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The effect of work on mental health: does occupation matter?

Ana Llena-Nozal[a,b,*], Maarten Lindeboom[a,b,c] and France Portrait[a,b]

[a] *Department of Economics and Business Administration, Free University of Amsterdam & Tinbergen Institute, The Netherlands*

[b] *Department of Life Sciences, Free University of Amsterdam & Tinbergen Institute, The Netherlands*

[c] *IZA, Germany*

Summary

This paper considers the effect of work choices on mental health and looks at whether this differs across occupations. This requires a model that can deal with the endogeneity in the relationship between health, occupation and work choices. We specify such a model and estimate it on a unique UK panel survey. The survey, called the National Child development Survey (NCDS), follows a cohort since their birth in 1958 until age 42. The analyses show us that early childhood health and ability have long lasting consequences for the mental health at the later ages. Females have lower levels of mental health. Mental health deteriorates with age for males and females, but the rate of deterioration is substantially lower for females. We also find that the rate of depreciation is lower when individuals work. For females we find large effects of occupation, for males we do not find this. Employment status is important for males, but not for females. For both genders we find very large effects of the onset of a long-standing illness. The probability of experiencing such an event depends on employment status, occupation and life style variables. Copyright © 2004 John Wiley & Sons, Ltd.

Keywords mental health; labour market status; occupation; panel data model

Introduction

This paper considers the effect of changes in labour market status and work history on mental health and, more specifically, looks at whether the gradient varies with the choice of occupation. The issue is relevant from a policy point of view. Several reports commissioned by the Health and Safety Executive in the UK provide information on the distribution of health and injuries by work status. In 2001, 2.3 million people in Great Britain suffered from an illness caused by their work or which was aggravated by it; accounting in total for around 32.9 million working days are lost at work. National statistics report that the most common type of work-related illnesses were musculoskeletal disorders (1 126 000 people) and stress, depression or anxiety (563 000), followed by breathing and lung problems (168 000) and hearing problems (87 000) [1]. Moreover, it appears that work-related stress varies by occupation and that occupational groups, such as teachers and nurses, have the highest prevalence rates [2].

Besides aspects associated with worker compensation, there are also short- and longer-run consequences for the demand for health care. A bad mental health can influence health care consumption directly and at a later stage of the life cycle, because current mental health problems may lead to increased risks for (other) health problems at a later stage of the life cycle.

*Correspondence to: Department of Economics and Business Administration, Free University of Amsterdam, De Boelelaan 1105, 1081 HV Amsterdam, The Netherlands. E-mail: allenanozal@econ.vu.nl

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How do work decisions and occupation affect health? Health may deteriorate with age and the rate of deterioration may be influenced by shocks affecting one's health status and by decisions that individuals make in the course of the life cycle. These decisions concern for instance, lifestyle (like smoking, drinking, exercising, etc.), but also work. Labour market status may well directly affect health since certain aspects of work (like highly physically demanding jobs) may cause health to deteriorate faster. On the other hand, inactivity and stress related to joblessness could result in ill health. Likewise, the rate of occurrence of health shocks (such as injuries) may be affected by work status, work environment and working conditions. The mental health condition of a worker is thus directly determined by choices regarding work and occupation and by other events (life events and accidents) that occur in the course of the working life. This is what we focus on in the current paper.

Assessing the causal effect of work choices and occupation on health is not straightforward. In empirical applications, researchers have to rely on household survey data and in general it will be very difficult to appropriately measure all relevant factors. For instance, genetic factors, time preference and the attitude towards risk will be of relevance for choices regarding work and health, but in general social surveys do not contain good measures for these factors. Failure to take this into account may bias the estimates of the impact of work and occupation choices on health.

There is a large literature on the relationship between socio-economic status (as measured by income, social class or occupation) and health and a significant part of this literature has focussed on the relationship between health and labour market behaviour [3]. However, the larger part of this literature has focused on the effect of health on work and not *vice versa*[a]. A few studies have looked at the effect of unemployment and/or employment on health and we comment on these below.

Bjorklund [12] and Mayer *et al.* [13] use panel data techniques and find that unemployment has a negative impact on mental health. Bjorklund also finds that it is not only the occurrence, but also the duration of unemployment that affects mental health. Lindeboom and Kerkhofs [11] and Kerkhofs and Lindeboom [14] find that a long work history has a negative impact on health. Gerdtham and Johannesson [15] estimate the effect of unemployment on mortality risk controlling for initial health status and other personal characteristics and find that unemployment increases the probability of death by nearly 50%. This is mainly due to increased risks of suicides and diseases other than cancer and cardiovascular diseases for the unemployed. Dano *et al.* [16] consider the effects of job loss due to displacement on health and find, contrary to other studies, no significant effect of displacement on health. Finally, Bardasi and Francesconi [17] explore the effect of employment on mental health for non-standard types of employment and find an effect of the type of employment on mental health.

Our paper differs from the previous contributions. The focus is on the effect of occupational and work choices on mental health outcomes. We acknowledge and incorporate into our analyses that health, work and occupation choices may be jointly determined. We have access to six waves (1965, 1969, 1974, 1981/1982, 1991/1992, and 1999/2000) of an unusually rich data set called the National Child Development Study (NCDS). The survey contains detailed information on health status, on the timing of health events, as well as on socio-economic status of the parents, education, labour market status, health-related behaviour, the occurrence of accidents, disability shocks and life events. The richness of the data and the relatively long period that we are able to follow a cohort of individuals allows us to explore in more detail the role of socio-economic background at the time of birth, health-related behaviours, work and occupation choices, and the occurrence of (work-related) accidents.

The structure of the paper is as follows. The following section introduces the NCDS data and reports on the variables used in the empirical part. The section 'The model and empirical specification of the model' presents some theory and the estimation strategy. Empirical results are discussed in the section 'Results'. The section 'Some calculations with the model' shows some further calculations performed with the model. Finally, the section 'Discussion and conclusion' concludes.

The Data

Sample

The National Child Development Study (NCDS) is a longitudinal study of 17 000 babies born in

Great Britain in the week of 3–9 March 1958. NCDS data are available for secondary analysis from The Data Archive at the University of Essex [18].

The study started as the 'Perinatal Mortality Survey' and surveyed the economic and obstetric factors associated with stillbirth and infant mortality. Since the first wave, cohort members have been traced on six other occasions to monitor their physical, educational and social circumstances. The waves were carried out in 1965 (age 7), 1969 (age 11), 1974 (age 16), 1981 (age 23), 1991 (age 33) and 1999 (age 42). The first three surveys were augmented with immigrants born in the same week, but no attempt to include immigrants was made since 1974. In addition to the main sweeps, information about the public examinations was obtained from the schools in 1978. For the birth survey, information was gathered from the mother and the medical records. For the surveys during childhood and adolescence, interviews were carried out with parents, teachers, and the school health service, while ability tests were administered. The subsequent surveys included information on employment and income, health and health behaviour, citizenship and values, relationships, parenting and housing, education and training of the respondents. The NCDS is therefore highly appropriate to look at life histories and to study the impact of early life experiences on health, education and employment.

