# Web Appendices

This document contains the Web Appendices, intended to be available electronically either from the journal website or my own website. These are for additional transparency for parts of the analysis that would previously not be publicly available (e.g. to avoid the situation of stating ‘details available on request’).

### Table of Contents

[Web Appendix 1. Additional references 1](#_Toc360900310)

[Web Appendix 2. Creation of demands/control/physicality scales 2](#_Toc360900311)

[Web Appendix 3. The bespoke occupational classification 7](#_Toc360900312)

[Web Appendix 4. Creating consistent classifications 12](#_Toc360900313)

[Web Appendix 5. Control variables & secondary outcome variables 15](#_Toc360900314)

[Web Appendix 6. Sensitivity analyses 26](#_Toc360900315)

[Bibliography for Web Appendices 29](#_Toc360900316)

## Additional references

### Policy references

For further detail, see the PMSU report (PMSU, 2005); Government Green Papers and White Papers reforming the incapacity benefits system: (DWP, 2010, DWP, 2006, DWP, 2008, DWP, 2008), and Coalition Government statements on incapacity benefits (DWP, 2010, Freud, 2010).

[Full bibliographic details are given in the bibliography at the end of the Web Appendices].

## Creation of demands/control/physicality scales

Three questions on demands and five questions on control are available in all of the Employment in Britain (EiB) survey 1992 and the Skills Surveys 2001/2006, from which we can construct scales of demands and control. In addition to this, two questions on physicality are available from the 1997-2006 Skills Surveys. These are:

**Demands**

D1: My job requires that I work very hard

1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

D4: How often does your work involve working at very high speed?

1. All the time 2. Almost all the time 3. Around three quarters of the time 4. Around half the time 5. Around quarter of the time 6. Almost never 7. Never

D12: I work under a great deal of tension

1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

**Control**

C1: How much influence do you personally have on how hard you work?

1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

C2: Which, if any, of the things on this card are important in determining how hard you work in your job?

...Your own discretion

C25: (And how much influence do you personally have on … deciding how you are to do the task?

 1. A great deal 2. A fair amount 3. Not much 4. None at all

C33: And how much influence do you personally have on… deciding what tasks you are to do?

1. A great deal 2. A fair amount 3. Not much 4. None at all

C49: And how much influence do you personally have on … deciding the quality standards to which you work?

1. A great deal 2. A fair amount 3. Not much 4. None at all

**Physicality**

P6: [In your job, how important is…] physical strength (for example, to carry, push or pull heavy objects?

1. Essential 2. Very important 3. Fairly important 4. Not very important 5. Not at all important/does not apply

P8: [In your job, how important is...] physical stamina (to work for long periods on physical activities)?

1. Essential 2. Very important 3. Fairly important 4. Not very important 5. Not at all important/does not apply

Initial analyses used all of these questions. However, Principal Components Analysis suggested that one of the items for control (C2) was only weakly related to the other questions; this question was therefore dropped. (The question itself was designed to measure effort pressures rather than job control, so it seems reasonable to consider that the responses reflect wider factors than the other questions).

There are various ways of constructing scales from measures such as these based on the degree to which they appear to measuring the same underlying construct (rather than arbitrary summary scores). Much of the previous work using the Skills Surveys has used Principal Components Analysis (PCA), but while this is a widely-used approximation, PCA makes assumptions that are not technically valid for the ordinal data used here.

Instead, I here used Item Response Theory (IRT) models. IRT models are conceptually distinct from PCA/factor analysis in certain ways (Bartholomew et al., 2008), but they are used here for the practical reason that they are more suited to ordinal data. The IRT model for ordinal data is an extension of the model for binary data, where is the probability of observing a specific binary response given the latent trait . For the ordinal model, we model the cumulative response probability of a response falling into group ‘*s*’ or lower (Bartholomew, et al., 2008, Zheng and Rabe-Hesketh, 2007):

and therefore

For example, would be the probability of a person giving the response ‘strongly agree’ (s=1) or ‘agree’ (s=2) to item D1 (‘My job requires that I work very hard’). The univariate two-parameter model is usually parameterised based on the logistic distribution, showing the odds of being in any category up to and including category s, based on the difficulty parameter and the discrimination parameters for each question in the overall scale:

While Stata is not the ideal package in which to do latent variable analyses, the capability to estimate ordinal IRT models has been provided using the GLLAMM command of Skrondal, Pickles and Rabe-Hesketh (Skrondal and Rabe-Hesketh, 2004, Zheng and Rabe-Hesketh, 2007). While some authors present relatively little of the GLLAMM output (Li et al., 2005, Ng et al., 2010), I here follow other authors (Bertelli and Richardson Jr, 2008, Faye et al., 2011:13, Raileanu Szeles and Fusco, 2009) in presenting the difficulty and discrimination parameters for transparency at the end of this Appendix. The trait score for each possible combination of answers was then estimated and assigned to each person in the Skills Surveys.

Finally, for the main demands and control scales, I checked the two-parameter IRT models against other possible ways of constructing latent scales, including less flexible (one-parameter) IRT models, PCA adapted for ordinal variables (polychoric PCA, Holgado-Tello et al., 2008, Kolenikov and Angeles, 2004) and conventional PCA analysis. These other methods all produced a control scale that was more highly non-normal than the two-parameter IRT models, but otherwise the scales all correlated with one another very highly.

Unless otherwise specified, the results below account for differential non-response by gender.[[1]](#footnote-1) The combined sample size for these results is 15,654 for control and 13,397 for demands (the difference between them being the absence of the 1997 Skills Survey for the demands results). Some caution should be used with linear forms of the control and physicality scales as the latent scales are non-normally distributed (although this is not a problem for the categorical job strain measures).

Table A1: Item Response Theory model for Demands

|  |  |
| --- | --- |
|  | Two-parameter model |
|  | Estimate | SE |
| *Difficulty parameter* |  |  |
| D1 work very hard |  |  |
| Strongly agree->Agree | 0.51 | 0.03 |
| Agree->Disagree | -2.69 | 0.06 |
| Disagree->Strongly disagree | -4.85 | 0.15 |
| D4 very high speed |  |  |
| All the time->Almost all the time | 0.77 | 0.04 |
| Almost all the time->Around ¾ of the time | -0.18 | 0.03 |
| Around ¾ of the time->Around ½ the time | 0.65 | 0.03 |
| Around ½ the time->Around ¼ of the time | -0.19 | 0.03 |
| Around ¼ of the time->Almost never | 0.04 | 0.03 |
| Almost never->Never | -0.68 | 0.03 |
| D12 great deal of tension |  |  |
| Strongly agree->Agree | 1.28 | 0.04 |
| Agree->Disagree | -0.14 | 0.02 |
| Disagree->Strongly disagree | -2.70 | 0.06 |
| *Discrimination parameter* |  |  |
| D1 work very hard | 1 | Fixed |
| D4 very high speed | 0.26 | 0.01 |
| D12 great deal of tension | 0.81 | 0.05 |
| *Log likelihood* | *-63,353* |  |
| *n* | *15,972* |  |

The ‘difficulty parameters’ refer to the point at which the item is most sensitive to changes in latent demands – higher values of difficulty parameters here mean that the items respond most strongly to changes at higher levels of demands on the latent scale. For example, the cut-point between ‘disagree’ and ‘strongly disagree’ for D1 (‘work very hard’) is -4.85, whereas the cut-point between ‘strongly agree’ and ‘agree’ is higher at +0.51, showing that the former cut-point is primarily about low levels of demands, while the higher cut-point is about higher levels of demands (analogously to a more difficult exam question).

The inclusion of the ‘discrimination parameter’ sets this apart from a one-parameter IRT model. A high value on the discrimination parameter means that the variable is more sensitive to changes in the latent scale (i.e. it discriminates better between different levels of WLD). In other words, D1 (‘work very hard’) has a discrimination parameter of 1, and is therefore better at predicting latent demands than D4 (‘very high speed’) with a discrimination parameter of 0.26 (see Bartholomew, et al., 2008).

