01

D Robustness to different autonomy variable definitions

I re-estimate my baseline results, but re-code my autonomy variables so that a person has low autonomy over a particular aspect of work only if they report "none" of this type of autonomy at work. Results are presented for men in Table D1, and women in Table D2.

My results are qualitatively similar to my baseline results, with the exception that there is no statistically significant association between autonomy over hours and women's SF12.

Table D1: Associations between work-related autonomy and mental health when low autonomy is defined as having no autonomy, men

	Panel A: effect on GHQ12 caseness							
Low autonomy:								
overall	0.375***	0.537***	0.332***	0.34***				
	(0.082)	(0.109)	(0.119)	(0.12)				
over job tasks					0.316***	0.394***	0.325***	0.333***
					(0.078)	(0.098)	(0.097)	(0.098)
over work pace					0.408***	0.407***	0.29***	0.257**
					(0.081)	(0.101)	(0.104)	(0.103)
over work manner					-0.038	-0.071	-0.188	-0.193
					(0.12)	(0.138)	(0.136)	(0.138)
over task order					-0.021	0.121	0.224*	0.264**
					(0.107)	(0.128)	(0.126)	(0.127)
over work hours					-0.056	0.024	0.098	0.097
					(0.048)	(0.06)	(0.066)	(0.065)
Observations	13,847	13,847	13,847	13,847	13,847	13,847	13,847	13,847
R^2	0.002	0.04	0.515	0.526	0.005	0.044	0.517	0.528
Observations	1.207	1.207	1.207	1.207	1.207	1.207	1.207	1.207
	Panel B: effect on SF12							
Low autonomy:								
overall	-1.371***	-1.831***	-0.871**	-0.905**				
	(0.289)	(0.384)	(0.356)	(0.356)				
over job tasks					-0.466*	-0.706**	-0.904***	-0.885***
					(0.274)	(0.33)	(0.297)	(0.298)
over work pace					-1.44***	-1.444***	-0.914***	-0.783***
					(0.284)	(0.333)	(0.298)	(0.298)
over work manner					0.213	0.267	1.126***	1.019**
					(0.422)	(0.496)	(0.437)	(0.434)
over task order					-0.552	-0.928**	-0.85**	-0.938**
					(0.373)	(0.438)	(0.404)	(0.403)
over work hours					-0.008	-0.255	-0.157	-0.2
					(0.166)	(0.216)	(0.207)	(0.207)
Observations	13,892	13,892	13,892	13,892	13,892	13,892	13,892	13,892
R^2	0.007	0.059	0.633	0.641	0.009	0.063	0.635	0.643
Dep var mean	50.489	50.489	50.489	50.489	50.489	50.489	50.489	50.489
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person FE	N	N	Y	Y	N	N	Y	Y
Other controls	N	Y	N	Y	N	Y	N	Y

Notes: I re-estimate my main results, redefining "low autonomy" on each measure of autonomy to refer to respondents saying they have "none" of this kind of autonomy. See notes to Table 3 for descriptions of the regression and key variables. *p<0.1; **p<0.05; ***p<0.01

Table D2: Associations between work-related autonomy and mental health when low autonomy is defined as having no autonomy, women