Since the cohort members are followed for such a long period of time, the data set suffers from attrition (Table 1 below reports characteristics of the sample at follows-up). This raises the question of whether the sample remains representative. In order to assess the representativeness of the NCDS sample two methods were employed by the advisory and user-support groups. The first method compared the respondents and the non-respondents in the later surveys in terms of social and economic status, education, health, housing and demography. It was found that the distribution of these variables among the sample survivors did not differ from the original sample to any great extent [19]. Likewise, in a recent study Case *et al.* [20] compare low birth weight and father's occupation across the different NCDS waves and found no substantial difference. In addition, using a second method, the 1981 sample was compared to the UK 1981 Population Censuses in terms of the distributions of key variables such as marital status, gender, economic activity, gross weekly pay, tenure and ethnicity [19,21]. The overall conclusion was that the sample appears to be representative with respect to age, gender, ethnicity and social class. Of relevance for our study is whether the sample remains representative with respect to our dependent variable (mental health). Unfortunately, we cannot find any information on this. In our empirical analyses we therefore have to use methods that can take possibly non-random sample attrition into account [22,23]. We return to this in the section 'Empirical specification of the model'.

In our analysis we focus on the last three waves where the respondents are at the ages where they normally participate in the labour market (1981, at the age of 23, 1991, at the age of 33 and 1999/2000 at the age of 42). We excluded individuals who were in the military service or who were in full time study at the date of the interview. We furthermore excluded a small number of respondents with a proxy interview. For estimation purposes we select only those respondents who are present in at least two consecutive waves and for whom we observe labour market status, labour history variables, occupation and the mental health measure (to be discussed below).

Health, work and lifestyle variables

Mental and emotional health is assessed through the Malaise Inventory designed by the Institute of Psychiatry from the Cornell Medical Index [24]. This is a self-completion scale for assessing

Table 1. Summary of survey dates and samples

Year	1958	1965	1969	1974	1981	1991	1999
Original sample size	17414	15468	15503	14761	12537	11407	11419
Sample used					6547	8744	7499
Age	0	7	11	16	23	33	42

Source: Centre for Longitudinal Studies.

psychiatric morbidity and includes a 24-item list of symptoms such as anxiety, irritability, depressed mood and psychosomatic illness.[b] The list provides a total score, obtained by summing up all the positive and negative answers, that places the individual on a depression scale. This scale was found previously to discriminate well between those with and without psychiatric disorder [24]. High scores are associated with poor mental health and scores above seven indicate those individuals at risk of depression. The validity of the Malaise Inventory has been demonstrated in other work by Rodgers *et al*. [25] using the NCDS dataset.

The occupation variable corresponds to the UK official socio-economic classification: social class based on occupations (SC and former RGSC). The SC is divided into six groups: professional (I), managerial and technical (II), skilled non-manual (IIIn), skilled manual (IIIm), partly skilled (IV) and unskilled (V). The classification is based upon the ranking of occupations by skill. We have chosen to use this classification, as it is available for all three waves and remains consistent throughout.[c]

Other labour market variables include the length of employment and of unemployment, as well as time out of the labour force (total number of months for each of the variables). In addition, several dummies are included to represent current status: employed, unemployed and out of the labour force. The status 'out of the labour force' refers to a heterogeneous population of mostly temporary and permanent sick people and those doing housework.[d]

The variables characterising health behaviour include a dummy for current smokers and a dummy for heavy drinkers. The latter is created according to the following criteria: a male is considered a heavy drinker if he consumes more than 50 units of alcohol per week, and a female more than 35 units. According to this categorisation, a light drinker is someone who drinks between 1 and 5 units per week for a female (1–10 for a male), and a medium drinker is someone consuming between 6 and 35 units for a female (11–50 for a male).

Two shock variables are included: a dummy for accidents and a dummy for a disability shock. The variable 'accidents' indicates whether the respondent has been admitted to a hospital or attended a hospital out-patient or casualty department as a result of any kind of accident or assault since the last survey. The type of accidents can be a road accident as a pedestrian (1.75%), road accident as a driver (15.61%), a work accident (28.56%), a home accident (14.25%), a sports-related accident (24.01%) or another type of accident (including mugging and sexual assault – 15.82%). The disability shock indicates if the individual has a longstanding illness or disability that was not present in the previous wave. For the first wave we use the information on the age of onset of the disability and consider it a shock if the disability occurred in the 10-year interval before the 1981 wave (i.e. if the disability occurred between the ages 13 and 23).

Descriptive analysis of the variables included in the study

Table 2 presents sample means for all variables used. The variables with respect to mental health are of particular interest for our study. Table 2 shows that malaise scores differ by gender, being higher for women at all ages. On the other hand, the malaise scores of males increase with age at a higher rate than the ones of females. Table 2 shows furthermore that on average, females have a lower attained education level, perform more often skilled non-manual and unskilled occupations, and work less (especially in 1999) than males. This is mainly due to being out of the labour force, and not to being unemployed. Table 2 also shows that the rate of unemployment decreased between 1981 and 1999 for both genders to reach a notably low level in 1999. This reflects period effects (the national unemployment rate was relatively high in 1980/1981) as well as age effects (in the later years the individuals are older and are on average more often at work than at younger ages where they are still studying or looking for a job. Note further that women are in proportion substantially less often out of the labour force at age 42 than at ages 23 and 33. This also reflects period and age effects (at age 42, most children are at school and women may start working).

With respect to health behaviours, it can first be seen that the percentages of current male and female smokers are very similar (about 33%). Second, males are more often heavy drinkers, and are more likely to be involved in accidents than females.

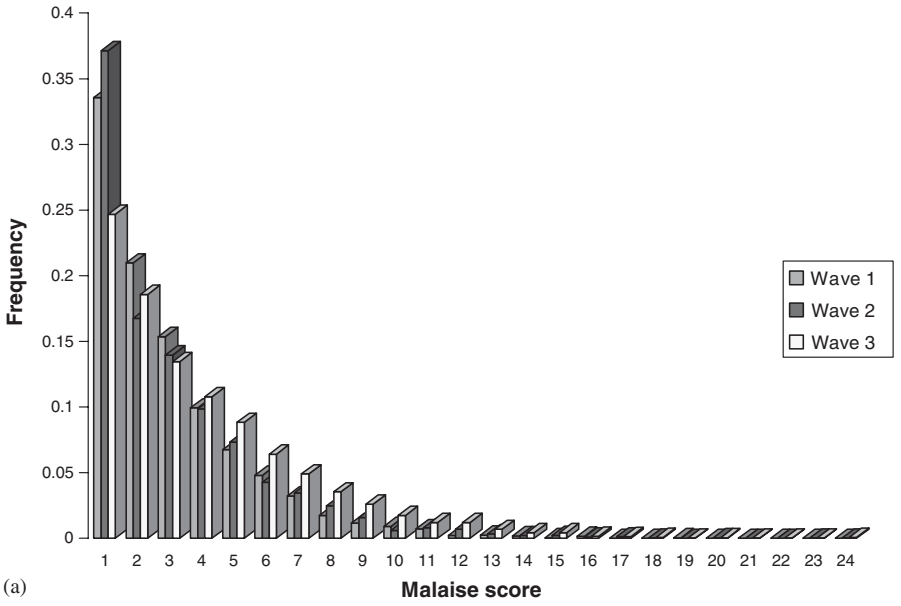
Figure 1(a) and 1(b) show the distribution of the malaise score at all waves. Figure 2(a) and 2(b) report on distribution of normal and depressed respondents (score above 7). From the latter