Table A2: Item Response Theory model for Control

|  |  |
| --- | --- |
|  | Two-parameter model |
|  | Estimate | SE |
| *Difficulty parameter* |  |  |
| C1 Influence on how hard work |  |  |
| Strongly agree->Agree | -0.67 | 0.02 |
| Agree->Disagree | -2.58 | 0.05 |
| Disagree->Strongly disagree | -3.17 | 0.08 |
| C25 Influence on how to do task |  |  |
| A great deal->A fair amount | -0.19 | 0.03 |
| A fair amount->Not much | -3.57 | 0.08 |
| Not much->None at all | -4.96 | 0.14 |
| C33 Influence on what tasks to do |  |  |
| A great deal->A fair amount | 0.62 | 0.03 |
| A fair amount->Not much | -1.39 | 0.04 |
| Not much->None at all | -2.72 | 0.06 |
| C49 Influence on quality standards |  |  |
| A great deal->A fair amount | -0.70 | 0.02 |
| A fair amount->Not much | -1.92 | 0.04 |
| Not much->None at all | -2.07 | 0.06 |
| *Discrimination parameter* |  |  |
| C1 Influence on how hard work | 1 | Fixed |
| C25 Influence on how to do task | 2.38 | 0.09 |
| C33 Influence on what tasks to do | 1.55 | 0.05 |
| C49 Influence on quality standards | 1.00 | 0.03 |
| *Log likelihood* | *-68,700* |  |
| *n* | *18,059* |  |

Table A3: Item Response Theory model for Physical demands

|  |  |
| --- | --- |
|  | Two-parameter model |
|  | Estimate | SE |
| *Difficulty parameter* |  |  |
| P6 (stamina) |  |  |
| Essential -> Very important | 2.83 | 0.23 |
| Very important -> Fairly important | 1.49 | 0.10 |
| Fairly important -> Not very important | 0.09 | 0.04 |
| Not v important -> Not at all important | -1.55 | 0.14 |
| P8 (strength) |  |  |
| Essential -> Very important | 2.22 | 0.14 |
| Very important -> Fairly important | 0.73 | 0.06 |
| Fairly important -> Not very important | -0.64 | 0.04 |
| Not v important -> Not at all important | -1.73 | 0.13 |
| *Discrimination parameter* |  |  |
| P6 (strength) | 1 | Fixed |
| P8 (stamina) | 0.83 | 0.11 |
| *Log likelihood* | *-41,113* |  |
| *n* | *14,695* |  |

## The bespoke occupational classification

Even when looking at a single occupational classification, we have the problem that there are relatively little data within each of the minor groups in the exposure data, with most unit-group occupations containing less than 30 people. If we use the higher-level groupings, however, then we lose some of the genuine variation that exists between different minor groups (for example, taxi drivers have a level of control just above 0 on the standardised scale, while bus and coach drivers have a level of control of -1.1). I therefore created a bespoke occupational grouping that combined rarer unit groups within the same major group until they contained at least 30 people; details of the resulting groups are given below.

### Bespoke occupational classification based on SOC 2000

|  |  |  |
| --- | --- | --- |
| **New code** | **Label** | **SOC2000 codes** |
| 102 | prod works & maintenance managers | [1121|1123] |
| 103 | managers in construction | [1122] |
| 104 | financial managers & chartered secs (plus purchasing managers) | [1131|1133] |
| 105 | marketing and sales managers (+ad/PR managers) | [1132|1134] |
| 106 | pers training, ind rel and R&D mngers | [1135|1137] |
| 107 | info & communication technol mngers | [1136] |
| 108 | customer care and QA managers | [1141|1142] |
| 109 | financial institution managers | [1151] |
| 110 | office managers | [1152] |
| 111 | storage, warehouse and transport/distn managers | [1161|1162] |
| 112 | retail and wholesale managers | [1163] |
| 113 | managers nec (inc health/social care and police/security) | [1171|1172|1173|1174|1181|1182|1183|1184|1185] |
| 114 | restaurant and catering managers | [1223] |
| 116 | leisure sector managers (inc leisure/sports,hotel,pub,travel agency) | [1221|1222|1224|1225|1226] |
| 117 | property, housing and land managers | [1231] |
| 118 | mngers and prop in other srvcs nec (inc hairdrs,garages,farms, natural environ) | [1211|1212|1219|1232|1233|1235|1239] |
| 119 | shopkprs, wholesale & retail dealrs | [1234] |
| 199 | senior officials in local/nat gov, spec interest orgs or major orgs(CEOs/directors) | [1111|1112|1113|1114] |
| 201 | natural scientists (chemists, physicists, metereologists) | [2111|2112|2113] |
| 203 | engineers | [2121-2129] |
| 204 | it strategy and planning prfsnals | [2131] |
| 205 | software professionals | [2132] |
| 206 | senior health professions + vets | [2211-2216] |
| 207 | higher educ teaching prfsnals | [2311] |
| 208 | further educ teaching prfsnals | [2312] |
| 209 | teaching professionals nec (inc senior admins) | [2313|2317|2319] |
| 210 | secondary eductn + SEN teaching prfsnals | [2314|2316] |
| 211 | prim & nurs eductn teaching profs | [2315] |
| 212 | researchers | [2321|2322|2329] |
| 213 | legal professionals (inc lawyers, judges & coroners) | [2411|2419] |
| 214 | chartered, certified & management accountants | [2421|2422] |
| 215 | mngmnt cons, actuar, econs & statn | [2423] |
| 216 | surveyors and architects (+town planners) | [2431-2434] |
| 217 | social workers (+probation officers & public admin profs) | [2441-2443] |
| 299 | other public profs (librarians/archivists,clergy) | [2444|2451|2452] |
| 300 | technicians | [3111-3119] |
| 301 | draughtspersons (+town plan technics) | [3121-3123] |
| 302 | it operations technicians | [3131] |
| 303 | it user support technicians | [3132] |
| 304 | nurses | [3211] |
| 305 | allied health professionals (midwives,pharma dispensers,med/dent technicians) | [3212-3218] |
| 306 | therapists (inc OTs, physios) | [3221-3229] |
| 307 | youth and community workers | [3231] |
| 308 | housing and welfare officers | [3232] |
| 309 | security officers (inc. police (sergeant&below), NCOs) | [3311-3314|3319] |
| 310 | creative workers (inc. authors, artists) | [3411-3416] |
| 311 | graphic and product designers | [3421|3422] |
| 312 | media & PR assoc profs (inc. journalists, photo equip operats) | [3431-3434] |
| 313 | sports & fitness occs (inc players, coaches, and fitness instructors) | [3441-3443|3449] |
| 314 | business, legal and related assoc profs (financial invest analysts & advisers, estimators, legal associates) | [3520|3529|3531-3537| |
| 315 | buyers and purchasing officers, estate agents, auctioneers | [3541|3544] |
| 316 | sales representatives | [3542] |
| 317 | marketing associate professionals | [3543] |
| 319 | assoc profs nec (inc occupl hygnists & health sfty offs, career advice) | [3551-3552|3561-3568] |
| 320 | personnel & ind relations offs | [3562] |
| 321 | vocatn & indust trainrs & instrctrs | [3563] |
| 401 | civil serv (EOs to admin assists) | [4111|4112] |
| 402 | local gov & NGO officers & assists | [4113|4114] |
| 403 | bookkeepers (+credit controllers) | [4121|4122] |
| 404 | counter clerks | [4123] |
| 405 | filng & othr recrds assists & clrks | [4131] |
| 406 | pensions and insurance clrks | [4132] |
| 407 | stock control clerks | [4133] |
| 408 | telephonists, comms operators and market res interviewers | [4137|4141|4142] |
| 409 | receptionists (+typists) | [4216|4217] |
| 410 | general office assistants or clerks | [4150] |
| 411 | medical,legal and school secretaries | [4211|4212|4213] |
| 412 | secretaries nec (PAs,company secs) | [4214|4215] |
| 413 | library and database assistants & clerks | [4135|4136] |
| 500 | agricult and fishing trades (inc farmers, gardeners) | [5111-5113|5119] |
| 501 | pipe, metal and welding trades | [5211-5216] |
| 502 | mtl working prod & maintnce fitter (+tool mkrs & setter-operators) | [5221-5224] |
| 503 | motor and vehicle workers (mechanics, electricians, spray painters) | [5231-5234] |
| 504 | electricians, electrical fitters | [5241] |
| 505 | elec & electronic engineer nec | [5242-5245|5249] |
| 506 | construction trades nec | [5311|5312|5313|5316|5319] |
| 507 | plumb, hea & ventilating engineers | [5314] |
| 508 | carpenters and joiners | [5315] |
| 509 | painters, decorators, plasterers and floorers | [5321-5323] |
| 510 | printers and bookbinders | [5421-5424]] |
| 511 | butchers, fishmongers, bakers | [5431-5433] |
| 512 | chefs, cooks | [5434] |
| 513 | hand craft occs nec | [5411-5414|5419|5491-5496|5499] |
| 600 | nursing auxiliaries and assistants (+ dental/animal care occs) | [6111|6112|6113|6131|6139] |
| 601 | care assistants and home carers | [6114|6115] |
| 602 | nursery nurses | [6121] |
| 603 | childminders, playgroup workers and rel occupations | [6122|6123] |
| 604 | educal assistants | [6124] |
| 605 | leisure & travel serv occs nec (inc travel agents, tour guides) | [6211-6215|6219] |
| 606 | hairdressers, beauticians and related occs | [6221-6222] |
| 607 | caretakers, housekprs and related occs | [6231-6232] |
| 708 | sales and retail assistants | [7111] |
| 709 | retail cashiers/check-out operators | [7112] |
| 710 | telephone salespersons | [7113] |
| 711 | customer care occupations (inc call centre agents) | [7211-7212] |
| 799 | sales related occupations nec (inc debt collectors, salespersons) | [7121-7125|7129] |
| 800 | food, drink & tobac process operat | [8111] |
| 801 | process operatives nec | [8112-8119] |
| 802 | metal working machine operatives | [8215] |
| 803 | operatives nec | [8121-8214|8216|8120] |
| 804 | assemblers (electrical/vehicle/met products) | [8131|8132] |
| 805 | assemblers & routine pertves nec (inc routine inspectors/testers, sewing machinists) | [8133-8139] |
| 806 | construction operatives | [8141-8143|8149] |
| 807 | transport operatives nec (inc HGV drivers) | [8211|8215-8219] |
| 808 | van drivers | [8212] |
| 809 | bus and coach drivers | [8213] |
| 810 | taxi, cab drivers and chauffeurs | [8214] |
| 812 | mobile machinery drivers & opertves (inc fork-lift trucks) | [8221-8223|8229] |
| 900 | fishng & agric reltd occupatns (inc farm workers) | [9111-9112|9119] |
| 901 | labourers in construction trades | [9121|9129] |
| 902 | labourers within process and plant operations (inc packers) | [9131-9134|9139] |
| 903 | good hndlng & storage occs | [9141|9149] |
| 904 | post workers and couriers (+ oth elementary office occs) | [9211|9219] |
| 905 | bar staff (+other elmntry personal servcs occs nec) | [9221|9222|9225|9226|9229] |
| 906 | kitchen/catering assistants and waiters | [9223|9224] |
| 907 | cleaners (inc domestics) | [9231-9235|9239] |
| 908 | security guards and rel occupations | [9241] |
| 910 | elementary security occ nec (inc school mid-day assistants) | [9242-9245|9249] |

