**An Analysis of the Impact of Health on Level of Occupation**

**Joanne Flavel**

**National Institute of Labour Studies, Flinders University**

**Abstract**

This paper uses dynamic multilevel modelling to examine the effect of health and changes in health on occupation for the working age population. Two measures of occupation are used to capture two aspects of occupation highlighted in the literature as linked with health: physical job demands and status. The models use data from the first ten waves of the Household, Income and Labour Dynamics in Australia Survey (HILDA) and accounts for initial condition, state dependence and unobserved heterogeneity. The results of the analyses find no significant effect of health, health shocks or health improvement on occupation after controlling for selection into employment.

**Keywords:** Health, occupation, dynamic multilevel models, HILDA survey

**JEL Classifications:** C33, I1, J24

*Introduction*

Previous research has shown that health has a substantial effect on labour market decisions, in particular the decision to participate in the labour market (Cai and Kalb, 2006; Cai, 2010; Oguzoglu, 2010; García-Gómez *et al.* 2010, Webber and Bjelland, 2015) and the retirement decision (Disney *et al.* 2006; Lindeboom, 2006; Jones *et al.* 2010; Zucchelli *et al.* 2010; Bound *et al.* 2010). In comparison, there has been limited examination of the effect of health on other labour market outcomes and during working age. About 15 per cent of working age Australians report that they have a work limiting condition, a condition which limits the type or amount of work they do. About half of those with a work-limiting condition also report being in poor health. National Health Survey statistics show that over a third of people reporting poor health are employed, emphasising that health matters beyond the effect it has on keeping people out of work.

Maintaining individuals with health limitations in the labour force is a challenge with the ageing population and anticipated increase in the proportion who will experience poor health.

As such, it is important to determine how health influences the occupations people work in, and how changes in health might affect the type of job worked. It is the purpose of this paper to examine the effect of health and changes in health on level of occupation. Occupation is important because different occupations are associated with differences in income and varying career prospects (Yamaguchi, 2010). Occupations also differ in their exposure to risk of unemployment and specific health hazards.

A number of studies have investigated the effect of occupation on health (see for example Sindelar *et al.* 2007; Chau & Khlat, 2009; Fletcher & Sindelar, 2009; Gueorguieva *et al.* 2009). These studies suggest a strong relationship between greater physical job demands and poorer health (especially cumulated physical job demands), that there are occupation-related health differences which persist with age and that blue collar work at labour force entry is associated with declining health later in life. There is also some suggestion that status of occupation is associated with health beyond the distinction between work which is physically demanding and that which is not. A social gradient in health is found when analysing the relationship between occupation status and health (Ferrie *et al.* 2002; Gueorguieva *et al.* 2009; Toivanen, 2011).

The effect of health on occupation is relatively under-examined. Studies which have examined effects of health and effects of changes in health on occupation include Pelkowski and Berger (2003), Cohiden *et al.* (2009), De Raeve *et al.* (2009) and Halleröd and Gustaffson (2011). These studies found that health affects occupational mobility (De Raeve *et al.* 2009; Halleröd and Gustaffson, 2011), they suggest health based selection into less prestigious jobs (Cohiden *et al.* 2009; Halleröd and Gustaffson, 2011), and they support the job change literature, suggesting that people in poor health who are not accommodated in their job will change jobs to adapt to onset of a health problem (Pelkowski and Berger, 2003; De Raeve *et al.* 2009). Differing methodologies were used, with few addressing the issue of endogeneity of health and in all cases samples were limited to those who were working. These papers go some way toward understanding behaviours of those who work after onset of a health problem but they do not control for selection into employment.

This paper adds to the contributions of previous analyses of the effect of health and changes in health (both good and bad) on occupation by considering the Australian setting. It can be differentiated from past work by its use of complex panel data analysis using representative

data, with methods to control for both selection into employment and the endogeneity of health.