	Panel A: effect on GHQ12 caseness							
Low autonomy:								
overall	0.419***	0.495***	0.386***	0.408***				
	(0.085)	(0.109)	(0.101)	(0.102)				
over job tasks					0.275***	0.344***	0.266***	0.287***
					(0.084)	(0.098)	(0.097)	(0.098)
over work pace					0.349***	0.323***	0.191**	0.181**
					(0.082)	(0.097)	(0.087)	(0.087)
over work manner					0.183	0.19	0.049	0.044
					(0.121)	(0.14)	(0.131)	(0.133)
over task order					-0.284**	-0.187	-0.052	-0.033
					(0.111)	(0.125)	(0.117)	(0.117)
over work hours					0.098	0.145**	0.121*	0.136**
					(0.05)	(0.06)	(0.062)	(0.063)
Observations	15,708	15,708	15,708	15,708	15,708	15,708	15,708	15,708
R^2	0.002	0.031	0.546	0.554	0.005	0.034	0.546	0.555
Dep var mean	1.663	1.663	1.663	1.663	1.663	1.663	1.663	1.663
	Panel B: effect on SF12							
Low autonomy:								
overall	-0.887***	-1.149***	-1.064***	-1.098***				
	(0.267)	(0.34)	(0.319)	(0.316)				
over job tasks					-0.967***	-1.219***	-0.813***	-0.847***
					(0.264)	(0.312)	(0.289)	(0.293)
over work pace					-1.062***	-0.935***	-0.572**	-0.565**
					(0.258)	(0.282)	(0.248)	(0.25)
over work manner					-0.089	-0.02	-0.07	0.006
					(0.381)	(0.436)	(0.393)	(0.395)
over task order					0.76**	0.439	0.148	0.139
					(0.35)	(0.41)	(0.349)	(0.341)
over work hours					0.025	-0.126	-0.235	-0.255
					(0.156)	(0.196)	(0.187)	(0.187)
Observations	15,692	15,692	15,692	15,692	15,692	15,692	15,692	15,692
R^2	0.006	0.043	0.618	0.628	0.008	0.045	0.619	0.628
Dep var mean	49.033	49.033	49.033	49.033	49.033	49.033	49.033	49.033
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person FE	N	N	Y	Y	N	N	Y	Y
Other controls	N	Y	N	Y	N	Y	N	Y

Notes: I re-estimate my main results, redefining "low autonomy" on each measure of autonomy to refer to respondents saying they have "none" of this kind of autonomy. See notes to Table 3 for descriptions of the regression and key variables. *p<0.1; **p<0.05; ***p<0.01

E Robustness to different summary measures of work-related autonomy

Tables E1 and E2 report regression results for different summary measures of overall low autonomy.

Table E1: Robustness of the Causal Effects of Low Overall Autonomy on the Mental Health of Men to Different Cutoffs

	Panel A: effect on GHQ12 caseness							
Dimensions of low autonomy (≥ 1)	0.237***	0.266***						
	(0.047)	(0.053)						
Dimensions of low autonomy (≥ 2)			0.448***	0.452***				
			(0.057)	(0.056)				
Dimensions of low autonomy (≥ 4)					0.539***	0.504***		
					(0.087)	(0.076)		
Dimensions of low autonomy (≥ 5)							0.497***	0.405***
							(0.112)	(0.094)
Observations	13,847	13,847	13,847	13,847	13,847	13,847	13,847	13,847
	Panel B: effect on SF12							
Dimensions of low autonomy (≥ 1)	-1.227***	-0.767***						
	(0.177)	(0.163)						
Dimensions of low autonomy (≥ 2)			-1.769***	-1.184***				
			(0.207)	(0.172)				
Dimensions of low autonomy (≥ 4)					-1.942***	-1.251***		
					(0.300)	(0.236)		
Dimensions of low autonomy (≥ 5)							-1.836***	-0.950***
							(0.392)	(0.294)
Observations	13,892	13,892	13,892	13,892	13,892	13,892	13,892	13,892
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person fixed effects	N	Y	N	Y	N	Y	N	Y
Other controls	N	Y	N	Y	N	Y	N	Y

Notes: This table shows the results of regressing measures of mental health on measures of low autonomy as measured by different cutoff values for my summary variable amongst men. For each regression, the explanatory variable is a dummy variable indicating whether a person has low autonomy across a greater number of dimensions than a given number. The GHQ12 caseness and SF12 are defined in the note to Table 1. Standard errors are clustered at the individual level. Other controls are defined in the note to Table 3. *p<0.1; **p<0.05; ***p<0.01

Table E2: Robustness of the causal effects of low overall autonomy on the Mental Health of Women to Different Cutoffs

	Panel A: effect on GHQ12 caseness							
Dimensions of low autonomy (≥ 1)	0.289***	0.335***						
	(0.055)	(0.059)						
Dimensions of low autonomy (≥ 2)			0.460***	0.388***				
			(0.059)	(0.057)				
Dimensions of low autonomy (≥ 4)					0.537***	0.515***		
					(0.088)	(0.075)		
Dimensions of low autonomy (≥ 5)							0.494***	0.507***
							(0.116)	(0.092)
Observations	15,708	15,708	15,708	15,708	15,708	15,708	15,708	15,708
	Panel B: effect on SF12							
Dimensions of low autonomy (≥ 1)	-0.863***	-0.802***						
	(0.185)	(0.172)						
Dimensions of low autonomy (≥ 2)			-1.294***	-1.074***				
			(0.189)	(0.165)				
Dimensions of low autonomy (≥ 4)					-1.210***	-1.151***		
					(0.272)	(0.219)		
Dimensions of low autonomy (≥ 5)							-1.081***	-1.076***
							(0.342)	(0.269)
Observations	15,692	15,692	15,692	15,692	15,692	15,692	15,692	15,692
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person fixed effects	N	Y	N	Y	N	Y	N	Y
Other controls	N	Y	N	Y	N	Y	N	Y