*Note that ‘nec’ stands for ‘not elsewhere classified’*

*Labels in brackets after a ‘+’ sign refer to rare occupations within the combined category*

### Bespoke occupational classification based on SOC90

|  |  |  |
| --- | --- | --- |
| **New code** | **Label** | **SOC2000 codes** |
| 101 | General managers in large organisations, senior administrators in national govt  | [100|101] |
| 102 | Production, works and maintenance managers  | [110] |
| 103 | Managers in building contracting (+mining/energy & clerks of works)  | [111-113] |
| 104 | Treasurers and company financial managers (+company secreatries)  | [120|127] |
| 105 | Marketing and sales managers  | [121] |
| 106 | Computer systems and data processing managers (+purchasing/methods managers)  | [122|125|126] |
| 107 | Personnel, training and industrial relations managers  | [124] |
| 108 | Bank, Building Society and Post Office managers (except self-employed)  | [131] |
| 109 | Other financial institutions and office managers nec (inc. credit controllers and civil service EOs)  | [130|132|139] |
| 110 | Managers in transport and storing  | [140-142] |
| 111 | Protective service officers (police, armed forces, immigration)  | [150-155] |
| 112 | Managers in farming, horticulture, forestry and fishing  | [160|169] |
| 113 | Managers and proprietors in service industries nec  | [170|171|176-179] |
| 115 | Restaurant and catering managers  | [174] |
| 116 | Hotel/accommodation/pub/inn managers and club stewards  | [173|175] |
| 117 | Other managers and administrators nec  | [190|191|199] |
| 118 | Local government officers (administrative and executive functions) and general adminsitrators in national govt  | [102|103] |
| 119 | Advertising and public relations managers  | [123] |
| 120 | Hairdressers' and barbers' managers and proprietors  | [172] |
| 201 | Natural scientists (+social scientists)  | [200-202|209|291] |
| 203 | Software engineers professional  | [214] |
| 204 | Mechanical/civil/structural/municipal/mining/quarrying engineers  | [210|211] |
| 205 | Other engineers and technologists nec  | [212|213|215|217-219] |
| 206 | Medical practitioners  | [220] |
| 207 | Pharmacists and dentists (+opticians, vets, psychologists)  | [221-224|290] |
| 208 | University and polytechnic teaching professionals  | [230] |
| 209 | Higher and Further education teaching professionals  | [231] |
| 210 | Secondary (and middle school deemed secondary) education teaching professionals (+inspectors)  | [232|233] |
| 211 | Primary (and middle school deemed primary) and nursery education teaching professionals  | [234] |
| 212 | Other teaching professionals nec  | [235|239] |
| 213 | Legal professionals (e.g. solicitors) | [240-243] |
| 214 | Chartered and certified accountants  | [250] |
| 215 | Architects, town planners and surveyors  | [260-262] |
| 216 | Social workers, probation officers  | [293] |
| 217 | Design and development engineers  | [216] |
| 218 | Management consultants, business analysts, actuaries, economists  | [251-253] |
| 301 | Laboratory/engineering/electrical technicians  | [300-302] |
| 302 | Other scientific technicians nec  | [303|304|309] |
| 303 | Draughtspersons, quantity/other surveyors  | [310-313] |
| 304 | Computer analyst/programmers  | [320] |
| 305 | Ship and aircraft officers, air taffic planners and controllers  | [330-332] |
| 306 | Nurses & midwives  | [340|341] |
| 307 | Other health professionals (e.g. radiographers, medical technicians, dental auxiliaries)  | [342|344-346|348|349] |
| 308 | Therapists (physios, OTs, psychotherapists etc)  | [343|347] |
| 309 | Legal service and related occupations  | [350] |
| 310 | Welfare, community and youth workers  | [371] |
| 311 | Authors, writers, journalists  | [380] |
| 312 | Artists, commercial artists, designers  | [381-383] |
| 313 | Vocational and industrial trainers, careers advisers  | [391|392] |
| 314 | Other associate professional and technical occupations nec  | [390|393|399] |
| 318 | Underwriters, claims assessors, brokers, investment analysts, taxation experts, valuers  | [360-362] |
| 319 | Personnel / industrial relations / organisation and methods officers  | [363|364] |
| 320 | Matrons, houseparents  | [370] |
| 321 | Actors, producers, musicians, sound/video operators  | [384-386] |
| 322 | Health and safety officers, statutory inspectors  | [394-396] |
| 401 | Civil administrative officers and assistants  | [400] |
| 402 | Local government clerical officers and assistants  | [401] |
| 403 | Book-keepers, other financial clerks, and cash collectors  | [410|412] |
| 404 | Counter clerks and cashiers  | [411] |
| 405 | Filing, computer and other records clerks (inc. legal conveyancing)  | [420] |
| 406 | Clerks (nes)  | [421|430] |
| 407 | Stores and despatch clerks, storekeepers  | [440|441] |
| 408 | Medical & legal secretaries  | [450|451] |
| 409 | Typists and word processor operators  | [452] |
| 410 | Other secretaries, personal assistants, typists, & word processor operators  | [459] |
| 411 | Receptionists/telephonists  | [460|461] |
| 412 | Telephone/radio/telegraph operators  | [462/463] |
| 413 | Computer operators, data processing operators, other office machine operators  | [490] |
| 501 | Bricklayers, roofers, pasterers, glaziers, scaffolders, floorers  | [500-503|505|506] |
| 502 | Builders, building contractors  | [504] |
| 503 | Painters and decorators  | [507] |
| 504 | Other construction trades nec  | [509] |
| 505 | Metal working production and maintenance fitters  | [516] |
| 506 | Other machine tool setters & setter-operators  | [510-515|517-519] |
| 507 | Electricians and other electrical/electronic trades nec  | [521|522|524|529] |
| 508 | Computer/radio/TV/video engineers and maintenance  | [525|526] |
| 509 | Plumbers, heating and ventilating engineers and related trades  | [532] |
| 510 | Welding trades (+sheet metal workers and riveters)  | [530|531|533-537] |
| 511 | Vehicle trades (e.g. motor mechanics)  | [540-544] |
| 512 | Other textiles, garments and related trades nec  | [550-552|554-557|559] |
| 513 | Sewing machinists, menders, darners and embroiderers  | [553] |
| 514 | Printing and related trades  | [560-569] |
| 515 | Woodworking trades  | [570-573|579] |
| 516 | Food preparation trades (bakers, butchers, fishmongers)  | [580-582] |
| 517 | Gardeners, groundsmen/women  | [594] |
| 518 | Other craft and related occupations nec  | [590-592|595-599] |
| 519 | Telephone & production (electrical/electronic) fitters  | [520|523] |
| 601 | NCOs and other ranks, armed forces  | [600|601] |
| 602 | Public service security officers, non-managers (police, armed forces, immigration)  | [610-614] |
| 603 | Non-public service protective service occupations (e.g. security guards)  | [615|619] |
| 604 | Chefs, cooks hotel supervisor  | [620] |
| 605 | Waiters, waitresses  | [621] |
| 606 | Bar staff  | [622] |
| 607 | Assistant nurses, nursing auxiliaries  | [640] |
| 608 | Dental nurses, hospital ward assistants, ambulance staff  | [641-643] |
| 609 | Care assistants and attendants  | [644] |
| 610 | Nursery nurses and playgroup leaders  | [650|651] |
| 611 | Educational assistants  | [652] |
| 613 | Other childcare and related occupations nec  | [659] |
| 614 | Hairdressers, beauticians and related occupations  | [660|661] |
| 615 | Caretakers and housekeepers  | [670-672] |
| 699 | Other personal and protective service occupations nec  | [630|631|673|690|691|699] |
| 701 | Buyers, brokers and related agents  | [700-703] |
| 702 | Technical and wholesale sales representatives  | [710] |
| 703 | Other sales representatives nec  | [719] |
| 704 | Sales assistants  | [720] |
| 705 | Retail cash desk and check-out operators  | [721|722] |
| 706 | Telephone salespersons  | [792] |
| 707 | Sales occupations nec (inc mobile salespersons and merchaniders)  | [730-733|790|791] |
| 801 | Food, drink, tobacco, textiles & tannery process operatives  | [800-802|809|810-814] |
| 802 | Chemical, gas and petroleum process plant operatives  | [820] |
| 803 | Paper, plastics and related process operatives  | [821-826|829] |
| 804 | Metal making and treating process operatives  | [830-834|839|840-844] |
| 805 | Assemblers/lineworkers (electrical/electronic goods)  | [850] |
| 806 | Other assemblers/lineworkers nes  | [851|859] |
| 807 | Inspectors, viewers, testers, sorters  | [860|861|863|864] |
| 808 | Packers, bottlers, canners, fillers & other routine process operatives  | [862|869] |
| 809 | Drivers of road goods vehicles  | [872] |
| 810 | Bus and coach drivers  | [873] |
| 811 | Taxi, cab drivers and chauffeurs  | [874] |
| 812 | Other transport & machinery operatives nes  | [870|871|875|880-884|889] |
| 813 | Crane and mechanical plant drivers  | [885|886] |
| 814 | Fork lift and mechanical truck drivers  | [887] |
| 815 | Construction and related operatives  | [896] |
| 816 | Plant and machine operatives nec  | [890-894|896-899] |
| 901 | Farm workers  | [900] |
| 902 | Other occupations in mining and manufacturing  | [910-913|919] |
| 903 | Other occupations in construction  | [920-924|929] |
| 904 | Other occupations in transport (inc. goods porters)  | [930-934] |
| 905 | Other occupations in communications (inc. postal workers)  | [940|941] |
| 906 | Kitchen/hotel/hospital porters  | [950-952] |
| 907 | Counterhands, catering assistants  | [953] |
| 908 | Shelf fillers  | [954] |
| 909 | Cleaners, domestics, and other occupations in sales and services  | [955-959] |
| 910 | All other labourers and related workers  | [910] |
| 911 | All other occupations in farming, fishing, and forestry  | [901-904] |