Table 2. Mean of the main variables in the analysis

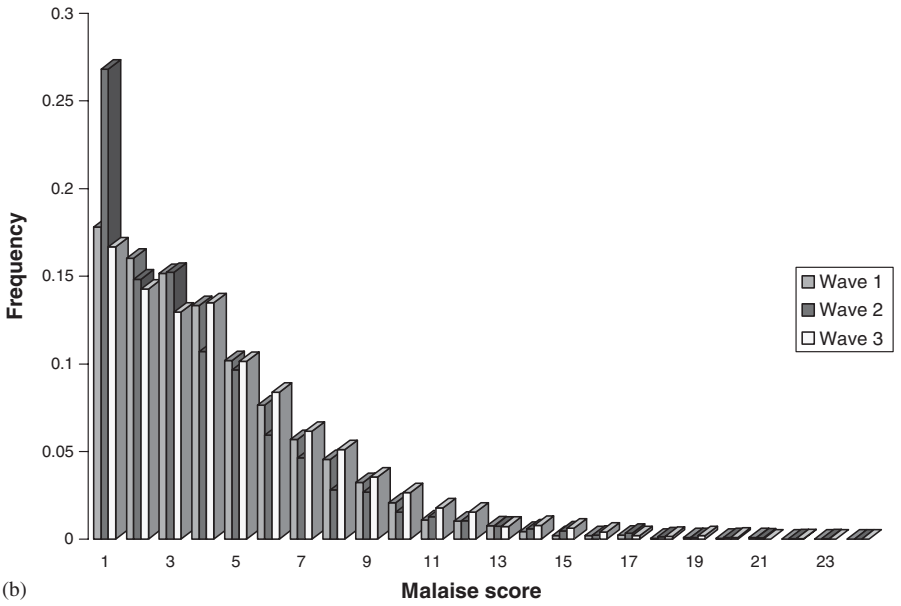
	Total	Male	Female
Malaise			
Mean score 1981	2.67	2.00	3.28
Mean score 1991	2.53	2.12	2.93
Mean score 1999	3.30	2.91	3.70
Self-assessed health	1.77	1.75	1.78
Education (NVQ equivalent)			
Below O-levels	27.96	26.99	28.90
O-level equivalent	35.14	29.79	40.35
A-level equivalent	17.97	24.28	11.81
Degree equivalent	18.93	18.93	18.93
Occupation			
Professional/managerial & technical	33.97	36.75	31.21
Skilled non-manual	26.86	13.54	40.04
Skilled manual	21.92	35.58	8.35
Partly skilled/unskilled	17.25	14.13	20.35
Number of months worked			
In 1981	66.76	71.35	62.45
In 1991	162.75	181.16	144.36
In 1999	254.87	277.24	231.71
Number of months unemployed			
In 1981	3.69	4.09	3.31
In 1991	6.23	7.40	5.06
In 1999	6.98	8.56	5.34
Number of months out of the labour force			
In 1981	5.39	1.13	9.40
In 1991	18.19	2.32	34.03
In 1999	24.68	4.12	45.96
Labour market status			
Working1981	80.05	89.47	71.21
Unemployed 1981	7.82	9.62	6.13
Out of the labour force 1981	12.13	0.91	22.66
Working1991	83.95	92.93	74.99
Unemployed 1991	3.57	5.1	2.03
Out of the labour force 1991	12.48	1.97	22.97
Working1999	91.6	94.34	88.77
Unemployed 1999	1.64	2.07	1.19
Out of the labour force 1999	6.76	3.59	10.04
Health behaviour			
Smoking	33.23	33.23	33.24
Heavy drinking	5.67	9.65	1.70
Marital status			
Single	27.05	30.40	23.73
Married	64.28	61.81	66.72
Divorced	8.42	7.64	9.19
Widowed	0.25	0.14	0.35
Children	58.89	56.14	61.62
Accidents	38.33	51.11	25.63
Disability shock	7.89	7.68	8.10
Number of respondents	22790	11354	11436

Source: NCDS data.

figures it can be seen that the majority of the observations are concentrated in the normal category. The proportion of observations in the depressed category appears to be increasing over time. Figures 1a and 2b show however, that the fraction of people who have a zero malaise score



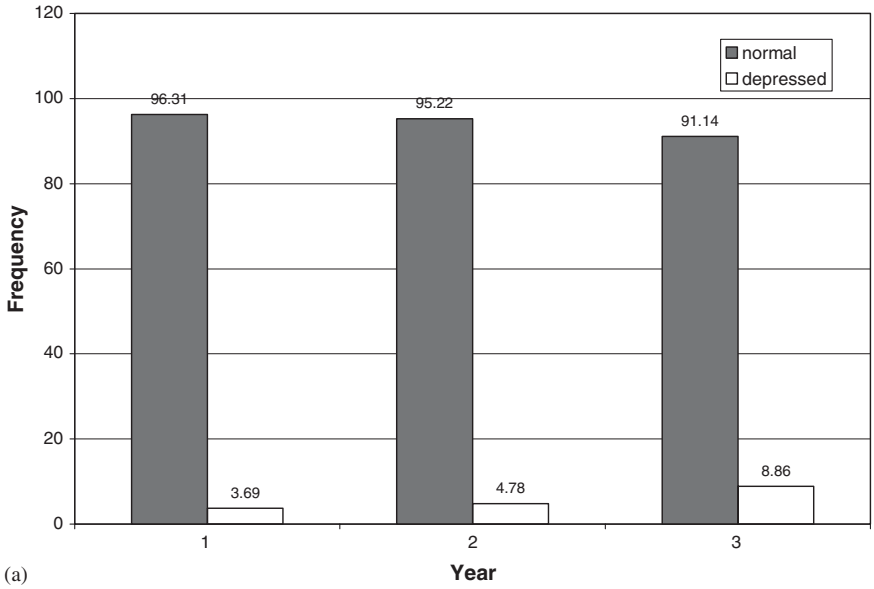
(a)