*Methods*

This paper examines the effect of health on level of occupation using two measures of occupation. One is a categorical manual/non-manual measure based on the Goldthorpe class measure, a schema composed of 11 categories which can be collapsed into a smaller set of classes (Rose, 2005). This is modelled by dynamic, multinomial multilevel logit models which also included non-employment as an outcome. The second measure used is a continuous measure of occupational status, the Australian Socioeconomic Index of 2006 (AUSEI06), modelled by dynamic multilevel linear regression for those who reported an occupation.

Using the two measures of occupation aims to capture two aspects of occupation highlighted in the literature as linked with health, physical job demands and status. Use of the continuous occupational status measure also addresses the lower number of transitions between the broadly defined manual and non-manual occupations. The models incorporate controls for state dependence, so that causal links between past and current labour market status and occupation are accounted for. Dynamic panel models with random effects are used to distinguish effects of unobserved heterogeneity and the models account for the initial conditions problem (Wooldridge, 2005).

Following the approach suggested by Bound (1991) and Bound *et al.* (1999) and implemented by Disney *et al.* (2006), Jones *et al.* (2010), Garcia-Gomez *et al.* (2010) and Bound *et al.* (2010), a latent variable model is used to construct an index of health (or measure of health stock). This attempts to account for measurement error in self assessed health (SAH) by modelling SAH as a function of demographic characteristics and more objective measures of health using ordered probit models.

Models are estimated on a sample aged 15 to 64 drawn from the first ten waves of the Household, Income and Labour Dynamics in Australia Survey (HILDA). The gllamm procedure in Stata is used to estimate multilevel models for the broad categorical measure of occupation. These models examine the likelihood of not being employed or of manual employment relative to non manual employment. For the AUSEI06 specification of

occupation, the xtmixed multilevel modelling procedure in Stata was used. Selection into employment is corrected for in the AUSEI06 models using a two stage procedure following Vella and Verbeek (1999) and Orme (2001)

In addition to the models estimating effects of health on occupation, job change models are also analysed as the models using the two measures of occupation estimate the effect of health and the effect of changes in health on occupation but they cannot establish the effects of health (or changes in health) on occupational changes. The job change models use the heckprob modelling procedure in Stata.

The constructed health index is used as a health measure in the occupation models. Lagged and initial health are included in the models to reduce the possibility of simultaneity bias. By using lagged health, the change in health occurs before any change in labour market status. Inclusion of both initial period health and lagged health allows for the estimated coefficient on lagged health to be interpreted as a deviation from an underlying health stock represented by initial health (Hagan *et al.* 2009; García-Gómez *et al.* 2010; Jones *et al.* 2010). To assist in determining the effects of changes in health on occupation, comparison models were also estimated using a measure of health shock and a measure of health improvement.

*Results/Discussion*

Key results of the models estimated in this paper are presented in Tables 1, 2 and 3. This paper aimed to provide empirical evidence of the direction of the effect of health on occupation. Both the theory and previous empirical findings support the conclusion that poor health reduces the probability of being employed. It is perhaps not surprising then that the results of the analyses in Tables 1 and 2 find no significant effect of health and health shocks on occupation for men or women after controlling for selection into employment. This suggests that the selection effect dominates any effect of health on occupation (in terms of physical job demands in particular).

Improved health also had no significant effect on occupation for either measure used or on decreasing the likelihood of non-employment. This may be attributed to positive shifts occurring at a more leisurely pace (whereas an adverse health shock requires an immediate response). It may also be due to state dependence.

There is strong evidence of state dependence and that initial conditions are a determinant of occupation. Failure to account for these risks overstating the magnitude of the other determinants of occupation. By controlling for these modelling issues the models are a better fit and offer more reliable results.

Tables 1 and 2 show that health selection into employment plays a large role, with persons in poor health less likely to be employed. While poor health had no significant effect on the likelihood of manual or non-manual employment, or on occupational level, it did still play a role in reducing employment in the models. Poor health was found to result in an increased likelihood of non-employment in the multinomial logit model using the categorical measure of occupation. The model of occupational status controlled for selection in a different manner but still found evidence of selection into employment. This supports findings from the literature (see for example Bound *et al.* 1999; Korpi 2001; Cai and Kalb 2006; Schuring *et al.* 2007; Cai 2010; García-Gómez *et al.* 2010; Zucchelli *et al.* 2010, Virtanen *et al.* 2013).