## Creating consistent classifications

#### Occupational classifications

To create a consistent occupational classification that allows us to compare the 2006 data to the earlier data, we have to use other pre-existing data sources that have been coded to both classifications (‘dual-coded data’). We can use these in one of four ways (Williams, 2011:187):

1. Modal allocation – SOC 2000 occupations are assigned to the SOC90 code that they are most likely to match to (i.e. the mode within each SOC 2000 group) (Oesch and Rodriguez Menes, 2011). This is easy to use, but works poorly at the most detailed level where each occupation maps onto many other occupations.
2. Random allocation – the SOC90 codes are randomly assigned to each person’s SOC 2000 code according to the probabilities in the dual-coded data (Goos and Manning, 2007). Again, this performs poorly when occupations map onto many codes and the within-occupation sample size is small.
3. Weighting – duplicate observations are generated for each person, with one observation generated for each SOC90 code that matches the respondent’s SOC 2000 code. For example, for a person in a SOC 2000 code that matches five SOC90 codes, five copies of this person would be generated. Each duplicate observation is then given a weight according to the probabilities in the dual-coded data, with the total weight adding to 1 (Weeden, 2005, Weeden and Grusky, 2005). The mean values from this recoded data will be appropriate; however, the results do not take into account the uncertainty involved in converting between classifications.
4. Multiple imputation – rather than just assigning occupations once (as in random allocation) or providing a fixed weight (as in weighting), multiple imputation creates several different versions of the dataset where the SOC90 code for each person with a SOC 2000 code is predicted differently in each version (Schenker et al., 1993). It then analyses all these different datasets simultaneously, taking into account the uncertainty in assigning occupational codes. However, care needs to be taken to ensure that the (multinomial logistic) model is working adequately, particularly at the fine-grained occupational level with several hundred outcomes; this also imposes considerable costs in terms of computation time and the viability of other statistical techniques.

Ultimately, I used the weighting method to create a merged dataset where the 2006 Skills Survey was coded to SOC90 to match the other datasets. This means that occupational demands-control from 2006 has greater measurement error than preceding years.

The dual-coded data was supplied by the Office of National Statistics based on the 2000 Labour Force Survey. Using the supplied LFS data, data were first cleaned so that the weight for each person summed to one (and obvious errors removed). For SOC 2000 occupations that in the dual-coded data had less than 30 observations, the SOC90 codes of men and women were pooled; otherwise data were mapped separately for men and women. For SOC 2000 occupations where the combined number of men and women in the 2000 LFS was <30, occupations were pooled with similar occupations in similar fashion to Web Appendix 3. This table lists the occupations that were grouped together in the dual-coded data to ensure that each cell had a sample size above 30.

|  |  |  |
| --- | --- | --- |
| **Grouped occ** | **SOC 2000 code** | **Label** |
| 1 | 1111 | Senior officials in national government |
| 1 | 1113 | Senior officials in local government |
| 2 | 1122 | Managers in construction |
| 2 | 1123 | Managers in mining and energy |
| 3 | 1182 | Pharmacy managers |
| 3 | 1183 | Healthcare practice managers |
| 4 | 1212 | Natural environment and conservation managers |
| 4 | 1219 | Managers in animal husbandry, forestry and fishing n.e.c. |
| 5 | 1221 | Hotel and accommodation managers |
| 5 | 1222 | Conference and exhibition managers |
| 6 | 1235 | Recycling and refuse disposal managers |
| 6 | 1239 | Managers and proprietors in other services n.e.c. |
| 7 | 2125 | Chemical engineers |
| 7 | 2129 | Engineering professionals n.e.c. |
| 8 | 2322 | Social science researchers |
| 8 | 2329 | Researchers n.e.c. |
| 9 | 2411 | Solicitors and lawyers, judges and coroners |
| 9 | 2419 | Legal professionals n.e.c. |
| 10 | 2451 | Librarians |
| 10 | 2452 | Archivists and curators |
| 11 | 3121 | Architectural technologists and town planning technicians |
| 11 | 3123 | Building inspectors |
| 12 | 3216 | Dispensing opticians |
| 12 | 3217 | Pharmaceutical dispensers |
| 13 | 3222 | Occupational therapists |
| 13 | 3223 | Speech and language therapists |
| 14 | 3413 | Actors, entertainers |
| 14 | 3414 | Dancers and choreographers |
| 15 | 3442 | Sports coaches, instructors and officials |
| 15 | 3449 | Sports and fitness occupations n.e.c. |
| 16 | 3511 | Air traffic controllers |
| 16 | 3512 | Aircraft pilots and flight engineers |
| 17 | 3536 | Importers, exporters |
| 17 | 3539 | Business and related associate professionals n.e.c. |
| 18 | 3551 | Conservation and environmental protection officers |
| 18 | 3552 | Countryside and park rangers |
| 19 | 3565 | Inspectors of factories, utilities and trading standards |
| 19 | 3568 | Environmental health officers |
| 20 | 5211 | Smiths and forge workers |
| 20 | 5212 | Moulders, core makers, die casters |
| 21 | 5231 | Motor mechanics, auto engineers |
| 21 | 5233 | Auto electricians |
| 22 | 5242 | Telecommunications engineers |
| 22 | 5243 | Lines repairers and cable jointers |
| 23 | 5311 | Steel erectors |
| 23 | 5319 | Construction trades n.e.c. |
| 23 | 5411 | Weavers and knitters |
| 24 | 5413 | Leather and related trades |
| 24 | 5414 | Tailors and dressmakers |
| 24 | 5419 | Textiles, garments and related trades n.e.c. |
| 25 | 5422 | Printers |
| 25 | 5424 | Screen printers |
| 26 | 5431 | Butchers, meat cutters |
| 26 | 5433 | Fishmongers, poultry dressers |
| 27 | 5493 | Pattern makers (moulds) |
| 27 | 5494 | Musical instrument makers and tuners |
| 27 | 5495 | Goldsmiths, silversmiths, precious stone workers |
| 27 | 5499 | Hand craft occupations n.e.c. |
| 28 | 6211 | Sports and leisure assistants |
| 28 | 6219 | Leisure and travel service occupations n.e.c. |
| 29 | 6291 | Undertakers and mortuary assistants |
| 29 | 6292 | Pest control officers |
| 30 | 8118 | Electroplaters |
| 30 | 8119 | Process operatives n.e.c. |
| 31 | 8122 | Coal mine operatives |
| 31 | 8123 | Quarry workers and related operatives |
| 32 | 8124 | Energy plant operatives |
| 32 | 8126 | Water and sewerage plant operatives |
| 32 | 8129 | Plant and machine operatives n.e.c. |
| 33 | 8136 | Clothing cutters |
| 33 | 8137 | Sewing machinists |
| 34 | 8143 | Rail construction and maintenance operatives |
| 34 | 8149 | Construction operatives n.e.c. |
| 35 | 8223 | Agricultural machinery drivers |
| 35 | 8229 | Mobile machine drivers and operatives n.e.c. |
| 36 | 9131 | Labourers in foundries |
| 36 | 9139 | Labourers in process and plant operations n.e.c. |
| 37 | 9222 | Hotel porters |
| 37 | 9229 | Elementary personal services occupations n.e.c. |
| 38 | 9232 | Road sweepers |
| 38 | 9239 | Elementary cleaning occupations n.e.c. |
| 39 | 9242 | Traffic wardens |
| 39 | 9245 | Car park attendants |

