
OVERVIEW

Key points

- Human capital theory supports the view that people with higher levels of education and lower incidences of chronic illness should have higher labour productivity.
- Hourly wages can be used as an indicator of labour productivity. While wages are likely to be a reasonable indicator of the effects of education on labour productivity, statistical issues and the way that labour markets function in practice mean that using wages as an indicator could lead to results that under- or overstate the negative effects of ill health on labour productivity.
- In this paper, higher levels of education are estimated to be associated with significantly higher wages. Compared to a person with a year 11 education or less, on average:
 - a man with a year 12 education earns around 13 per cent more, and a woman earns around 10 per cent more
 - a man with a diploma or certificate earns around 14 per cent more, and a woman earns around 11 per cent more
 - a university education adds around 40 per cent to men's and women's earnings.
- People in the workforce who suffer from chronic illnesses are estimated to earn slightly less than their healthy counterparts (between 1.0 per cent and 5.4 per cent less for a range of conditions).
 - It is possible that these results understate the impact of ill health on productivity, because of the impact that one person's illness can have on other employees.
 - It is also possible that 'endogeneity bias' and unobserved heterogeneity in the data lead to results that overstate the positive effects of education and good health on labour productivity.
- A second objective of this paper is to estimate the potential productivity of people who are not employed or not in the labour force. These people tend to have characteristics that are systematically different to people who are employed. For example, they tend to have less education and work experience, and also to be in worse health. Because of this, they are more likely to be targeted by government programs.
 - Comparison of the characteristics of people in employment with those not in employment found that, depending on their age, gender and whether they receive the Disability Support Pension, the average potential wage of people who are not employed or not in the labour force is between 65 and 75 per cent of the wage of people who are employed.

Overview

In 2006 the Productivity Commission published a report on the potential benefits of the National Reform Agenda (NRA). The NRA is a program of reforms that were proposed by the Council of Australian Governments (COAG) to address impediments to productivity growth and to achieve higher levels of workforce participation and productivity. In March 2008 COAG announced a ‘COAG Reform Agenda’ that focuses on many of the areas that were part of the NRA, including productivity, education, skills and early childhood (COAG 2008).

The NRA includes a ‘stream’ of reforms to address human capital development. ‘Human capital’ refers to the set of attributes that makes it possible for individuals to work and contribute to production. It encompasses skills, work experience, health and intangible characteristics such as motivation and work ethic. Human capital is a key driver of workforce participation and labour productivity and, at the aggregate level, gross domestic product, consumption and community wellbeing. Measures to maintain and enhance the community’s stock of human capital are likely to increase standards of living.

As part of its report on the potential benefits of the NRA, the Commission was asked to estimate the potential future benefits to the community of increasing education levels and reducing the incidence of chronic illnesses. In particular, the Commission investigated six ‘target’ conditions: heart disease, cancer, diabetes, arthritis, mental illness and serious injury. The Commission’s task included estimating the effects of NRA reforms on labour force participation and labour productivity. To do this, the Commission undertook an extensive review of the literature, drawing from Australian and overseas sources to estimate the effects of education and chronic illness on labour market outcomes. Results from the literature indicated that increasing levels of education and reducing the incidence of illness are associated with higher levels of workforce participation and labour productivity.

Although the Commission relied on the best evidence available at the time, the information obtained was ‘often limited or speculative’ (PC 2006, p. 339). To address the gaps in the literature, the Commission has undertaken further quantitative work to enhance and refine estimates of the effects of chronic illness

and education on labour market outcomes. A previous paper (Laplagne et al. 2007) estimated the effects of education and health on labour force participation. This paper estimates the effects on hourly wages, which are used as an indicator of labour productivity.

A second objective of this project was to estimate the potential wages of people who are unemployed or not in the labour force. The NRA includes reforms to work incentives that were intended to increase the workforce participation of people who are not working. To estimate the economy-wide effects of such reforms it is necessary to estimate the potential productivity of the people who would be brought into the workforce as a result of the reforms. The model that was developed to estimate the effects of education and health status on wages is used to estimate the wages that these people would receive if they were to enter the labour force. This can give an indication of their potential productivity, assuming that there is no change to their level of education or health status.