Notes: This table shows the results of regressing measures of mental health on measures of low autonomy as measured by different cutoff values for my summary variable amongst women. For each regression, the explanatory variable is a dummy variable indicating whether a person has low autonomy across a greater number of dimensions than a given number. The GHQ12 caseness and SF12 are defined in the note to Table 1. Standard errors are clustered at the individual level. Other controls are defined in the note to Table 3. *p<0.1; **p<0.05; ***p<0.01

F Using Principal Component Analysis to summarize work-related autonomy

I test robustness of my results to using an alternative method of aggregating different aspects of work-related autonomy into a single measure. Specifically, I run a Principal Component Analysis (PCA) and take the first Principal Component (PC1) as my measure of low overall autonomy. PC1 explains 35% of the variation in the individual components of work-related autonomy.

In Figure F1, I plot the factor loadings on PC1, compared to equal weighting. Notably, PC1's loadings are reasonably close to equal weights.

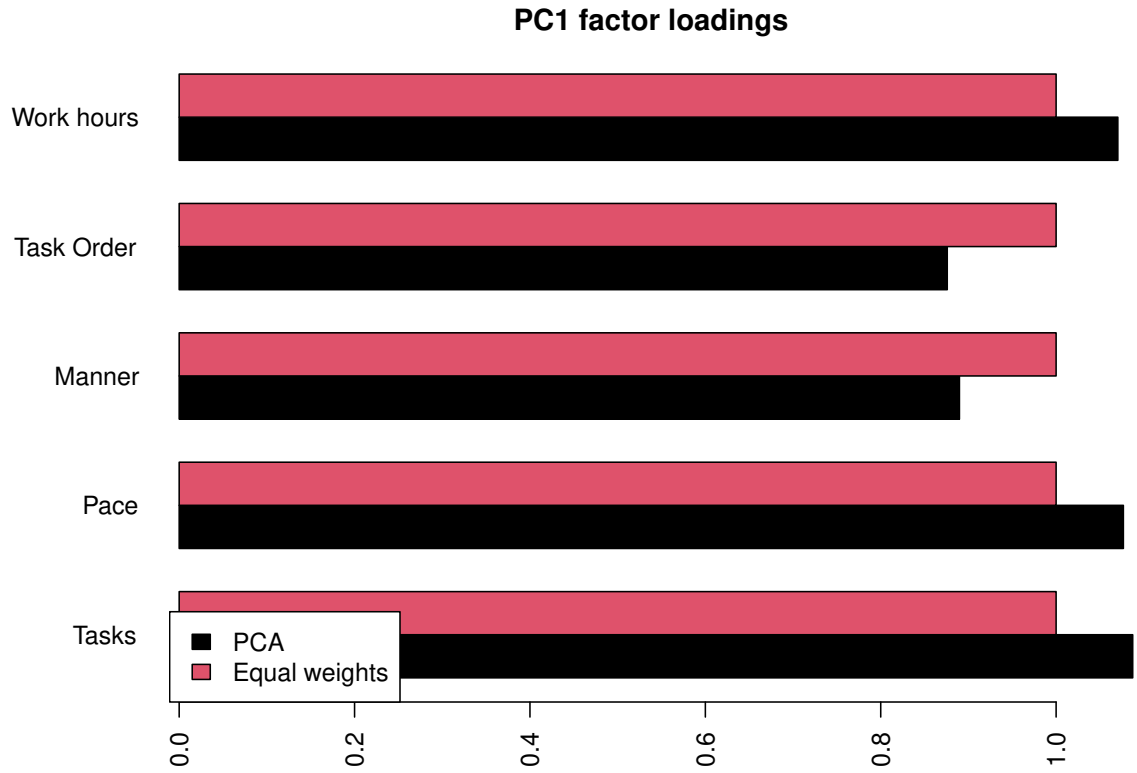
In Table F1, I re-estimate my baseline results using PC1 as my measure of work-related autonomy. I scale the PC1 so that it has the same standard deviation as my main overall work-related autonomy variable. Results are qualitative similar to my baseline results: there is a consistent association between low work-related autonomy and worse mental health. Estimates are not heavily affected by controls.