#### Industrial classifications

For some analyses below, I also need to recode the *industrial* classification available in EiB 1992 (SIC80) with the classification available in the Skills Surveys and BHPS (SIC92). However, no dual-coded data are available for this. I therefore created my own proportional mapping matrix from the dual-coded data in BHPS. Rather than using the weighting procedure, it was here feasible to use the model allocation method, as the industrial classifications map more closely to one another (the accuracy of this technique in the dual-coded data was around 94%). Again, the industrial classifications in EiB 1992 will have a greater level of measurement error than those in other years.

## Control variables & secondary outcome variables

### Control variables

|  |  |  |
| --- | --- | --- |
| **Variable**  | **Description** | **Waves available** |
| ***Demographics and administrative*** |
| *Wave dummies*Each year of 1992-2006 | BHPS study wave | All |
| *Age dummies*Five-year bands from 20-24 to 60-64 | Age group at date of interview | All |
| Male | Gender (dummy where Male=1, Female=0) | All |
| Minority ethnic group | Black and minority ethnic group membership*Based on wRACE (1991-2002) and wRACEL (2003-2008). Binary indicator of white vs. others due to small sample sizes individual ethnic groups and incomparability across years (for wRACEL, this is 'white British', 'white Irish', 'white Welsh', 'white Scottish' and 'other white background' for comparability with the 'white' category in wRACE).Previous research suggests that certain ethnic minorities show elevated job stress after controlling for demands-control (Smith et al., 2005). In a sensitivity analysis, I therefore used a five-banded version of ethnicity:* ***White*** *(wRACE=White; wRACEL=White British, White Irish, White Welsh, White Scottish, or other White background),* ***Black*** *(wRACE=Black Carribean, Black African,or Black Other; wRACEL=mixed White and Black Carribean, mixed White and Black African, Black/British Carribean, Black/British African),* ***Indian*** *(wRACE=Indian, wRACEL=Asian/British Indian),* ***Pakistani/Bangladeshi*** *(wRACE=Pakistani, Bangladeshi; wRACEL=Asian/British Pakistani, Asian/British Bangladeshi) and* ***Other****. The choice of these groups was primarily determined by sample size considerations rather than any a priori theory. In these sensitivity analyses I see no difference in the estimated effects.* | All |
| *Marital status*MarriedSeparated/divorced /widowedNever married | Marital status, grouped*From wMLSTAT (self-reported marital status). In later waves, this includes 'in a civil partnership' (under 'married') and 'have a dissolved civil partnership' (under 'separated/divorced/widowed')* | All |
| *Children* | Number of own children in household, grouped*From wNCHILD, with 3-9 children grouped into 3+* | All |
| *Region* | Region of residence*From wREGION2, Government Office Region: 1=North East | 2=North West | 3=Yorkshire & Humber | 4=East Midlands | 5=West Midlands | 6=East of England | 7=London | 8=South East | 9=South West | 10=Wales | 11=Scotland* | All |
| ***SES*** |
| **Label** | **Description** | **Waves** |
| *Education*No qualificationsLevel 1Level 2Level 3Level 4 - OtherLevel 4 - Degree | Highest educational qualification, grouped*Recoded version of wQFEDHI; see BHPS User Guide:253 for details. This is then recoded as follows:- Level 4 - Degree: University or higher degree- Level 4 - Other: teaching qualifications; nursing qualifications; any other technical, professional or higher qualifications- Level 3: A levels or recognised trade apprenticeship- Level 2: GCSE grades A-C; clerical or commercial qualifications- Level 1: GCSE grades D-G; youth training certificate; any other qualifications* | All |
| Log household income | Log of net household income*From wHHNETDE2, supplied by BHPS team in supplementary dataset based on HBAI definitions; see Jenkins 2010. Household net income is equivalised using the Modified OECD scale, and deflated to Jan 2008 prices* | 1991-2006 |
| *Tenure*OwnedSocial housingOther rented housing | Housing tenure, recoded*From wTENURE, recoded as follows:- Owned = owned outright or owned with mortgage- Social housing = Local Authority rent or Housing Association renter- Other rented housing = all other options* | All |
| ***Other work characteristics*** |
| **Label** | **Description** | **Waves** |
| Industry | Standard Industrial Classification 1992*wJBSIC92 is available in 1994, 1997, and 2001-2008. For other years, I recoded SIC80 (wJBSIC) using the BHPS dual-coded data in 1994, 1997 and 2001. SIC80 codes were assigned a SIC92 code based on the most frequent SIC92 code in the data. The person-weighted reliability of the recoding in the dual-coded BHPS data is 94.3%.*  | All |
| *Sector*Private sectorPublic sectorNon-profit and other | Sector of work*From wJOBSECT, recoded as follows:- Private sector = 'private firm/company'- Public sector = 'Civil Service/Central Govt', 'Local govt/town hall', 'NHS or higher educ', 'nationalised industry' or 'armed forces'- Non-profit and other = 'non-profit orgs' or 'other'* | All |
| Self-employed | Self-employment status*From wJBSEMP. Self-employed respondents were excluded from all analyses* | All |
| Temporary job | Contractual status, permanent vs. temporary*From wJBTERM (1991-1998) and wJBTERM1 (1999-2008). wJBTERM was recoded such that a temporary job = 'seasonal/tmp job' or 'contract/fixed time'; for wJBTERM1 a temporary job = 'non-permanent job'* | All |
| *Size of workplace*SmallMediumLarge | Size of workplace*From wJBSIZE, recoded into <25 employees (small), 25-199 employees (medium), and 200+ employees (large)* | All |
| *Hours of work*<16hrs16-29hrs30-45hrs>45hrs | Total hours of work per week, including overtime*Sum of wJBHRS and wJBOT, recoded into bands* | All |
| Occupational pension | Member of employer's occupational pension scheme*Coded as 1 if respondent reports being a member of employer's pension scheme (wJBPENM), and 0 if either not a member, employer doesn't run an pension scheme, or respondent is uncertain if employer runs a scheme (wJBPEN)* | All |
| ***Health*** |
| **Label** | **Description** | **Waves** |
| GP visits | GP visits in past year*From wHL2GP* | All |
| GHQ caseness | Minor psychistric morbidity (GHQ caseness)*Based on GHQ-12 score (wHLGHQ2), with scores of 3+ being considered a 'case' (following the recommendations of Goldberg et al 2000,* Psychological Medicine *28:915-921). The original scale score is used in a sensitivity analysis.* | All |
| Musculoskeletal problem | Problem with arms, legs, hands, feet or back*Based on wHLPRBA, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Vision problem | Difficulty in seeing*Based on wHLPRBB, part of the list of problem types. Respondents were asked to exclude temporary conditions. Excludes needing glasses to read normal size print.* | All |
| Hearing problem | Difficulty in hearing*Based on wHLPRBC, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Allergy problem | Problem with skin/allergies*Based on wHLPRBD, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Breathing problem | Problem with chest/breathing, asthma or bronchitis*Based on wHLPRBE, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Heart problem | Problem with heart, circulation, or high blood pressure*Based on wHLPRBF, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Digestive problems | Problem with stomach, liver, kidneys, or digestion*Based on wHLPRBG, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Diabetes | Diabetes*Based on wHLPRBH, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Anxiety/depression | Anxiety, depression, or psychiatric problems*Based on wHLPRBI, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Addiction problems | Alcohol or drug-related problems*Based on wHLPRBJ, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Epilepsy | Epilepsy*Based on wHLPRBK, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Migraine | Migraine or frequent headaches*Based on wHLPRBL, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Other health problem | Other health problems*Based on wHLPRBM, part of the list of problem types. Respondents were asked to exclude temporary conditions.* | All |
| Activity limitation: housework | Limitations in doing the housework*From wHLLTA, asked if respondents have an LLSI (those without LLSI are coded as 0).* | All bar 1999 and 2004 |
| Activity limitation: climbing stairs | Limitations in climbing stairs*From wHLLTB, asked if respondents have an LLSI (those without LLSI are coded as 0).* | All bar 1999 and 2004 |
| Activity limitation: dressing | Limitations in dressing yourself*From wHLLTC, asked if respondents have an LLSI (those without LLSI are coded as 0).* | All bar 1999 and 2004 |
| Activity limitation: walking | Limitations in walking for at least 10 minutes*From wHLLTD, asked if respondents have an LLSI (those without LLSI are coded as 0).* | All bar 1999 and 2004 |
| Hospital in-patient | Hospital in-patient in past year*From wHOSP and wHOSPCH, including all hospital visits except those for childbirth* | All waves |
| ***Partner's characteristics*** |
| **Label** | **Description** | **Waves** |
| Partnered | Whether has partner in household | All |
| Partner's employment | Whether partner is working*Derived from wJBHAS (whether did any paid work in the past week) and wJBOFF (whether had a job that was away from, even though wasn't working in the past week). Respondents without partners coded to zero; respondents whose partners do not respond are coded missing* | All |
| Partner's IB receipt | Whether partner claims an incapacity benefit*See under IB in text for details of IB measure. Respondents without partners coded to zero; respondents whose partners do not respond are coded missing* | All |
| ***Variables used in sensitivity analyses only*** |
| ***Other work characteristics*** |
| **Label** | **Description** | **Waves** |
| *Job satisfaction*DissatisfiedNeither satisfied /dissatisfiedSatisfiedCompletely satisfied | Satisfaction with present job overall*Based on wJBSAT, recoded from the original 7-point scale as follows:- 1/3 = Dissatisfied- 4/5 = Neither satisfied nor dissatisfied- 6 = Satisfied- 7 = Completely satisfiedNote that the labelling of the response options changed during the lifetime of the BHPS, with significant effects on the distribution of the results (see ISER Working paper 2008-39).* | All |
| *Satisfaction with security*DissatisfiedNeither satisfied /dissatisfiedSatisfiedCompletely satisfied | Satisfaction with job security*Based on wJBSAT4, with same coding as job satisfaction* | All |
| *Satisfaction with pay*DissatisfiedNeither satisfied /dissatisfiedSatisfied | Satisfaction with relations with supervisor/manager*Based on wJBSAT2, recoded from the original 7-point scale as follows:- 1/3 = Dissatisfied- 4/5 = Neither satisfied nor dissatisfied- 6/7 = Satisfied* | All |
| *Satisfaction with boss*DissatisfiedNeither satisfied /dissatisfiedSatisfiedCompletely satisfied | Satisfaction with relations with supervisor/manager*Based on wJBSAT3, with same coding as job satisfaction* | 1991-1997 |
| *Satisfaction with initiative*DissatisfiedNeither satisfied /dissatisfiedSatisfiedCompletely satisfied | Satisfaction with being able to use own initiative*Based on wJBSAT5, with same coding as job satisfaction* | 1991-1997 |
| Opportunities for promotion | Whether has current opportunities for promotion*Based on wJBOPPS. Note that wasn't asked in 1992-1994 if respondent had not changed jobs since previous wave; response therefore copied from previous response* | All |
| *Self-reported class*Working classMiddle classOther | Self-reported social class*Based on wOPCLS2, "which social class would you say you belong to?" Responses recoded into working class (inc. lower/upper w/c), middle class (inc lower/upper m/c and upper class) and other (inc no particular class, refuses class category, other not class, and other)* | 1991, 1996, 2000, 2005 |
| *Value of work*Not importantQuite unimportantQuite importantVery important | Importance of having a fulfilling job*Based on wLFIMPD, with the 1-10 scale recoded into not important (1-4), quite unimportant (5-6), quite important (7-8) and very important (9-10). Because this variable was not available at any baseline wave at which WLD was asked, respondents at all waves from 1998 onwards were given their last reported value of work score (for most respondents, this means the 1998 score in 1999-2002, and the 2003 score in 2004-6).* | 1998, 2003, 2008 |

