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# Heterogeneous Effects of Health Shocks in Developed Countries: Evidence from Australia*

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## Abstract

Idiosyncratic shocks, such as health shocks, have been shown to have significant effects of income, consumption smoothing and asset accumulation in developing countries. However, less is known about how health shocks impact on individuals' and households' consumption and saving behaviour in developed countries. In this paper we examine how health shocks impact on households' decision to save, and how different socio-economic and ethnic groups respond to health shocks in Australia. We find that health shocks are associated with a substantial reduction in individual savings, but not in household net worth. We do not find any substitution of labour supply by a partner in response to an individual's health shocks. We also find evidence that negative health shocks are associated with an increase in receipts of public transfers and benefits in the following years. There is some evidence that the fall in savings is greater for low-income individuals, even if they are insured by the public health system and unemployment benefits. Migrants experience a larger decline in savings compared to Australian-born individuals. Surprisingly, savings of individuals who have private health insurance are more affected by health shocks, compared to individuals who do not have private health insurance, suggesting a role for selection into private health insurance.

**JEL codes:** D14, I13, I14
**Keywords:** health shocks, savings, insurance

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## 1. Introduction

Individuals and households in different societies experience shocks of very different natures. Some shocks, such as natural disasters, droughts, or fluctuations in commodity prices are aggregate, involving entire communities or regions, while other shocks, such as unemployment, illness, or death of a family member are idiosyncratic, affecting a particular individual or household.

Idiosyncratic shocks can also impact on many other economic decisions (Guiso et al. 2002). Individuals, or households, may save more or work harder for "rainy days" to protect against the potentially dire consequences of negative shocks, such as job loss, health problems, or even death in the family. Health shocks, such as serious illness and injury, are largely unpredictable events. They can have potentially devastating effects on individuals and households, both through a loss of income and increased expenditure associated with medical care. Indeed, evidence from the United States suggests that nearly half of all personal bankruptcies are due to medical problems, with both out-of-pocket payments and loss of income being contributing factors (Himmelstein et al. 2005).

Previous studies on developed countries focused on the relationship between job-related activities and earning shocks, and the focus has predominantly been on the effects of consumption (see, for example, Stephens 2001, Steven 1997). However, one of the sources of earning shocks that is relatively underexplored in previous research on developed countries is health shocks and their influence on saving decisions of individuals and households. An individual or a household may find ways to cope with a health shock and, therefore, could support treatment and health care cost without a significant impact on consumption. This could involve drawing down savings, accessing formal institutions (such as borrowing from the bank or relying on the social security system) or relying on other available family members who are more likely to enter the labour market to compensate consumption loss due to illness.

Previous studies on the effect of health shocks in developing countries find mixed evidence (see, for example, Islam and Maitra 2012). Cochrane (1991) finds that consumption is unaffected in the short term but could be reduced in the longer term. Townsend (1994) and Kochar (1995) analyse a sample of households in India and find that consumption is not responsive to health shocks. Gertler and Gruber (2002) find illness shocks have a negative and significant effect on labour supply and earnings. The results from developing countries

generally tend to indicate that wealthier households are better able to insure against income shocks in general and health/illness shocks in particular (see Islam and Maitra 2012).

This implies formal institutions could have an important role to play in mitigating against health shocks. The presence of different institutional arrangements in developed countries mean that individual and household coping strategies against shocks in these countries could be significantly different from those in developing countries. Using U.S. data, Smith (1999) finds that the onset of a serious health condition reduces households' wealth significantly. He finds that individuals need to alter their spending on medical care, and this influence has been shown to be large and significant. Himmelstein et al. (2005) point out that medical issues have an effect on out-of-pocket payments and income, which is an important cause of U.S. personal bankruptcies. Stephens (2001) finds that disability of the head of a household is associated with a long-term decline in consumption. Large effects of health shocks on labour supply have also been found in German data (Riphahn 1999). In the context of Australia, Cai et al. (2008) and Zucchelli et al. (2010) show significant negative effect of health shocks on the labour supply. Their findings show that physical functional limitations have a negative and statistically significant effect on earnings and consumption.

In this paper, we examine the economic consequences of health shocks among individuals and households in Australia. We focus on how changes in self-assessed health and limitations in physical functioning (e.g., criteria in SF36 – Short Form Health Survey 36) of individual and household members impact on saving behaviour. We extend previous work by examining whether access to formal health insurance or government benefits mitigate the economic consequences of a health shock. For example, both Smith (1999, 2003) and Levy (2002) find that the impact of health shocks could be significant on income and wealth of households in the U.S. However, unlike U.S., Australia has a universal public health system (called Medicare) providing access to hospital, medical and pharmaceutical benefits.[1] Thus, health shocks could have different consequences for households in Australia than in the U.S. Medicare provides access to a range of health services at little or no cost. There is also a private health insurance scheme for people willing to seek medical services within or outside the public health system.