G Robustness to inclusion of respondents who are not consistently in work

As a robustness test, I re-run my analysis including observations of people who are not in work in every wave they are observed. The rationale for excluding these workers from my main sample is that including them introduces a selection problem. For these workers, their work-related autonomy is only observed in some periods, and employment and mental health may be jointly determined.

Including these respondents increases the total sample size to 69, 824 person-wave observations of 22, 945 unique individuals. I estimate the same set of regressions as for the main sample. Results are presented in Table G1. Point estimates are generally similar to those calculated from the main sample, but controls have a larger effect on the estimate. Results are broadly robust, in

Figure F1: factor loading of the first principle component of individual aspects of autonomy, compared to equal weights



Notes: The Figure plots the factor loadings of the first principal component of individual components of autonomy, and equal weights, for comparison.

Table F1: Associations between mental health and the first principal component of work-related autonomy

	Panel A: GHQ12 caseness, men			
Autonomy PC1	0.521***	0.689***	0.669***	0.658***
	(0.059)	(0.066)	(0.073)	(0.087)
Observations	13,847	13,847	13,847	13,847
R-squared	0.007	0.032	0.517	0.526
Dep var mean	1.187	1.187	1.187	1.187
	Panel B: SF12, men			
Autonomy PC1	-2.195***	-2.668***	-1.870***	-1.825***
	(0.197)	(0.216)	(0.216)	(0.265)
Observations	13,892	13,892	13,892	13,892
R-squared	0.014	0.055	0.635	0.640
Dep var mean	50.534	50.534	50.534	50.534
	Panel C: GHQ12 caseness, women			
Autonomy PC1	0.573***	0.704***	0.593***	0.601***
	(0.062)	(0.067)	(0.068)	(0.080)
Observations	15,708	15,708	15,708	15,708
R-squared	0.007	0.027	0.544	0.549
Dep var mean	1.642	1.642	1.642	1.642
	Panel D: SF12, women			
Autonomy PC1	-1.546***	-1.883***	-1.527***	-1.520***
	(0.189)	(0.200)	(0.195)	(0.238)
Observations	15,692	15,692	15,692	15,692
R-squared	0.008	0.036	0.620	0.626
Dep var mean	49.045	49.045	49.045	49.045
Wave	Y	Y	Y	Y
Person FE	N	N	Y	Y
Other controls	N	Y	N	Y

Notes: The Table presents conditional associations between mental health and the first principal component of work-related autonomy. See Table 3 for a description of the regression specifications and mental health variables. *p<0.1; **p<0.05; ***p<0.01

that low overall autonomy is always associated with worse mental health; low autonomy over job tasks is associated with worse mental health in nearly all specifications; and low autonomy over work hours causes worse mental health for women in my preferred specifications.

There are two likely reasons for the greater effect of controls in this sample. Firstly, workers who experience spells of non-work are observably and unobservably different in their mental health, the types of jobs they do, and variables such as education. This variation generates additional associations between mental health and work-related autonomy which can be explained with controls. One implication is that my results in the main text which refer specifically to workers who are consistently in work likely do not generalize to all workers. Secondly, the average number of observations per individual in this sample is 2.11, versus 3.6 in the main sample. As a result, controls such as person fixed effects mechanically absorb larger portions of the variation in the dependent variable.

Table G1: Robustness of the causal effect of low autonomy on the mental health of men using the full sample of workers