### Descriptive statistics for main control variables

|  |
| --- |
| **Sociodemographic controls** |
| Age group |   | Region |   |
| >20-24 | 14.1% | >North-East | 4.1% |
| >25-29 | 15.7% | >North-West | 10.7% |
| >30-34 | 15.9% | >Yorkshire&Humber | 8.1% |
| >35-39 | 14.0% | >East Midlands | 7.6% |
| >40-44 | 12.3% | >West Midlands | 7.5% |
| >45-49 | 9.8% | >East of England | 7.9% |
| >50-54 | 6.3% | >London | 7.7% |
| >55-59 | 1.5% | >South-East | 12.3% |
| Male | 49.6% | >South-West | 7.7% |
| Marital status |   | >Wales | 11.1% |
| >Married | 61.0% | >Scotland | 15.3% |
| >Separated/divorced/widowed | 11.9% | Maximum qualifications |   |
| >Never married | 27.1% | >No qualifications | 11.1% |
| Number of children |   | >Level 1 | 4.3% |
| >0 | 58.8% | >Level 2 | 22.4% |
| >1 | 17.9% | >Level 3 | 14.5% |
| >2 | 17.8% | >Level 4 - other | 31.0% |
| >3+ | 5.5% | >Level 4 - degree | 16.7% |
| Tenure |   | Black / ethnic minority | 2.7% |
| >Owns home | 81.1% | Partner in household | 75.4% |
| >Social housing | 10.9% | Partner's IB receipt | 2.5% |
| >Other rented | 8.0% | Partner is employed | 64.0% |
| **Health controls** |
| Musculoskeletal problem | 17.4% | Anxiety/depression | 4.9% |
| Vision problem | 2.2% | Addiction problems | 0.2% |
| Hearing problem | 4.1% | Other health problem | 3.7% |
| Allergy problem | 12.7% | Limitations for housework | 1.3% |
| Breathing problem | 9.6% | Limitations climbing stairs | 1.1% |
| Heart problem | 6.6% | Limitations getting dressed | 0.3% |
| Digestive problems | 5.1% | Limitations walking >10mins | 1.2% |
| Diabetes | 1.5% | Hospitalised in past year | 5.8% |
| Epilepsy | 0.6% | GHQ Caseness | 23.4% |
| Migraine | 8.9% |   |   |

|  |
| --- |
| **Work controls** |
| Sector |   | Industry |   |
| *>Private* | 67.5% | *>Agric., Hunting and Forestry* | 0.9% |
| *>Public* | 28.8% | *>Mining and Quarrying* | 0.5% |
| *>Nonprofit/other* | 3.7% | *>Manufacturing* | 20.4% |
| Temporary job | 4.8% | *>Electricity/Gas/Water* | 1.1% |
| Size of workplace |   | *>Construction* | 4.0% |
| *>Small* | 46.3% | *>Wholesale and Retail Trade* | 13.7% |
| *>Medium* | 22.7% | *>Hotels and Restaurants* | 3.5% |
| *>Large* | 31.1% | *>Transport & Storage* | 6.1% |
| Hours of work |   | *>Financial Intermediation* | 5.8% |
| *> Less than 16 hrs* | 5.8% | *>Real Estate* | 9.4% |
| *>16-29 hrs* | 13.0% | *>Public Administration* | 8.7% |
| *>30-45 hrs* | 57.0% | *>Education* | 9.6% |
| *> 45+ hrs* | 24.2% | *>Health and Social Work* | 12.6% |
| Occupational pension | 54.9% | *>Other Comm./Social/Pers.* | 3.7% |