[1] See http://www.aihw.gov.au/australias-health/2016/health-system/ for the details of Australian health system. Since 2000, Australian government has encouraged people to take out private health insurance through initiatives such as rebates for health insurance premiums and higher Medicare levy surcharge for individuals who do not hold private health insurance for hospitals. The private insurance coverage is significant as well, 47 precent of population held some form of hospital cover and 56 percent held some form of general treatment cover through the private insurance system in June 2015 (APRA, 2015).

Individuals can choose to obtain their health care solely from Medicare or use a combination of Medicare and private health insurance to meet their medical needs. Private health insurance offers alternative, relatively quick access to doctors and hospitals.[2]

At the individual level, health shocks could affect labour supply, income and consumption behaviour even though public health care system could protect someone from incurring out-of-pocket expenses. In an analogy with models of precautionary saving, a catastrophic health shock is likely to delay the consumption of leisure. In particular, members of a household may work longer hours when they are exposed to such shocks, rather than sacrificing consumption as in the standard model (Cameron and Worswick 2003; Islam and Maitra 2012). Hence, we examine if different types of households respond differently to health shocks. For example, Lundborg et al. (2011) find that low educated people would suffer relatively more from different types of health shocks and that this becomes more obvious with age. People with different income levels could have different responses on the timing of return to work. For high-income earners, the economic incentive to return to work after a health shock is stronger, due to their higher earnings and the maximum benefit levels in the social insurance.

We also examine if health shocks affect immigrants and native-born individuals differently. Health shocks could have different implications for savings behaviour for immigrants compared with non-immigrants in any country. This may occur because immigrants typically work in different occupations from native-born, because they typically have weaker job and social networks which can serve as protection against adverse shocks, and because in certain circumstances their residency status may depend on their ability to maintain employment and/or a particular level of savings. Immigrants are more likely to have limited sources of cash transfer from friends and family and, thus, are more exposed to health shocks compared to native-born households.[3] Other potential reasons for differential responses to shocks by immigrants include underlying differences in culture (Carroll et al. 1994, 1999), attitudes towards risk (Amuedo-Dorantes and Pozo 2002; Galor and Stark 1990), and preferences

[2] Private health insurance offers several advantages over the public system: such as the option of being treated by own physician, control over when and where one receives medical care and the waiting times for elective surgery tend to be considerably shorter. The Government actively encourages individuals to take out private health cover by applying the Medicare levy surcharge to higher income earners who elect not to have hospital cover. Private health cover also assists with those services not covered by Medicare, including dental, physiotherapy, chiropractic, optical and a number of other specific health care requirements.

[3] Clarke and Isphording (2017) investigate the role of language barriers in immigrant health in Australia.

(Browning and Crossley 2001).

Our results show a significant negative effect of health shock on individual savings. However, we do not find a significant effect on changes in household net worth. Transfers from the government significantly increase in the years following a health shock. Household supply of labour decreases as the individual experiencing a health shock and, to a lesser extent, their partner, are less likely to employed and reduce their hours worked. Health shocks have considerable heterogeneous effects on saving across groups with migrants, low-income groups, and privately insured persons experiencing greater declines in savings.

## 2. Data and Descriptive Statistics

We use 14 waves of panel data at the individual and household level collected for the nationally representative Household, Income and Labor Dynamics in Australia (HILDA) survey. This survey is a household-based panel study, which began in 2001 and has been administered annually since. The first wave consisted of 7,682 households and 19,914 individuals. It collects information on economic and subjective well-being, labour market dynamics and family dynamics of individuals aged 15 and older (see Wooden et al. 2002). Individuals in sample households are followed over time regardless of whether they remain in the original households. The survey collected information on several socioeconomic variables, including health condition, education, income, and consumption. We restrict the sample to individuals who are in the survey for at least three waves and are employed in at least one wave.

We use a number of health shocks or illness measures such as serious personal injury or illness to self (i.e. serious health problem), self-reported health status, and SF36 measures. The data on health shocks is collected by the respondent's rating of health compared to one year ago. For self-reported health shock, respondents in the survey are asked about their reported health transition. The rating ranged from 1 to 5, with each individual asked if they are much better, somewhat better, about the same, somewhat worse, or much worse than one year ago, with a lower number indicating better health. A similar question asks respondents about expected change in health status. The first measure of health shock, *health worse* is equal to 1 if the respondent reports that their general health is somewhat, or much, worse compared to last year, and the second measure is forward-looking, where *expect health worse* is equal to 1 if the respondent definitely, or mostly, expects their health to get worse. SF36 measures of physical

role limitations (*limitations*) and bodily pain (*pain*) are constructed according to Ware et al. (2000) and are reported on a 0–100 scale, with 0 denoting poor health and 100 denoting excellent health. In addition to these, we employ *health event,* which is equal to 1 if the respondent reports experiencing serious injury or illness to self in the past year. Note that the *health event* measure is collected from wave 2 (2002) onwards. These five measures of health shocks comprehensively capture different aspects of health.