Modelling approach and data

The effects of education and health status on wages were estimated using a wage model based on Mincer (1974). In this model the natural logarithm of wages is expressed as a function of education and health status. The model includes variables to account for labour market and demographic characteristics such as age, work experience, marital status and living in a regional area. These factors have all been observed in other studies to have a statistically significant effect on wages.

Hourly wages were chosen as the best available indicator of labour productivity. Labour productivity could not be directly measured, because to do so would require detailed data on individuals and their employers, including their access to capital and other inputs. However, according to standard economic theory, under certain conditions a person's wage would be an accurate reflection of their productivity (the value of their 'marginal product'). This, however, requires a number of assumptions about the actual functioning of labour markets, some of which do not fully apply. Nonetheless, as long as wages are set in reasonably competitive markets, differences in wages should provide a useful indication of the effects of education and health on labour productivity.

In the case of education, it is likely that on average across the community, the effect of a person's level of education on their wage gives a reasonable indication of the contribution of education to labour productivity. The effects of illness on labour productivity are more complicated, and wages may be a less reliable indicator of how illness influences productivity. For example, if a person who works as part of a

team is absent due to illness, the cost to their employer is not only the cost of the absentee's forgone labour, it is also the cost of the loss of production from other members of the team who rely on the absent worker in their own work (Pauly et al. 2002). The implication for the current project is that using hourly wages as an indicator of labour productivity might tend to understate the extent to which ill health reduces productivity.

However, statistical issues including 'endogeneity bias' and 'unobserved heterogeneity' could lead to the opposite effect — overstating the benefits to labour productivity of good health. It is not possible to determine the net effect of these issues, and whether the results systematically understate or overstate the benefits of education and good health. For that reason, the results should be interpreted with caution.

Controlling for sample selection bias

On average, employed people have higher levels of education and better health than people who are unemployed or not in the labour force, and they tend to have different labour market and demographic characteristics. As a result there is potential for bias in the econometric model because only people who report a wage — the employed — are included in the data used to estimate the effects of education and health on wages. The modelling approach used was developed to account for this possibility of 'sample selection bias', which can arise where the sample that is being used to estimate the model has systematically different characteristics from the rest of the population.

To account for this potential bias, the model was estimated using the approach proposed by Heckman (1979). This involves a two-stage process where the model is adjusted to account for the probability that a person is not in the labour force.

The model was estimated using data from five waves of the Household, Income and Labour Dynamics in Australia (HILDA) survey. HILDA is an annual survey that includes information on the demographic, labour market and human capital characteristics of respondents, including their education and health status. Around 30 000 observations were included in the dataset used for this project.

The HILDA data include reliable information on the educational attainment of respondents. HILDA does not include reliable information on the prevalence of the six COAG target health conditions. To address this, a technique was developed that involved estimating the effect of the target conditions on general physical and mental health (of which there are reliable measures in HILDA) and using that information to estimate the effects of the target conditions on wages.

The marginal effects of education and chronic illness

Empirical estimates in the academic literature — both Australian and overseas — support the hypothesis that high education levels and lower incidence of illness are associated with higher wages and, by implication, higher labour productivity. The results of this project are in line with these findings.

Higher levels of education are found to have a large positive effect on wages (table 1). Relative to the base case of a year 11 education or below, completing year 12 or a diploma or certificate qualification is found to increase wages by between 10 and 14 per cent. Results vary slightly for men and women. Obtaining a university education has a large effect on wages — a 38 per cent increase in men’s wages and a 37 per cent increase in women’s wages.

Table 1 Average marginal effects of education on hourly wages

Per cent increase in hourly wages compared with year 11 or below (standard errors in brackets)

<i>Highest level of education</i>	<i>Marginal effect of each level of education</i>	
	Men	Women
	per cent	per cent
Degree or higher	38.4 (1.90)	36.7 (1.57)
Diploma or certificate	13.8 (1.50)	11.4 (1.44)
Year 12	12.8 (2.11)	10.1 (1.63)

Source: Productivity Commission estimates based on HILDA release 5.1, waves 1–5.