	Panel A: effect on GHQ12 caseness							
Low autonomy:								
overall	0.474***	0.508***	0.322***	0.334***				
	(0.039)	(0.051)	(0.056)	(0.056)				
over job tasks					0.154***	0.19***	0.128**	0.13**
					(0.044)	(0.051)	(0.055)	(0.055)
over work pace					0.408***	0.385***	0.268***	0.269***
					(0.046)	(0.053)	(0.056)	(0.055)
over work manner					0.023	-0.001	0.078	0.083
					(0.059)	(0.068)	(0.072)	(0.071)
over task order					0.187***	0.255***	0.138**	0.15**
					(0.054)	(0.063)	(0.068)	(0.068)
over work hours					-0.064*	-0.062	-0.025	-0.009
					(0.033)	(0.038)	(0.045)	(0.045)
Observations	27,594	27,594	27,594	27,594	27,594	27,594	27,594	27,594
R^2	0.005	0.038	0.557	0.562	0.01	0.042	0.558	0.564
Observations	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
	Panel B: effect on SF12							
Low autonomy:								
overall	-2.001***	-2.034***	-1.076***	-1.165***				
	(0.135)	(0.176)	(0.17)	(0.172)				
over job tasks					-0.362**	-0.535***	-0.201	-0.241
					(0.154)	(0.168)	(0.165)	(0.164)
over work pace					-1.683***	-1.569***	-0.889***	-0.895***
					(0.16)	(0.177)	(0.162)	(0.162)
over work manner					0.035	0.095	-0.135	-0.155
					(0.206)	(0.226)	(0.221)	(0.22)
over task order					-0.898***	-1.123***	-0.677***	-0.739***
					(0.187)	(0.207)	(0.2)	(0.2)
over work hours					-0.151	0.002	0.101	0.05
					(0.114)	(0.136)	(0.143)	(0.143)
Observations	27,594	27,594	27,594	27,594	27,594	27,594		
R^2	0.014	0.067	0.664	0.67	0.02	0.073	0.665	0.671
50.598	50.598	50.598	50.598	50.598	50.598	50.598	50.598	
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person FE	N	N	Y	Y	N	N	Y	Y
Other controls	N	Y	N	Y	N	Y	N	Y

Notes: I re-estimate my main results with a larger sample, including all observations of workers, instead of only those who are continuously in work. See notes to Table 3 for descriptions of the regression and key variables. *p<0.1; **p<0.05; ***p<0.01

Table G2: Robustness of the causal effect of low autonomy on the mental health of women using the full sample of workers

	Panel A: effect on GHQ12 caseness							
Low autonomy:								
overall	0.517***	0.548***	0.318***	0.345***				
	(0.039)	(0.049)	(0.051)	(0.051)				
over job tasks					0.267***	0.3***	0.268***	0.279***
					(0.045)	(0.05)	(0.051)	(0.051)
over work pace					0.265***	0.258***	0.146***	0.139***
					(0.047)	(0.051)	(0.052)	(0.052)
over work manner					0.185***	0.182***	0.032	0.041
					(0.058)	(0.065)	(0.064)	(0.064)
over task order					-0.035	0.008	0.043	0.067
					(0.055)	(0.061)	(0.062)	(0.062)
over work hours					0.054	0.051	0.096**	0.115**
					(0.035)	(0.04)	(0.046)	(0.046)
Observations	33,711	33,711	33,711	33,711	33,711	33,711	33,711	33,711
R^2	0.006	0.034	0.576	0.58	0.008	0.037	0.577	0.581
Dep var mean	1.766	1.766	1.766	1.766	1.766	1.766	1.766	1.766
	Panel B: effect on SF12							
Low autonomy:								
overall	-1.57***	-1.597***	-0.844***	-0.932***				
	(0.123)	(0.153)	(0.15)	(0.15)				
over job tasks					-0.898***	-0.944***	-0.668***	-0.695***
					(0.142)	(0.155)	(0.15)	(0.15)
over work pace					-0.916***	-0.909***	-0.54***	-0.519***
					(0.151)	(0.157)	(0.149)	(0.148)
over work manner					-0.316*	-0.267	0.055	0.008
					(0.185)	(0.2)	(0.187)	(0.187)
over task order					0.199	0.013	0.134	0.059
					(0.174)	(0.195)	(0.184)	(0.183)
over work hours					-0.356***	-0.21	-0.445***	-0.514***
					(0.111)	(0.133)	(0.134)	(0.135)
Observations	33,699	33,699	33,699	33,699	33,699	33,699	33,699	33,699
R^2	0.012	0.054	0.649	0.654	0.015	0.056	0.649	0.655
Dep var mean	48.663	48.663	48.663	48.663	48.663	48.663	48.663	48.663
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person FE	N	N	Y	Y	N	N	Y	Y
Other controls	N	Y	N	Y	N	Y	N	Y

Notes: I re-estimate my main results with a larger sample, including all observations of workers, instead of only those who are continuously in work. See notes to Table 3 for descriptions of the regression and key variables. *p<0.1; **p<0.05; ***p<0.01

H Robustness to inclusion of respondents with missing personality information

In this Appendix, I re-estimate my baseline results on a larger sample which includes observations of people who do not report personality scores. Results are presented in Tables H1 and H2. My results are qualitatively consistent with my baseline results, and similar in magnitude.