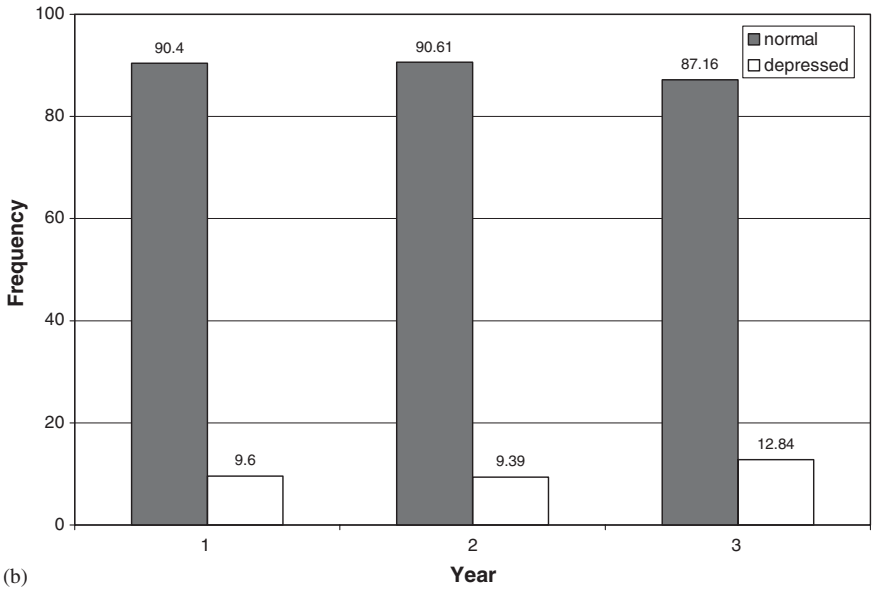
(b)

Figure 1. (a) Malaise score distribution by wave (male). (b) Malaise score distribution by wave (female)

(associated with very good mental health) is relatively high in 1991, in particular for women. It is difficult to understand why this happens and correspondence with both the NCDS support group and the Centre for Longitudinal Studies (CLS) confirmed that the relatively large number of zeros was not due to coding errors. Regardless of the exact reason, the data show that variation in mental health is substantial and that a bad mental health at a point in time does not preclude good mental health in future time. This will be important for the specification of our model (section 'Empirical specification of the model') and the model results (section 'Results').



(a)



(b)

Figure 2. (a) Mental health status by wave (male). (b) Mental health status by wave (female)

Table 3 reports the transition matrices between two successive waves. The rows indicate mental health state at wave (t-1) while the columns indicate mental health state at wave (t). The table shows, for both genders, a high persistence in the normal health state and a relatively low persistence in the depressed state. Quite a few individuals move from a depressed state to a normal state.

Table 4 displays the relationship between mental health and labour market status. It can be seen that, on average, people out of the labour force tend to have the highest mean scores, indicating that they have the worst mental health. For males mental health deteriorates over time. For females the time patterns seems to follow a U-shaped curve. It is interesting to see that males appear to suffer more from being out of the labour force than females.

Table 5 shows the relationships between mental health (malaise score) and our occupation variable. We observe that health deteriorates over time for males, for all occupations. Females appear to have a U-shaped pattern over time and have better mental health at age 33 for all occupations. Mental health appears to be better at higher occupational skill levels (professional/managerial and skilled non-manual), than at the skilled manual and the partly skilled/unskilled levels. These results should not be interpreted as a causal effect. We return to this issue in a later section.

Table 6 relates mental health with initial health at birth and during childhood, as well as with past and current socioeconomic and lifestyle variables[e]. The significance of earlier health diminishes when we add health variables at later stages of the life cycle. The only variable from birth that remains significant is a dummy for whether the mother smoked during pregnancy. Smoking of the mother during pregnancy is associated with lower mental health for 23-year-old males. For females none of the natal/childhood variables are significant. Mental health is also negatively correlated with psychosocial and psychosomatic illnesses during childhood and adolescence, as well as with the Bristol Social Adjustment Guide (BSAG), an indicator of behavioural adjustment [26]. Interestingly, the BSAG is not significant for males. Indicators of socioeconomic status (SES) at an early age do not appear to play a major role in mental health in adulthood. Only father's low socioeconomic status is associated with worse mental health for males. We use an arithmetic test score at age 11 as a measure of intelligence or ability and find that it is related with better mental health for both genders. Lifestyle variables at age 16 and at 23 are also important in explaining mental health. Smoking is associated with worse mental health at age 23. We find no effects for drinking. Regular exercise appears to be associated with better mental health while obesity has the opposite association. Obesity appears to play a significant negative role on mental health, but only for females. We use dummies for marital status (married as the reference group). We find that being a widow or divorced is associated with worse mental health (significant for females only). Not surprisingly, people who have ever suffered from homelessness have higher malaise scores. Finally, we investigate the effect of education. We use a dummy for no

Table 3. Transition matrices for mental health by gender

	Normal (t)	Depressed (t)
Male		
Normal (t-1)	94.51	5.49
Depressed (t-1)	54.06	45.94
Female		
Normal (t-1)	92.01	7.99
Depressed (t-1)	54.23	45.77

Source: NCDS dataset.

Table 4. Mean of total malaise score by current economic activity 1981–1999

	Year		
	1981	1991	1999
Total			
Employed	2.44	2.40	3.13
Unemployed	3.12	3.26	3.89
Out of the labour force	3.86	3.19	5.46
Male			
Employed	1.94	2.01	2.76
Unemployed	2.55	2.97	3.62
Out of the labour force	2.17	4.99	6.38
Female			
Employed	3.02	2.87	3.53
Unemployed	3.95	3.99	4.36
Out of the labour force	3.92	3.04	5.12

Source: NCDS data.

Table 5. Mean of total malaise score by occupation

	Year		
	1981	1991	1999
Male			
Professional/managerial & technical	1.67	1.7	2.71
Skilled non-manual	1.45	2.16	2.93
Skilled manual	2.16	2.38	3.12
Partly skilled/unskilled	2.55	2.62	3.12
Female			
Professional/managerial & technical	2.44	2.48	3.34
Skilled non-manual	3.12	2.8	3.8
Skilled manual	3.84	3.40	4.02
Partly skilled/unskilled	4.37	3.68	4.05

Source: NCDS data.

qualifications or qualifications below O-levels as the reference group and find that people with higher qualifications have better mental health.

The results of Table 6 are based on simple regressions where unobserved individual heterogeneity is not controlled for. For instance, individuals with a genetic predisposition towards mental illness or worse general health may choose a particular type of education path, leading towards certain occupation and work choices. This will make it difficult to interpret the findings of Table 6 in terms of causal effects. We return to this issue in the next section.