An earlier paper (Laplagne et al. 2007) found that the target health conditions have a significant negative effect on workforce participation. Averting or successfully treating chronic illness was estimated to increase the probability that a person would be in the workforce by up to 30 percentage points (for males suffering a nervous condition or poor mental health). The second largest effect on participation was observed for major injury (a reduction in the probability of participation of up to 14 percentage points for males and 16 percentage points for females). Other conditions were estimated to have smaller, but still significant effects on the probability of participation (between around 3 and 10 percentage points).

In this paper, chronic illness is found to have a negative — but often small — effect on wages. Many of the conditions are estimated to reduce wages by less than 2 per cent. The largest effects related to poor mental health and major injury, which are associated with an average reduction in men’s wages of 4.7 per cent and 5.4 per cent respectively, and women’s wages by 3.1 per cent and 3.5 per cent respectively.

Table 2 Marginal effects of target health conditions on hourly wages

<i>Target condition</i>	<i>Percentage hourly wage reduction attributable to presence of target condition</i>	
	Men	Women
Cardiovascular disease	-1.9	-1.3
Diabetes	-1.8	-1.2
Cancer	-1.6	-1.0
Arthritis	-2.3	-1.5
Poor mental health	-4.7	-3.1
Major injury	-5.4	-3.5

Source: Productivity Commission estimates based on HILDA release 5.1, waves 1–5.

Potential wages of people who are unemployed or not in the workforce

The wage model developed in this paper was used to estimate the potential wages of people who are unemployed or not in the workforce, given their existing characteristics. These estimates are useful as inputs into estimates of the economy-wide effects of labour market reforms such as reforms to work incentives.

People who are unemployed or not in the labour force have systematically different characteristics from people who are employed. For example, they tend to have lower levels of education, a greater incidence of chronic illness and a longer experience of unemployment. Human capital theory suggests that given their characteristics, if employed, these people would be expected to be less productive on average than people who are currently working, and earn lower wages.

The potential wages of people who are not working were estimated separately for men and women, and dummy variables were used to estimate the potential wages of different age groups and recipients of the Disability Support Pension (DSP). Potential wages were estimated separately for different age groups and DSP recipients because COAG noted in its agreement to develop a NRA that ‘international benchmarking suggests that the greatest potential to achieve higher participation is among people on welfare, the mature aged and women’ (COAG 2006, p. 4). Women, older workers and DSP recipients were therefore considered ‘target’ groups for the NRA.

The results (table 3) indicate that a person with the labour market and demographic characteristics of the average unemployed person would be expected to earn around 70–75 per cent of the average wage of the average employed person in their age

group. The estimated potential wage of DSP recipients is lower, around 64–70 per cent of the average wage of employed people of the same age.

These results suggest that people who are unemployed or not in the labour force are likely to be less productive than people who are employed, were they to enter the labour force. This can have economy-wide implications, including lower average labour productivity.

Table 3 Predicted potential relative wages for NRA target groups

<i>Demographic group</i>	<i>Estimated potential wages of people not currently employed relative to employed people (per cent)</i>		
	Men	Women	Men and women
15–24 years	75.4	76.6	76.1
25–44 years	67.3	74.8	71.3
45–64 years	72.2	73.7	73.0
55–64 years	72.8	75.2	73.9
Weighted average ^a	70.5	74.7	72.7
Disability Support Pension recipients			
15–24 years	69.7	72.5	71.1
25–44 years	64.0	65.1	64.5
45–64 years	69.1	68.7	68.9
Weighted average ^a	66.6	67.6	67.1

^a Weighted to reflect sample proportions.

Source: Productivity Commission estimates based on HILDA release 5.1, waves 1–5.

Concluding remarks

The research in this paper shows that increasing levels of education and reducing the incidence of chronic illness are likely to increase individuals' labour productivity, as reflected in their wages.

Using wages as an indicator of labour productivity could lead to biases in the results. In particular, it might serve to underestimate the negative effects of ill health on labour productivity. Conversely, statistical issues could lead to results that overstate the negative effects of chronic illness on wages and productivity. It is not possible to say conclusively which of these effects will have a greater impact.

While the paper suggests that there is scope for potential productivity pay-offs from education and improved health status, whether such improvements could be achieved in a cost effective way is a separate matter. Any proposed interventions through health or education programs to increase human capital would require careful assessment to ensure that they would deliver net community benefits.