Table H1: Robustness of the association between low autonomy and mental health including observations without personality information, men

	Panel A: effect on GHQ12 caseness							
Low autonomy:								
overall	0.384***	0.478***	0.399***	0.392***				
	(0.047)	(0.061)	(0.072)	(0.072)				
over job tasks					0.217***	0.274***	0.232***	0.223***
					(0.053)	(0.06)	(0.068)	(0.067)
over work pace					0.344***	0.333***	0.256***	0.256***
					(0.055)	(0.061)	(0.067)	(0.067)
over work manner					0.099	0.055	0.107	0.111
					(0.071)	(0.08)	(0.091)	(0.091)
over task order					0.022	0.12	0.151*	0.148*
					(0.065)	(0.074)	(0.088)	(0.089)
over work hours					-0.088**	-0.02	0.042	0.042
					(0.039)	(0.045)	(0.055)	(0.055)
Observations	17,300	17,300	17,300	17,300	17,300	17,300	17,300	17,300
R^2	0.004	0.046	0.562	0.571	0.009	0.051	0.564	0.573
Observations	1.206	1.206	1.206	1.206	1.206	1.206	1.206	1.206
	Panel B: effect on SF12							
Low autonomy:								
overall	-1.733***	-1.997***	-1.234***	-1.224***				
	(0.166)	(0.212)	(0.213)	(0.213)				
over job tasks					-0.431**	-0.672***	-0.391*	-0.379*
					(0.187)	(0.204)	(0.201)	(0.202)
over work pace					-1.333***	-1.276***	-0.852***	-0.81***
					(0.192)	(0.213)	(0.196)	(0.198)
over work manner					0.035	0.095	-0.135	-0.155
					(0.206)	(0.226)	(0.221)	(0.22)
over task order					-0.442*	-0.72***	-0.64**	-0.665***
					(0.229)	(0.255)	(0.257)	(0.256)
over work hours					-0.446*	-0.339	-0.206	-0.23
					(0.25)	(0.279)	(0.287)	(0.284)
Observations	17,317	17,317	17,317	17,317	17,317	17,317	17,317	17,317
R^2	0.013	0.06	0.673	0.681	0.017	0.065	0.675	0.682
Dep var mean	50.477	50.477	50.477	50.477	50.477	50.477	50.477	50.477
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person FE	N	N	Y	Y	N	N	Y	Y
Other controls	N	Y	N	Y	N	Y	N	Y

Notes: I re-estimate my main results with a larger sample, including observations which do not report scores for the personality variables. See notes to Table 3 for descriptions of the regression and key variables. *p<0.1; **p<0.05; ***p<0.01

Table H2: Robustness of the association between low autonomy and mental health including observations without personality information, women