The model and empirical specification of the model

The model

Our point of departure is an individual agent who maximises expected lifetime utility. Per period, utility depends on consumption C, leisure l, and health H. Health may enter the utility function directly because it may affect the relative preference for income and leisure. More specifically, per period t, utility U_t can be written as $U_t = U(C_t, H_t, l_t)$ and the optimisation problem is to maximise $E_t \Sigma_{i=t} \rho^{i-t} U(C_i, H_i, l_i)$ subject to a budget constraint and a health production function. E is the expectation operator and ρ the discount factor. Of primary interest for our study is the specification of the health production function. Similar to Grossman [27] or Sickles and Yazbeck [28], one may specify the health production function:

$$H_t = h^k(C_t, l_t, \beta) + \alpha H_{t-1} \quad (1)$$

The health production function relates the stock of current health (H_t) to the stock of health in the previous period H_{t-1} and current investments in health $h^k(.)$. With $h^k(.)$ it is assumed that consumption and labour supply choices directly affect health production and that this may differ

Table 6. Health stock equation at age 23

	Male		Female	
Variables	Parameter	*T*-value	Parameter	*T*-value
Mother smoked during pregnancy	0.288	(2.82)	0.249	(1.88)
Low birth weight for gestational period (below the 10th percentile)	0.086	(0.52)	−0.040	(0.18)
Dummy mother's age 19 or below	−0.008	(0.03)	−0.411	(1.45)
Number of kids under 21 years in the household	0.105	(3.25)	0.071	(1.66)
BSAG at age 7	0.006	(0.95)	0.034	(3.62)
Arithmetic test score at age 11	−0.028	(4.80)	−0.023	(2.85)
BSAG at age 11	0.010	(1.62)	0.035	(3.63)
Dummy father's high socioeconomic status	0.119	(1.11)	−0.185	(1.34)
Dummy father's low socioeconomic status	0.413	(3.10)	−0.041	(0.24)
Psychosocial illness at 7	0.084	(0.62)	0.074	(0.40)
Psychosomatic illness at 7	0.070	(0.67)	0.632	(4.85)
Psychosocial illness at 16	0.530	(1.82)	1.293	(2.95)
Psychosomatic illness at 16	0.298	(2.83)	0.324	(2.68)
Dummy smoking at 16	0.351	(3.39)	0.536	(3.98)
Dummy drinking at 16	0.066	(0.69)	0.045	(0.36)
O-level equivalent	−0.519	(3.80)	−0.410	(2.50)
A-level equivalent	−0.561	(3.78)	−0.695	(2.99)
Degree equivalent or above	−0.476	(2.78)	−1.056	(4.72)
Dummy regular exercise at 23	−0.362	(3.75)	−0.268	(2.11)
Ever been homeless	0.779	(3.87)	1.306	(5.01)
Obese at 23	−0.119	(0.31)	0.939	(2.99)
Dummy single at 23	0.106	(1.06)	0.242	(1.90)
Dummy divorced/widow at 23	0.286	(0.85)	0.851	(2.87)
Constant	1.934	(8.30)	2.712	(9.83)
Observations	2275		2337	
R^2	0.112		0.156	

per occupation type $k = 1, \ldots, K$. Health effects of work are different, for instance, for manual unskilled workers as compared to non-manual highly educated workers. The choice for a specific occupation is part of the optimisation problem, along with the other choice variables of the model (consumption C, leisure l, and (indirectly) health H). It is not our aim to obtain explicit expressions for the choice of occupation and to structurally estimate the model, but rather to acknowledge its endogenous nature and the consequences for empirical models of health and work.

Empirical specification of the model

Our empirical model is based on Equation (1). Our indicator for mental health, the malaise score, is measured at the last three waves (1981, 1991, and 1999) of the NCDS, when the respondent was aged 23, 33 and 42, respectively. With three waves we can estimate a dynamic health model, where, in line with (1) current health depends on previous health and current investments in health. However, it should be noted that given the relatively young age of our respondents and the long time span between the successive waves, the information in the lagged value of health should not be overestimated. The descriptive analyses of the section 'The data' (Table 3) already showed us that the malaise score in our data does not display strong patterns of state dependence. A substantial fraction of depressed individuals at time t return to a normal health state at time $t+1$. We have estimated a fixed-effect dynamic panel data model for mental health and used the Arellano–Bond [29] procedure to estimate the model. The results of this exercise are reported in Table A1 of Appendix A and reveal that lagged health does not have a significant impact on current health.[f]

We therefore choose to proceed with a reduced-form specification, where lagged health is substituted out of Equation (1), so that we obtain:

$$H_{it} = X_{it}^{'}\beta + L_{it}^{'}\gamma + \delta_i + u_{it} \quad (2)$$

The vector L_{it} contains measures for work history and time spent in unemployment. The set of coefficients, γ, allow for differential effects across different types of occupations. X_{it} contains a range of socio-economic and demographic variables, but also includes life style variables (smoking, drinking) as well as an indicator of whether an individual recently had an accident or a disability shock and whether the respondent recently was divorced or recently lost a partner. δ_i is an individual specific effect, and u_{it} an idiosyncratic shock. The individual effect δ_i will contain omitted individual variation and in addition, due to our static formulation of the health production model, effects of lagged health outcomes that are not appropriately taken account by the observables X_{it} and L_{it}.

Of particular relevance to our analysis is that L_{it} contains summary measures for past labour market behaviour and its effect is allowed to depend on the occupation of the individual. Both are in essence choice variables of the model and therefore endogenous to mental health. This will also hold for the life style variables contained in X_{it}. In terms of the model, some of our regressors are not orthogonal to either δ_i or u_{it}. We therefore choose to estimate the model using fixed effects methods. This approach is most flexible and requires no assumptions on the correlation between X_{it} , L_{it} and δ_i. The fixed effect approach would indeed eliminate the nuisance parameters δ_i, but still part of the simultaneity could run via the idiosyncratic shocks u_{it}. In line with the larger part of the empirical micro-econometric literature we assume that L_{it} and X_{it} are orthogonal to the idiosyncratic shock (u_{it}), but possibly not to the time persistent unobservable individual attributes (δ_i). It is important to note that our vector X_{it} contains (unforeseen) shocks like the occurrence of an accident, a disability and whether an individual was recently divorced or lost a partner. With the inclusion of these variables we hope to capture the most important part of the correlation between u_{it} and the included regressors.

We use a sample of individuals who have sorted themselves into different types of occupations and where some of our individuals leave the sample after the first wave (there is some attrition and proxy interviews are removed from the sample). Note that the fixed effect approach may take these possibly endogenous selections explicitly into account. Let us for now concentrate on the selection into an occupation. Suppose for instance, that there are two types of occupations and that selection into an occupation takes place before the age of 23, the age where we first observe our respondents as adults. Denote $J_i \in \{0, 1\}$ as an indicator for the occupational choice and suppose

that selection into an occupation is governed by a latent index J^*:

$$J_i^* = W_{i0}'\varphi + \eta_i \quad (3)$$

W_{i0}' is a set of regressors such as education, socio-economic background, etc. $J_i = 1$, iff $J_i^* > 0$. This conditioning implies for the mean of the mental health for occupation $J_i = 1$:

$$\begin{aligned} E[H_{it}|J_i^* > 0] &= X_{it}'\beta + L_{it}\gamma + E[\delta_i|J_i* > 0] \\ &= X_{it}'\beta + L_{it}\gamma + f(W_{i0}'\alpha) \end{aligned} \quad (4)$$

$f(W_{i0}'\alpha)$ is an arbitrary function for the conditional mean $E[\delta_i|M_i^* > 0]$. This function is equal to the (standard) inverse of Mill's ratio under the assumption of joint normality of δ_i and η_i. Of interest for our purposes is that $f(W_{i0}'\alpha)$ varies per individual, but that it does not vary over time and that therefore difference regressions of mental health only depend on differences in X_{it}, L_{it} and u_{it}. As a consequence, estimation remains very simple and estimates of β and γ do not depend on the choice of instrument and/or exclusion restrictions. Using the same argument we can show that fixed effect models also deal with non-random attrition, as long as the dependence between the selection equation and the health Equation (2) is governed by the correlation between the time invariant unobserved components[g].