Occupational level models were also estimated in order to explicitly examine the degree to which job change is used as a way to adapt to health impairment. Surprisingly, persons experiencing an adverse health shock are not more likely to change occupational level once selection into employment is accounted for (see Table 3). These findings are consistent with persons experiencing poor health being more likely to leave employment than to change occupation. People who experience impaired health and who are not accommodated in their current job have been found in other research to select into less physically demanding jobs (Daly & Bound, 1996; Krause *et al.* 2001). These previous studies focus on samples of people who have experienced health impairment. They do not control for selection out of employment or compare the likelihood of job change with that for persons in better health. The findings in this study emphasise how important it is to account for this. People with impaired health may change occupational level but they are not significantly more likely to change occupational level compared with persons who do not experience a health shock after taking into account selection out of employment.

It must be acknowledged that people may change jobs within an occupation and this is not captured in the models. Nonetheless, they support the conclusion that withdrawal from the workforce is a more powerful source of harm from poor health than is reduced occupational status and not just for those nearing retirement but for younger workers too. This has implications for lifetime earnings in that loss of income will widen the gap between those

who cannot find employment accommodating their health and those healthy individuals who continue working and do not face such barriers.

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**Table 1: Key Multinomial Logit Parameter Estimates (and Standard Errors) for Outcomes of Not-employed and Manual Employment Relative to Non Manual Employment**

| | **Health Index (1)** | | **Health shock (2)** | | **Health Improvement (3)** | |
|---|---|---|---|---|---|---|
| | Not Employed | Manual | Not employed | Manual | Not Employed | Manual |
| Not employed at t-1 | 2.577*** (0.089) | 1.245*** (0.107) | 2.625*** (0.090) | 1.223*** (0.108) | 2.606*** (0.089) | 1.216*** (0.107) |
| Manual at t-1 | 0.887*** (0.112) | 2.858*** (0.114) | 0.924*** (0.113) | 2.963*** (0.117) | 0.911*** (0.112) | 2.954*** (0.116) |
| Not employed at t=1 | 1.827*** (0.118) | 1.893*** (0.141) | 1.846*** (0.117) | 1.868*** (0.140) | 1.853*** (0.117) | 1.885*** (0.140) |
| Manual at t=1 | 2.112*** (0.149) | 3.184*** (0.145) | 2.115*** (0.149) | 3.131*** (0.145) | 2.128*** (0.149) | 3.146*** (0.145) |
| Lagged health Index | -0.028*** (0.004) | -0.003 (0.004) | | | | |
| Health shock | | | 0.658*** (0.129) | -0.201 (0.144) | | |
| Health Improvement | | | | | -0.212 (0.131) | 0.0962 (0.117) |
| Initial health | -0.012*** (0.003) | -0.001 (0.004) | -0.023*** (0.003) | -0.003 (0.003) | -0.025*** (0.003) | -0.003 (0.003) |
| Female | -1.421*** (0.306) | -0.903** (0.357) | -0.211** (0.087) | -1.208*** (0.096) | -0.272*** (0.087) | -1.161*** (0.098) |
| Lagged health index*female | 0.018*** (0.004) | -0.006 (0.005) | | | | |
| Health shock*female | | | -0.212 (0.171) | 0.507** (0.211) | | |
| Health Improvement*female | | | | | 0.236 (0.165) | -0.046 (0.179) |
| Between individual variance | 2.229*** (0.179) | | 2.180*** (0.176) | | 2.205*** (0.177) | |
| Sample | 38,774 | | 39,446 | | 39,446 | |
| Individuals | 7,735 | | 7,600 | | 7,600 | |
| Pseudo R squared | 0.6360 | | 0.6321 | | 0.6310 | |
| BIC | 29106.09 | | 29415.59 | | 29493.63 | |

Notes: 1) ***Statistically significant at 1% level. **Statistically significant at 5% level. *Statistically significant at 10% level. 2) Sample is number of observations spread over the 10 waves of HILDA. 3) Excludes full-time students