	Panel A: effect on GHQ12 caseness							
Low autonomy:								
overall	0.515***	0.594***	0.383***	0.397***				
	(0.051)	(0.065)	(0.068)	(0.069)				
over job tasks					0.242***	0.289***	0.26***	0.283***
					(0.059)	(0.065)	(0.068)	(0.069)
over work pace					0.221***	0.241***	0.053	0.039
					(0.061)	(0.065)	(0.069)	(0.069)
over work manner					0.357***	0.348***	0.215***	0.222***
					(0.077)	(0.085)	(0.082)	(0.082)
over task order					-0.134*	-0.105	0.054	0.063
					(0.073)	(0.079)	(0.078)	(0.079)
over work hours					0.056	0.119**	0.182***	0.193***
					(0.045)	(0.053)	(0.062)	(0.063)
Observations	18,884	18,884	18,884	18,884	18,884	18,884	18,884	18,884
R^2	0.006	0.036	0.588	0.595	0.009	0.039	0.589	0.597
Dep var mean	1.665	1.665	1.665	1.665	1.665	1.665	1.665	1.665
	Panel B: effect on SF12							
Low autonomy:								
overall	-1.386***	-1.624***	-0.99***	-0.975***				
	(0.161)	(0.202)	(0.201)	(0.201)				
over job tasks					-0.87***	-0.956***	-0.64***	-0.662***
					(0.185)	(0.202)	(0.199)	(0.2)
over work pace					-0.881***	-0.919***	-0.354*	-0.324*
					(0.193)	(0.202)	(0.192)	(0.191)
over work manner					-0.733***	-0.696***	-0.491**	-0.486*
					(0.242)	(0.264)	(0.25)	(0.248)
over task order					0.685***	0.469*	0.142	0.12
					(0.23)	(0.255)	(0.244)	(0.241)
over work hours					-0.178	-0.302*	-0.569***	-0.583***
					(0.144)	(0.174)	(0.181)	(0.182)
Observations	18,872	18,872	18,872	18,872	18,872	18,872	18,872	18,872
R^2	0.011	0.048	0.654	0.662	0.014	0.051	0.655	0.663
Dep var mean	48.968	48.968	48.968	48.968	48.968	48.968	48.968	48.968
Wave	Y	Y	Y	Y	Y	Y	Y	Y
Person FE	N	N	Y	Y	N	N	Y	Y
Other controls	N	Y	N	Y	N	Y	N	Y

Notes: I re-estimate my main results with a larger sample, including observations which do not report scores for the personality variables. See notes to Table 3 for descriptions of the regression and key variables. *p<0.1; **p<0.05; ***p<0.01

I Trajectory of mental health about changes in work-related autonomy

In this section, I explore how mental health evolves around changes in work-related autonomy. To do so, I limit my sample to just those individuals who experience exactly one transition in work-related autonomy, either from high autonomy to low autonomy or low autonomy to high autonomy, and estimate the conditional change in mental health symptoms around that change. Specifically, I estimate the following regressions:

$$\text{mental\_health}_{it} = \Sigma_{t \neq -2} \beta_\tau \mathbb{1}(t - T_i = \tau) + X_{it}' \gamma + \eta_t + \mu_i + \epsilon_{it} \tag{6}$$

Here X_{it} include all of the controls used in the most saturated model (occupation, education, marital status, having children and age). T_i is the wave of the survey in which person i is first "treated" (i.e., either working in a low autonomy job if this is the treatment, or working in a high autonomy job is this is the treatment). η_t and μ_i are wave and person fixed effects respectively. The β_τ coefficients report how the worker's mental health changes relative to the period when they first report being treated, holding constant my control variables. I plot β_τ, and their 95% confidence intervals, in Figure I1.