Results

The results of the fixed effects panel data model for Equation (2) are reported in Table 7.[h] The table reports the results for males in the first column and for females in the second column. A negative coefficient is associated with low malaise scores and hence with better mental health. The effect of labour market status is captured by a series of dummies with the category 'out of the labour force' as the reference group. Similarly, variation in the employment time and unemployment time variables comes from time spent out of the labour force. Therefore, changes in the malaise score for individuals who are out of the labour force may reflect ageing effects and/or time effects. Our panel data model (2) is estimated in first differences and therefore the constant refers to a linear age and period effect for a worker who stays 'out of the labour force'.[i]

The constant indicates that mental health deteriorates with age and that the rate of deterioration is higher for males. An average male's health worsens with 0.118 points for each year that he stays out of the labour force, for an average female this is only 0.036 points per year. Previously (Table 2) we noted that females had on average higher malaise scores than males. Time spent in employment influences the rate of deterioration. From the coefficients of employment variables we can conclude that working results in lower health depreciation rates (as compared to those out of the labour force) for males and females. We postpone a discussion about the magnitude of these effects to a later subsection, where we show the results of some calculations with the model. The effect of employment time differs per occupation for females, but not for males. Females in a professional or managerial occupation have lower levels of the malaise score (better mental health), but their mental health also deteriorates at a faster rate.[j] The effect of current employment status is strong for males, but not for females. For males, employment and unemployment leads to substantially better mental health than being out of the labour force. Time spent in unemployment has an effect on mental health for both genders. The coefficients on the quadratic function tell us that for the relevant part of the unemployment time distribution, unemployment time is better (or rather less worse) than time spent out of the labour force.[k]

Smoking leads to worse mental health levels for females. It is interesting to see that marital status has different effects for males and females. Mental health for non-married males is better than mental health for married males and the reverse holds for females. Bereavement has a substantial negative effect on the mental health of females, for males we do not find an effect. The accident variable indicates whether the respondent has been admitted to a hospital or attended a hospital outpatient or casualty department as a result of any kind of accident or assault since last survey. The disability shock indicates if the individual has a long-standing illness or disability that was not present in the previous wave. Therefore it is not surprising to see the large positive and significant effect of the accident variable (for males) and of the disability shock variable.

The strong and large effects of accidents and a disability shock makes it interesting to see to what extent factors like occupation, employment time and employment status may be of influence for the

Table 7. Results of fixed effect panel data model (first differences) for mental health

	Male		Female	
	Parameter	*T*-value	Parameter	*T*-value
Constant	0.118	(5.23)	0.036	(2.48)
Logarithm months in current job	−0.070	(2.23)	−0.022	(0.72)
Logarithm total months in employment	0.645	(1.07)	−2.713	(5.81)
Squared logarithm total months in employment	−0.170	(1.99)	0.243	(3.88)
Logarithm of total months in unemployment	0.072	(0.45)	0.420	(1.91)
Squared logarithm of total months in unemployment	−0.091	(2.23)	−0.134	(2.16)
Professional occupation	−0.384	(0.56)	−2.162	(3.29)
Skilled non-manual occupation	−0.758	(1.02)	−0.539	(0.82)
Skilled manual occupation	−0.185	(0.26)	−1.139	(1.14)
Professional*logarithm of months in employment	0.061	(0.45)	0.462	(3.41)
Skilled non-manual*logarithm of months in employment	0.168	(1.11)	0.135	(0.98)
Skilled manual*logarithm of months in employment	0.061	(0.43)	0.266	(1.28)
Currently employed	−0.883	(2.67)	0.173	(1.51)
Currently unemployment	−0.979	(2.80)	0.298	(1.39)
Heavy drinker	0.044	(0.40)	0.150	(0.50)
Currently smoking	0.081	(0.82)	0.447	(3.89)
Single	−0.163	(2.16)	0.092	(1.04)
Divorced	−0.261	(2.64)	0.034	(0.32)
Widowed	−0.067	(0.14)	1.246	(2.50)
Children	−0.071	(1.04)	−0.166	(2.02)
Had an accident	0.215	(3.09)	0.116	(1.25)
Disability shock	0.765	(5.39)	1.151	(7.65)
Observations	5536		5776	
R^2	0.076		0.043	

occurrence of an accident or a disability shock. Tables 8 (the occurrence of an accident) and 9 (whether the individual had a disability shock) report on this. The tables report the results from clustered Probit analyses.

Table 8 shows that the probability of having an accident differs by gender. Females have lower probabilities of experiencing an accident. We already observed this difference in Table 2. Occupation also matters. The reference group is the semi-skilled/unskilled occupation. People in the skilled manual group have a higher probability of accidents than the partly skilled/unskilled while those in skilled non-manual occupations have lower chances of experiencing an accident. The probability of an accident is also lower for older people and higher for singles, divorced and widowed people. Heavy drinking and smoking increases the chance of accidents. Both employed and unemployed people have a higher probability of getting an accident. On the other hand, employment time does not influence the accident probability.

The results for the disability shock differ in some important aspects from the probability of experiencing an accident. None of the employment history variables seem to matter and the most prominent effects come from age and current economic activity. The age effect is opposite to the effects found in Table 8, but in line with *a priori* expectations. As people age, the chances of getting a long-standing illness increases. Employed and unemployed have compared to those out of the labour force, lower probabilities of experiencing a disability shock. Furthermore it is interesting to note that there are no gender differences and that as far as the occupation variables are concerned, individuals with a professional or managerial occupation have lower disability shock probabilities.

Figures 1 and 2 from the section 'The data' showed that the second wave data contained a relatively large number of zeros. Correspondence with the NCDS support group and the CLS confirmed that these zeros were actual cases and not a result of a miscoding and/or changes in the

Table 8. Results of Probit model for the occurrence of an accident

Variables	Parameters	*T*-values
Dummy female	−0.607	(27.62)
Dummy professional occupation	−0.053	(1.91)
Dummy skilled non-manual occupation	−0.079	(2.74)
Dummy skilled manual occupation	0.088	(2.94)
Age	−0.012	(5.58)
Dummy single	0.048	(2.24)
Dummy divorced/widowed	0.089	(2.81)
Current cigarette smoking	0.132	(6.52)
Heavy drinker dummy	0.187	(4.84)
Current economic activity employed	0.179	(5.46)
Current economic activity unemployed	0.156	(2.97)
Log of total time in employment	0.005	(0.18)
Constant	0.763	(7.98)
Observations	21886	