**Table 2: Key Estimates (and Standard Errors) of Determinants of Occupational Status (Dependent Variable AUSEI06 score 0-100)-Multilevel Linear Regression**

| | Health Index | Health Shock | Health Improvement |
|---|---|---|---|
| AUSEI06 at t-1 | 0.326*** (0.008) | 0.328*** (0.009) | 0.328*** (0.009) |
| AUSEI06 at t=1 | 0.335*** (0.009) | 0.337*** (0.010) | 0.337*** (0.010) |
| Lagged health Index | 0.007 (0.012) | | |
| Health shock | | 0.204 (0.329) | |
| Health Improvement | | | -0.235 (0.312) |
| Initial health | -0.019* (0.011) | -0.026** (0.011) | -0.026** (0.011) |
| Female | 4.000*** (1.040) | 1.842*** (0.267) | 1.782*** (0.268) |
| Lagged health index*female | -0.023* (0.014) | | |
| Health shock*female | | -0.268 (0.453) | |
| Health Improvement*female | | | 0.584 (0.410) |
| Generalised residual | 0.885** (0.368) | 0.921*** (0.346) | 0.920*** (0.346) |
| Between individual variance | 48.520*** (2.909) | 48.323*** (3.044) | 48.280*** (3.041) |
| Residual variance | 100.528*** (2.267) | 99.750*** (2.356) | 99.748*** (2.355) |
| Sample | 38,406 | 36,269 | 36,269 |
| Individuals | 7,743 | 7,501 | 7,501 |
| BIC | 295298.7 | 278701.6 | 278696.8 |

Notes: 1) ***Statistically significant at 1% level. **Statistically significant at 5% level. *Statistically significant at 10% level. 2) Sample is number of observations spread over the 10 waves of HILDA. 3) Excludes full-time students

**Table 3: Key Estimates (and Standard Errors) for Probit Marginal Effects for the Probability of Changes in Occupation Corrected for Selection into Employment**

| | Lower AUSEI06 | Same AUSEI06 | Higher AUSEI06 |
|---|---|---|---|
| Female | -0.003<br>(0.007) | 0.011<br>(0.010) | -0.007<br>(0.007) |
| Health shock | -0.013*<br>(0.007) | 0.005<br>(0.013) | 0.012*<br>(0.007) |
| Initial health | 0.001<br>(0.010) | 0.004<br>(0.014) | -0.005<br>(0.010) |
| Health shock*female | 0.008<br>(0.011) | -0.009<br>(0.017) | 0.001<br>(0.012) |
| Initial health | -0.0001<br>(0.0002) | 0.0005<br>(0.0004) | -0.0004**<br>(0.0002) |
| Hours worked | -0.0004**<br>(0.0002) | -0.0002<br>(0.0003) | 0.0006***<br>(0.0002) |
| Job tenure | -0.003***<br>(0.0003) | 0.007***<br>(0.0006) | -0.003***<br>(0.0003) |
| Union member | 0.041***<br>(0.006) | -0.091***<br>(0.009) | 0.051***<br>(0.006) |
| Private sector | 0.007<br>(0.006) | 0.009<br>(0.010) | -0.015**<br>(0.006) |
| Degree or above | -0.022***<br>(0.007) | 0.053***<br>(0.012) | -0.029***<br>(0.007) |
| Constant | -1.125***<br>(0.094) | -0.485***<br>(0.110) | -0.869***<br>(0.095) |
| Rho | 0.314***<br>(0.036) | -0.434***<br>(0.033) | 0.186***<br>(0.038) |
| Sample | 48,632 | 48,632 | 48,632 |
| Individuals | 9,493 | 9,493 | 9,493 |

Notes: 1) ***Statistically significant at 1% level. **Statistically significant at 5% level. *Statistically significant at 10% level. 2) Sample is number of observations spread over the 10 waves of HILDA. 3) Excludes full-time students. 4) Standard errors are panel adjusted standard errors. 5) Models were also estimated using the health index and an alternative measure of health shock. Results were not substantially different. Health does not have a significant effect regardless of the health measure used.