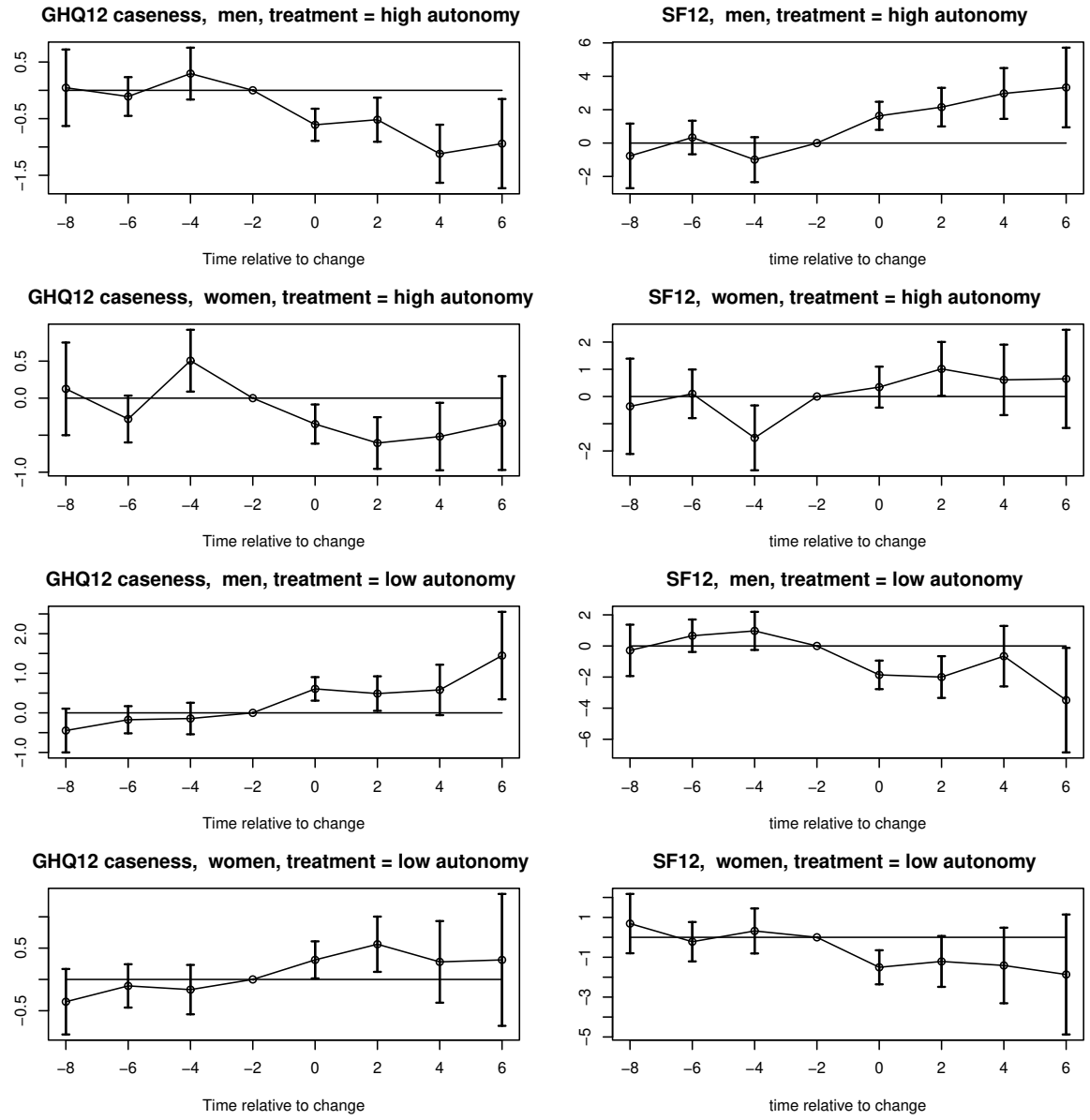
In principle, the timing of the transition from high autonomy to low autonomy work and vice versa and the change in mental health may be informative about the causal connection between the two. If the majority of the change in mental health happens after the change in working conditions, this is consistent with a causal effect of working conditions on mental health; if the majority of the change in mental health happens before the change in working conditions, it seems more likely that the association reflects sorting based on mental health (Boyce and Oswald 2012).

In general, the event studies suggest that the majority of the change in mental health occurs in the same two year time period as the change in work-related autonomy. Men who transition from low autonomy to high autonomy experience an improvement in their mental health in the

first period in which they are observed working in a high autonomy job, and men who transition from high autonomy jobs to low autonomy jobs experience worse mental health in the first period in which they are observed working in a low autonomy job. There is little evidence of pre-trends for any of the event studies of men. For women, while their mental health improves at the time they transition from low autonomy to high autonomy work, there is also evidence of an improvement in mental health in the four years leading to this transition. However, for women transitioning to low autonomy work the pre-trends are small and insignificant. For the most part these results are consistent with work-related autonomy having an effect on mental health rather than the other way around.

Some caution is required in drawing firm conclusions from this exercise. My event studies cannot speak to the ordering of the changes in work-related autonomy and mental health within the two-year window between observations. They are, however, mostly consistent with the causal effect I argue for in the main text.

Figure I1: The evolution of mental health around a transition between high and low autonomy work.



Notes: I estimate the path of mental health about a transition from high autonomy to low autonomy work or low autonomy work to high autonomy work as in equation 6. I plot the coefficients β_τ which describe average mental health compared to the first period in which a person is treated, conditional on covariates. The sample is all people who ever experience the relevant transition (either from low autonomy work to high autonomy work, or from high autonomy work to low autonomy work), and transition at most once. I define overall low autonomy as being equal to 1 if a person scores 1 (low) on 3 or more aspects of workplace autonomy. The GHQ12 caseness is the number of negative mental health symptoms a person has. The SF12 index scores the mental health of a person between 0 (worst) and 100 (best) based on their answers to a health survey.