### Estimated effects of control variables on incapacity receipt

For reasons of space, the full tables of coefficients for the final model (Model 7 in Table 2) are not included in the main paper, but are instead reproduced below

|  |  |
| --- | --- |
|  | **Odds Ratio** |
| Low control (base) | 1 |
| Moderate control | 0.77\* |
| High control | 0.71\* |
| Low demands (base) | 1 |
| Moderate demands | 1.15 |
| High demands | 0.93 |
| Low physicality (base) | 1 |
| Moderate physicality | 1.61\*\* |
| High physicality | 1.70\*\* |
| Receipt of incapacity benefits in past year at baseline | 11.52\*\*\* |
| Age: 18-24 | 0.88 |
| Age: 25-29 | 0.66+ |
| Age: 30-34 | 0.88 |
| Age: 35-39 | 0.85 |
| Age: 40-44 | 1 |
| Age: 45-49 | 1.08 |
| Age: 50-54 | 1.26 |
| Age: 55-59 | 1.45+ |
| Age: 60-64 | 1.84\* |
| Sex: female | 0.86 |
| Marital status: married | 1 |
| Marital status: separated/widowed/divorced | 0.91 |
| Marital status: never married | 1.07 |
| Number of own children in household: 0 | 1 |
| Number of own children in household: 1 | 0.81 |
| Number of own children in household: 2 | 0.58\*\* |
| Number of own children in household: 3+ | 0.99 |
| Region: North-East | 3.25\*\*\* |
| Region: North-West | 2.25\*\* |
| Region: Yorkshire & Humber | 1.44 |
| Region: East Midlands | 1.77\* |
| Region: West Midlands | 1.38 |
| Region: East of England | 1.24 |
| Region: London | 1 |
| Region: South-East | 0.95 |
| Region: South-West | 1.17 |
| Region: Wales | 2.29\*\* |
| Region: Scotland | 1.76\* |
| Ethnic minority | 1.31 |
| 1991b.wave | 1 |
| 1992.wave | 0.93 |
| 1993.wave | 0.68+ |
| 1994.wave | 1.07 |
| 1995.wave | 0.59\* |
| 1996.wave | 0.63\* |
| 1997.wave | 0.35\*\*\* |
| 1998.wave | 0.58\* |
| 2000.wave | 0.42\*\*\* |
| 2001.wave | 0.42\*\*\* |
| 2002.wave | 0.36\*\*\* |
| 2003.wave | 0.38\*\*\* |
| 2005.wave | 0.30\*\*\* |
| 2006.wave | 0.20\*\*\* |
| health problems: arms, legs, hands, etc | 1.88\*\*\* |
| health problems: sight | 0.88 |
| health problems: hearing | 0.99 |
| health problems: skin conditions/allergy | 0.95 |
| health problems: chest/breathing | 1.30+ |
| health problems: heart/blood pressure | 1.46\*\* |
| health problems: stomach or digestion | 1.24 |
| health problems: diabetes | 1.59 |
| health problems: anxiety, depression, et | 1.95\*\*\* |
| health problems: alcohol or drugs | 2.30 |
| health problems: epilepsy | 1.08 |
| health problems: migraine | 1.21 |
| health problems: other | 2.03\*\*\* |
| health hinders doing the housework | 1.80\* |
| health hinders climbing the stairs | 1.29 |
| health hinders getting dressed | 0.92 |
| health hinders walking more than 10 mins | 2.75\*\*\* |
| Hospital inpatient in past year exc childbirth | 1.96\*\*\* |
| GHQ caseness | 1.89\*\*\* |
| Usual hours of work: <16hrs | 0.84 |
| Usual hours of work: 16-29hrs | 0.94 |
| Usual hours of work: 30-45 hours | 1 |
| Usual hours of work: 45+ hours | 0.87 |
| Member of occupational pension scheme | 0.90 |
| Sector: private | 1 |
| Sector: public | 1.18 |
| Sector: nonprofit/other | 0.97 |
| Temporary contract | 1.27 |
| Workplace size: small (<50) | 0.99 |
| Workplace size: medium (50-200) | 0.87 |
| Workplace size: large (200+) | 1 |
| Industry (SIC92): agric., hunting, forestry, fishing | 1.01 |
| Industry (SIC92): mining & quarrying | 1.49 |
| Industry (SIC92): manufacturing | 0.94 |
| Industry (SIC92): electricity/gas/water supply | 1.39 |
| Industry (SIC92): construction | 0.84 |
| Industry (SIC92): wholesale & retail | 0.75 |
| Industry (SIC92): hotels & restaurants | 0.74 |
| Industry (SIC92): transport, storage & communication | 0.92 |
| Industry (SIC92) : financial intermediation | 1.07 |
| Industry (SIC92): Real estate, renting, & business | 0.67 |
| Industry (SIC92): Public administration & defence | 1.02 |
| Industry (SIC92): Education | 0.62\* |
| Industry (SIC92): Health and social work | 1 |
| Industry (SIC92): Other service activities | 0.64 |
| Has spouse/partner in hhld | 1.16 |
| Spouse/partner: Receipt of incapacity benefit | 1.47+ |
| Spouse/partner: Employed | 0.99 |
| Highest educational qualification: none | 1 |
| Highest educational qualification, Level 1 | 0.72 |
| Highest educational qualification, Level 2 | 0.88 |
| Highest educational qualification, Level 3 | 0.80 |
| Highest educational qualification, Level 4+ (exc deg) | 0.94 |
| Highest educational qualification, Degree+ | 0.52\* |
| Log hhld net income | 0.75+ |
| Housing tenure: owns home | 1 |
| Housing tenure: social housing | 1.60\*\*\* |
| Housing tenure: other rented | 1.01 |
| Observations  | 52608 |
| Num persons  | 1742 |
| Parameters | 97 |
| *+ p<0.10, \* p<0.05, \*\* p<0.01, \*\*\* p<0.001* |  |

### Secondary outcome variables

Several secondary outcomes were considered to see if the effect was specific to measures theoretically linked to incapacity receipt. This includes:

* **A broader measure of disability benefits receipt:** this included a number of other benefits that could conceivably have included mis-reported incapacity benefit receipt. This includes Disability Living Allowance (1992-), Attendance Allowance, Mobility Allowance (1991-7), and Industrial Injuries Disablement Benefit. Income Support was not included, as this would primarily include non-disabled lone parents.
* **Long-term sickness/disability:** individuals were asked to described their employment situation and could give the response ‘long-term sick/disabled’.
* **Non-employment per se**: this used the standard BHPS measure of employment, based on (i) whether the respondent reported working in the past week; and (ii) for respondents not working, whether they said they had a job that they were away from last week.
* Reasons for job loss**:** at every wave respondents reported if they had lost a job in the previous year, and if so, the reasons that they lost the job. From this annual employment history, I created a dummy variable for whether respondents said ‘I gave up work for health reasons’ (hereafter ‘**health-related job loss**’), ‘I was made redundant’ (**redundancy**), or ‘I was dismissed/sacked’ (**sacked**). Health-related job losses did not necessarily lead to a spell of long-term sickness; respondents would often report moving to other jobs or being unemployed.

## Sensitivity analyses

The results presented in the main text are robust to a wide variety of different sensitivity analyses. These are reported in this Appendix and the syntax is available from the Stata files on the author’s website; more detailed tables are also available from the author on request.

#### Different covariates when imputing demands/control/physicality

it is possible to capture more of the variation in working conditions by accounting for additional covariates such as age and gender – e.g. older men may have systematically more job control. However, incorporating this may introduce the very reporting biases that the imputation method is designed to avoid. The main analyses therefore estimate people’s level of demands/control/physicality simply from the combination of occupation and year,[[2]](#footnote-2) to take account of changing demands/control over the 1990s. Aside from the main analyses (based on 135 unit occupations and year), I also imputed based on:

1. just occupation;
2. unit occupation and trends *within major occupational groups*;
3. occupation, year, major industrial group and education;
4. as (3) plus age, gender and working hours; and
5. 181 sufficiently large occupation-industry subgroups and year.

The results were robust to these different forms of imputation. Where the imputation used a greater amount of information in 2-5, the strength of the effect of job control slightly increased and became slightly more strongly significant. Where the imputation used less information – 1 was based on occupation averages across 1992-2006, without adjusting for declining control over time – the effect was smaller (0.17 percentage points) and non-significant (p=0.29). No effect was found for job demands in any model, while physicality remained strongly significant throughout. These results are as we would expect: the more measurement error in the imputation technique, the more attenuation we would expect to see; but the direction of the effect was the same in all models, and in 5 out of 6 imputations the results for control were statistically significant.