Table 9. Results of a Probit model for the occurrence of a disability shock

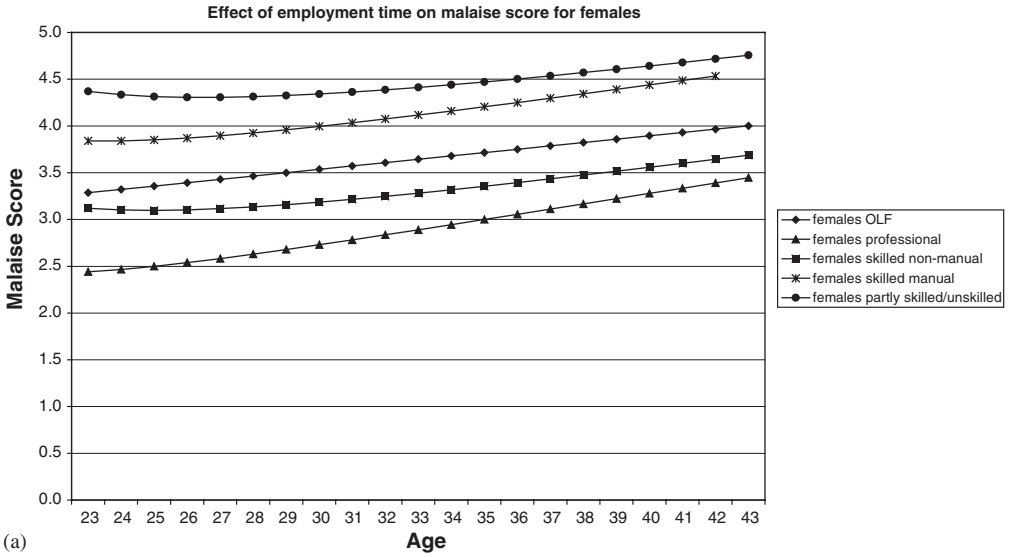
Variables	Parameters	*T*-values
Dummy female	−0.009	(0.28)
Dummy professional occupation	−0.117	(2.83)
Dummy skilled non-manual occupation	−0.083	(1.93)
Dummy skilled manual occupation	−0.052	(1.14)
Age	0.049	(14.64)
Dummy single	0.001	(0.04)
Dummy divorced/widowed	−0.101	(2.09)
Current cigarette smoking	0.101	(3.30)
Heavy drinker dummy	0.116	(2.05)
Current economic activity employed	−0.427	(9.77)
Current economic activity unemployed	−0.178	(2.28)
Log of total time in employment	0.033	(0.79)
Constant	−2.848	(18.08)
Observations	20027	

test. This prompts the question whether the linear effects of age and/or period that we allow for in the current specification is too restrictive and whether the job time variables may pick up non-linear age and period effects.[l] We also estimated a model that includes a wave dummy in addition to the constant.[m] Adding the dummy appeared to have a very strong impact on the effect of the job time variables for males. These coefficients were reduced in size and became insignificant while the wave dummy was large and significant. For females we also found a large and significant wave dummy, and some changes in the coefficients of the job time variables, but the job time coefficients remained significant. The results for males may be due to the relatively large share of males who had an uninterrupted period of employment between the two waves. This is particularly true for the last two waves (about 85% of the male respondents has an uninterrupted employment spell). Indeed, a wave dummy may pick up some non-linearities in the age and/or period effects, but it may on the other hand also absorb the effect of employment time. Therefore, in this case the wave dummy also reflects employment time effects. We plotted the effect of job time for males and females using the two different specifications. The plots for the two different specifications were virtually identical, so the choice for a specification would not lead to different conclusions concerning the evolution of mental health over time. We therefore chose to stay with the results of Table 7. We realise however, that (notably for males) the effect of job time may pick up some non-linear age and/or period effects.

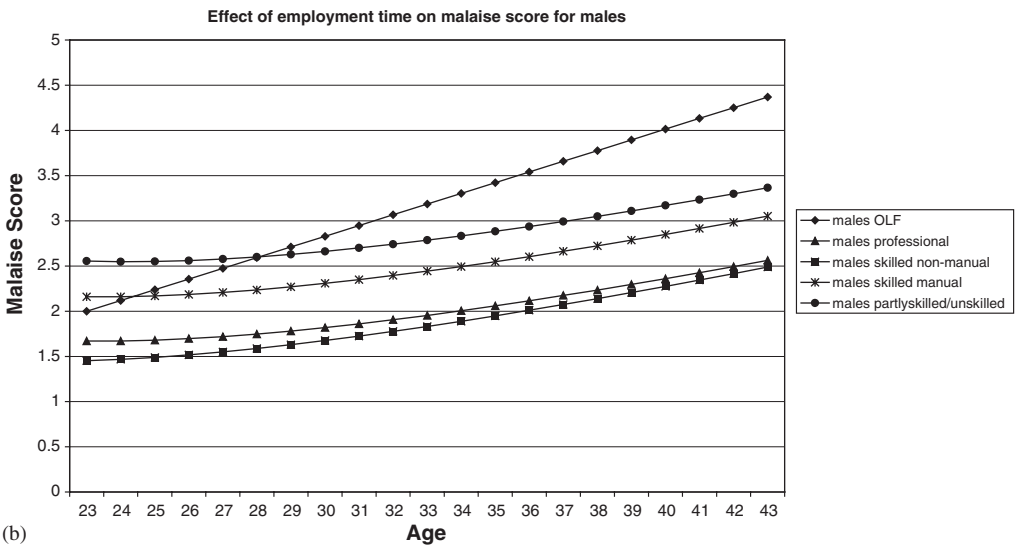
Some calculations with the model

The curves in Figure 3 depict the relationship between the malaise score and time spent in employment for females (upper panel) and males (lower panel). The curves are drawn for a specific male and female with the following characteristics: (s)he does not drink or smoke and does not have an accident or a disability shock over the entire 20 year period. The straight line refers to the situation where the individual remains out of the labour force (OLF) for the entire period. At age 23 we start with the average malaise score of the 23 year old respondents in the 1981 wave. The other lines refer to the situation where an individuals works during the entire period in a specific occupation. For these lines we start with occupation-specific average malaise scores of the 1981 respondents.

The OLF line graphically confirms what we already saw in Table 7. Health deteriorates when



(a)



(b)

Figure 3. Effect of employment time on malaise score

people are out of the labour force and the rate of deterioration is larger for males than for females. Females have, however, higher malaise scores and hence worse levels of mental health. For females the shapes of the curves are very similar for different occupations, but the differences between the different occupations is quite large. The higher the skill level of the occupation, the lower the curves and hence the better the mental health. For males there is quite a difference between the slope of the OLF curve and the other curves. Employment leads to substantially lower rates of depreciation of the mental health for males. However, the differences between the different occupations are small (and not significant as we saw from Table 7).