#### Different forms of demands and control

When the main models were repeated with linear rather than categorical versions of demands, control and physicality, then the results were similar to the main analyses.[[3]](#footnote-3) When job demands and control were not mutually adjusted for one another, control was significant while demands was not, suggesting that an effect of job demands is not being concealed by any collinearity with control.

#### Different time lags

I checked the importance of different time lags between control and incapacity benefits receipt. If we exclude those who said they were away from work due to ‘temporary sickness’ in the week prior to the baseline interview, then the effect of job control becomes non-significant (although still large in size). This removes from consideration some people who had already started down the pathway from job control to benefits receipt – and a one-year gap may be too short for other people to complete this pathway. If we therefore repeat the analysis looking at effects *two* waves into the future (rather than one), and still excluding the temporarily sick, then we again see a large and statistically significant effect of job control.[[4]](#footnote-4)

#### Different estimation techniques

The main analyses below use an exchangeable correlation structure, assuming a constant person-specific correlation between waves. The estimates are robust to mis-specification of this matrix and a recent guide suggested that ‘intensive modelling’ of this structure would provide ‘negligible’ gains (Ziegler and Vens, 2010). Nevertheless, I check two other correlation structures: an autoregressive(1) model where correlations are only estimated between successive waves; and an unstructured model that estimates the between-wave correlations with no constraints. I also checked whether the loss of information in categorising the continuous covariates (age, income, GHQ and hours of work) led to residual confounding (Altman and Royston, 2006, Royston et al., 2006), by using fractional polynomial transformations of these variables (Royston and Sauerbrei, 2008). None of these variations led to even slight changes to the conclusions above.[[5]](#footnote-5)

I also checked the goodness-of-fit of the main model using an adapted form of the standard Hosmer-Lemeshow test.[[6]](#footnote-6) This showed that the goodness-of-fit of the model was poor. I therefore used a slightly different parameterisation that produced a better-fitting model, and this made little difference to the results.[[7]](#footnote-7)

#### Clustering of demands-control within occupations

Ideally I would account for not only the clustering of observations within people, but also the clustering of demands-control within particular occupations/years. However, the computational burdens made this impractical (the analyses were sufficiently burdensome that even in LSE’s ABACUS system, the first iteration – let alone convergence – had not been reached within several days).

Instead, I tested whether the results were affected by (i) accounting for the clustering of occupations at a single baseline wave (1991); and (ii) by conducted a crossed-level model that treats the *binary* outcomes as normally-distributed *continuous* variables (which is easier computationally, but particularly problematic for rare outcomes like incapacity benefit receipt). In both cases, the standard errors were often (but not consistently) raised when accounting for clustering within occupations, but only by small amounts – and the impact on the conclusions in this chapter will therefore be minimal.[[8]](#footnote-8)

#### Missing data and weights

The main analyses are a complete case analysis of British employees aged 20 to 59(f)/64(m) who personally provided the required data at both a baseline wave and a follow-up wave, one year later. To make these analyses nationally representative – and also to account for any attrition biases – I would ideally use the weights supplied with BHPS. However, weighting is problematic when looking at pairs of successive waves in panel studies; as Jenkins (2010:13) notes, *“in this case, it is unclear what population of interest the pooled transitions are intended to represent and hence how to calculate suitable longitudinal weights or to combine the weights typically supplied.”* Some analyses therefore ignore weights entirely (Cappellari and Jenkins, 2008), which will produce unbiased estimates if the weights would simply depend on the observed covariates (Winship and Radbill, 1994).

While the regression coefficients in properly-specified unweighted analyses would be unbiased, this would still lead to biases in the average marginal effects, which depend on the prevalence of different types of people in the data. Here, I follow Jenkins’ suggestion to complement the main (unweighted) analyses with various sensitivity analyses using the supplied weights.[[9]](#footnote-9) However, using the supplied BHPS weights had little effect on the results; after weighting, job control had strong and marginally significant effects in both of the subsamples that allowed weighting.

I also use multiple imputation on the unweighted data to look at the impact of short-run attrition between the baseline and follow-up waves, as well as missing data. For the imputation I use multiple imputation by chained equations, which has been shown to perform well in simulations (Carpenter and Kenward, 2008, Kenward and Carpenter, 2007), using the ICE and MIM commands in Stata (Royston, 2009, Royston et al., 2009).[[10]](#footnote-10) After multiple imputation, the difference in incapacity receipt between those in high and low control jobs was similar in size to the main analyses and significant at the 1% level.

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1. All of these surveys include both design weights and non-response weights. However, EiB includes two different sets of non-response weights. I have used the weights that are most likely to be comparable to the Skills Surveys (adjusting for non-response by gender), rather than the weights that account for further forms of non-response (adjusted for full-time vs. part-time, sex, age, and socio-economic group, compared to the Labour Force Survey from the same period, cf. the weights for WiB). [↑](#footnote-ref-1)
2. 3 The analysis linearly imputes between survey years (1992/1997/2001/2006), and assume no change 1991-1992 and 2006-2007 (in the case of physicality, the weak 1997-2001 trend is extrapolated to earlier years). [↑](#footnote-ref-2)
3. Job demands was non-significant, while job control (p<0.05) and job physicality (p<0.01) were significant. Also the estimated AME for the change from the average control in the lowest-control tertile to the average control in the highest-control tertile was also virtually identical to the AMEs reported in the main text. [↑](#footnote-ref-3)
4. AMEcontrol=0.49% against an incidence of transitions to incapacity benefits of 1.4%. [↑](#footnote-ref-4)
5. In the subsample for the autoregressive(1) model that excludes the 1991 wave, the effect of control was slightly weaker and non-significant, but still strong; however, the AR(1) model produced identical results to the exchangeable correlation matrix. [↑](#footnote-ref-5)
6. The Hosmer-Lemeshow test cannot be run after GEE models, but it is possible to create a similar version by creating dummies for each decile of predicted probabilities, and testing their joint significance in a model that contains a continuous linear version of the predicted score on the logit scale Hardin, J., and Hilbe, H. (2003) *Generalized Estimating Equations*, Boca Raton, Florida: Chapman & Hall/CRC.. [↑](#footnote-ref-6)
7. The main model (containing controls for individual-level SES and physicality) was poorly-fitting (adapted Hosmer-Lemeshow chi2(9)=17.2, p<0.05), primarily because it overestimated the probability of claiming incapacity benefits among those with the very lowest predicted probabilities. I therefore created a latent health scale by regressing the specific health measures on self-reported general health, and used a multivariate fractional polynomial model to find the best-fitting form of this latent health scale (alongside the non-health controls and a dummy for zero health problems). This revised model fitted the data acceptably (chi2(9)=13.6, p=0.14), and produced similar results (AMEcontrol=0.33% vs. 0.34% in the main model). [↑](#footnote-ref-7)
8. For the 1991 wave, the coefficients and standard errors for high control, high demands and high physicality were -0.90 (se=0.60), 1.21 (0.48) and 1.71 (0.61) respectively. When the clustering within occupations was incorporated, this changed to -0.90 (se=0.62), 1.21 (0.55) and 1.71 (0.57) respectively.

For the linear panel model on the full sample, the coefficients accounting for the clustering of observations within people were for high control, high demands and high physicality were -0.0019 (se=0.0016), -0.0007 (0.0015) and 0.0054 (0.0015) respectively. When the clustering within occupations was additionally incorporated in a crossed-effects model, the coefficients were -0.0017 (se=0.0017), -0.0013 (0.0016) and 0.0054 (0.0017).

For these analyses, I used the version of the JEM that imputed based only on occupations (rather than occupations + years). Random effects rather than GEE models were used in both cases (the XTLOGIT command for the 1991 wave, and the XTMIXED command for the linear crossed model). [↑](#footnote-ref-8)
9. I do this in two ways: (i) using the longitudinal weights from 2006 for all individuals that respond at every wave 1991-6, excluding the booster samples; and (ii) using the longitudinal weights that incorporate the Scottish and Welsh booster samples, that exclude responses 1991-1998. [↑](#footnote-ref-9)
10. Ideally data would be imputed in ‘wide’ format to reflect the longitudinal structure of the data Rose, R. A., and Fraser, M. W. (2008) 'A Simplified Framework Fo Rusing Multiple Imputation in Social Work Research', *Social Work Research* 32:171-78.; that is, job demands at each wave are considered entirely different variables. However, we are not quite a the stage that this type of imputation is practicable, and data were therefore imputed in ‘long’ format. [↑](#footnote-ref-10)