Discussion and conclusion

This paper considers the effect of work choices on mental health and looks whether this differs across

occupations. This requires a model that can deal with the endogeneity in the relationship between health, occupation and work choices. We specify such a model and estimate it on a unique UK panel survey. The survey, called the National Child development Survey (NCDS), follows a cohort since their birth in 1958 until age 42. Mental and emotional health is assessed through the Malaise Inventory designed by the Institute of Psychiatry from the Cornell Medical Index [24]. This is a self-completion scale for assessing psychiatric morbidity and includes a 24-item list of symptoms such as anxiety, irritability, depressed mood and psychosomatic illness. The occupation variable corresponds to the UK official socio-economic classification: social class based on occupations (SC and former RGSC). The classification is based upon the ranking of occupations by skill. Therefore it has to be noted that this occupational classification may measure to a large extend hierarchy of skill level, rather than a classification of actual occupations. We used fixed effects methods to control for time invariant unobserved heterogeneity and include a range of measures for (unforeseen) shocks to control as much as possible for the correlation between the transitory error term and the included regressors. In this way we hope to control as much as possible for the endogeneity in the relationship between occupational choices, work choices and mental health.

The analyses show us that early childhood health and ability have long-lasting consequences for the mental health at the later ages. Mental health deteriorates for males and females, but the rate of deterioration is substantially lower for females. Females start however, with lower (worse) levels of mental health. We also find that the rate of deterioration slows down when people work and that this effect is strong for males and small for females. For females we find large differences from the effect of occupation: the higher the occupation, the better the mental health. The quality of the job seems to be of more importance to females. For males there are no differential effects with respect to the type of occupation. We find however, that employment status is important for males. Males who are out of the labour force have substantially worse mental health. We do not find this for females. This may have to do with the still dominant view that non-market activities like taking care of the home and the children is acceptable for females, but not for males. We also find that single males are in better mental health, whereas for females the opposite holds. For both genders we find very large effects of the onset of a long-standing illness (a disability shock). Additional analyses reveal that there are no gender differences, but that employment status, occupation and life style variables are important for the probability of experiencing a disability shock. Individuals who participate in the labour market and who hold a professional occupation have substantially lower disability shock probabilities. The reverse is true for individuals who smoke and drink.

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Notes

a. This literature has two strands: a part that looks at the effect of poor health on wages [4–6], and the effect of poor health on retirement/labour supply choices [7–11].
b. See Appendix B.
c. Other classifications such ISCO are not available in the first wave. The British SOC classification has been modified in between the waves and is therefore not suitable.
d. Most women within the category out of the labour force are doing housework while this is not the case for men. The sample size prevented us from making a further disaggregation.
e. Table 6 is obtained through an OLS regression of a mental health indicator at age 23 on several health and socio-economic variables at ages 7, 11, 16, 23 and birth.
f. In Appendix A we only report the results for the total sample. We also estimated separate models for males and females. This did not alter the conclusions.
g. Of course we do not have a problem when selection is based on observable characteristics alone.
h. The model is estimated in first differences using STATA version 7.0.
i. Our data consist of a single cohort born in a particular week of 1958 that we follow at subsequent points in time. At the end of this section we discuss alternative specifications for the age and/or period effects.

j. In the fixed effect specification of Table 7, the effect of occupation is identified from changes in occupation over time. Therefore it is relevant to mention that there are quite a lot of changes in occupation. Our sample concerns a group of young individuals at the start of their career (age 23) up to the age of 42. We refer to Table A2 of Appendix A for details.
k. Our results differ from results found by Smith *et al.* [30] who focus on occupational stress. They use a random sample of workers and find similar reported levels of stress for males and females and they find that occupational stress increases with educational attainment and salary. It is not possible to compare their occupational classification with ours, but our occupational classification suggest that there are only effects for females and that females with a higher educational attainment and higher salaries have lower levels of stress. The differences may be due to the fact that they have a random sample of the entire population of workers, whereas we have a single cohort that we follow up to the age of 42. Moreover, their analyses are based on a direct comparison of means across different subgroups, which makes it difficult to control for observed and unobserved factors that may confound the results.
l. We thank an anonymous referee for pointing us to this potential problem.
m. With the three waves that we have at our hand a first difference specification with two wave dummies would be equivalent.

Appendix A: Dynamic model

Dynamic estimation for mental health is given in Table A1.

Transition matrix of occupation by gender is given in Table A2.

Appendix B: Malaise Score

The malaise score Questionnaire is given in Table B1.

Table A1. Dynamic estimation for mental health

Variables	Parameter	*T*-value
Lagged malaise score	−0.021	(0.85)
Log months in current job	0.019	(0.51)
Log total months in employment	2.593	(1.51)
Squared log total months in employment	−0.352	(1.80)
Log total months in unemployment	0.650	(2.33)
Squared log total months in unemployment	−0.181	(2.46)
Professional occupation	−2.339	(1.63)
Skilled non-manual occupation	−4.373	(2.87)
Skilled manual occupation	−2.135	(1.26)
Professional*log months in employment	0.471	(1.71)
Skilled non-manual*log months in employment	0.841	(2.87)
Skilled manual*log months in employment	0.468	(1.47)
Currently employed	−0.427	(2.47)
Currently unemployment	−0.274	(1.00)
Had an accident	0.094	(0.98)
Disability shock	1.048	(6.81)
Heavy drinker	−0.012	(0.07)
Currently smoking	0.310	(2.20)
Single	−0.088	(0.88)
Divorced	−0.077	(0.70)
Widowed	0.442	(1.00)
Children	−0.019	(0.23)
Constant	0.123	(4.36)
Observations	4137	
R^2	0.111	

Table A2. Transition matrix of occupation by gender

	Professional	Skilled non-manual	Skilled manual	Unskilled
Male				
Professional	78.64	8.56	9.55	3.26
Skilled non-manual	46.79	38.28	9.98	4.95
Skilled manual	18.06	5.1	65.49	11.34
Unskilled	16.41	5.8	38.27	39.52
Female				
Professional	70.97	16.89	3.96	8.17
Skilled non-manual	22.25	58.63	4.14	14.99
Skilled manual	17.17	19.7	31.14	31.99
Unskilled	15.13	21.07	13.47	50.33

Source: NCDS data.

Table B1. Malaise score questionnaire

1.	Do you often have backache?
2.	Do you feel tired most of the time?
3.	Do you often feel miserable or depressed?
4.	Do you often have bad headaches?
5.	Do you often get worried about things?
6.	Do you usually have great difficulty in falling or staying asleep?
7.	Do you usually wake unnecessarily early in the morning?
8.	Do you wear yourself worrying about your health?
9.	Do you often get into a violent rage?
10.	Do people often annoy and irritate you?
11.	Have you at times had a twitching of the face, head or shoulders?
12.	Do you often suddenly become scared for no good reason?
13.	Are you scared to be alone when there are no friends near you?
14.	Are you easily upset or irritated?
15.	Are you frightened of going out alone or of meeting people?
16.	Are you constantly keyed up and jittery?
17.	Do you suffer from indigestion?
18.	Do you often suffer from an upset stomach?
19.	Is your appetite poor?
20.	Does every little thing get on your nerves and wear you out?
21.	Does your heart often race like mad?
22.	Do you often have bad pains in your eyes?
23.	Are you troubles with rheumatism or fibrositis?
23.	Have you ever had a nervous breakdown?

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