Savings can be measured either as the change in the stock of wealth or as the difference between income and consumption flows. We first employ as our measure of savings, Income less Consumption. The expenditure data was not collected annually until 2006; hence, we begin our analysis at the 2006 survey round when using this measure of savings. When defined as the difference between consumption and after-tax income, saving requires accurate treatment of income and consumption in the presence of capital gains, mortgages, pension funds, and accounting for the durable nature of some consumption items. The details of this variable are in Appendix 1. We also employ a measure of net worth and savings as the change in net worth for the household. Information on assets and liabilities is collected as part of wealth modules administered only in waves 2, 6, 10, and 14 (corresponding to years 2002, 2006, 2010, and 2014), hence, analysis using measures of net worth is restricted to these years.

In order to understand adjustment to health shocks, we examine changes in individual labour supply and partner's labour supply in terms of employment and weekly hours worked. We also examine the individual and household benefits and transfers from the government. We further explore differences by migrant status, income groups, and private health insurance status.

INSERT TABLE 1

INSERT FIGURE 1

Summary statistics for the individuals and households employed in the analysis are presented in Table 1. The mean and standard deviation for health variables in the first two rows indicate that 10 percent of the sample report health to be worse compared to the previous year, and 13 percent report that they expect their health to be worse next year (compared to this year). SF36 measures of pain and limitations are reported in rows 3 and 4. On a scale of 0–100, the average score is 75 for *pain* and 84 for *limitations*. Furthermore, the mean value for the *health event* is 0.073, which represents 3520 observations where respondents report experiencing serious injury or illness in the past year. Thus, a significant proportion of individuals report a health

shock. We explore these in detail in the following section. The average annual savings for an individual is about $20,000, and average household net worth is around $700,000.

The average age in the sample is 42 years. Some 59 percent are married, and a further 17 percent have a partner. 31 percent have a graduate or postgraduate qualification, and further 35 percent have a diploma or certificate qualification. Consistent with the sample selection criterion used, 87 percent are employed at a point in time. On average, an individual received about $3000 in benefits and transfers from the government, with the corresponding figure for a household about $6000. Migrants (people born overseas) make up 21 percent of the sample, and almost 40 percent hold private health insurance.

*Measures of Health Shocks*

We now describe the five health measures employed in our empirical analysis. For clarity in reporting the descriptive statistics and the discussion, we convert the SF36 measures of *pain* and *limitations* into indicator variables, taking value = 1 if the reported measure is greater than the mean, that is, if the SF36 measure reported is better than the average score, indicating better than average health. We begin by examining the correlation between the health shocks documented in Table 2 to determine if these measures of health move together, and the extent of any such relationship. Correlation between *health worse* and *expect health worse* is low (0.2), suggesting that the reported change in current health status (compared to last year) is positively but weakly correlated with the expected change in health status. Thus, an experience of worsening health does not necessarily mean that individuals perceive their future health as worse. Both *health worse* and *expect health worse* are negatively correlated with SF36 measures of *pain* and *limitations*, that is, better health status (as reported by lower than mean SF36 scores) is associated with less likelihood of reporting health to be worse compared to last year or of expecting health to get worse next year. Again, however, the correlation is low. For example, the fourth row in the table indicates that if a score on the SF36 measure of *limitations* increases (indicating better health on that measure), we are less likely to observe reporting of worse health (the correlation with *health worse* is -0.38) or an expectation of worse health (the correlation with expect *health worse* is -0.20), however, the association is low. The highest correlation (0.6) is between the two SF36 measures *pain* and *limitations,* indicating that these measures tend to move in the same direction.

INSERT TABLE 2

INSERT TABLE 3

Table 3 reports the transition probabilities for health shocks for individuals across years in the panel data. The reported probabilities for all measures of health shocks highlight that a significant proportion of people experience a health shock, and that there is wide variation in the persistence of health shocks. Looking at the totals for *health worse* and *expect health worse*, more than 10 percent report a health shock in terms of these measures. Further, about 30 percent of those reporting health shock in terms *health worse* also report a health shock the next year. For the *expect health worse* measure, 56 percent have an expectation of worse health in the following year if they experienced a health shock this year.

The variables *limitations indicator* and *pain indicator* take the value = 1 if the reported value for *limitations* and *pain*, is greater than the mean. About 24 percent report their health as worse than the average in terms of the SF36 measure of role limitations (*limitations indicator*). There is considerable movement in reported health status for these measures. For the *limitations indicator,* 15 percent of those reporting better than average health score change their health scores to lower than the mean. On the other hand, of those reporting these measures to be lower than the average, 46 percent report improvement but 54 percent continue with lower than average health score. Overall, 48 percent report a score which is lower than average for the SF36 measure of bodily pain (*pain indicator*), and the probability of continuing to report lower than the average health score is 71 percent. Further, looking at the bottom panel in Table 3 for *health event*, 7 percent report a serious personal injury or illness in the past 12 months and, of those, 26 percent report a similar health shock in the following year.

These summary statistics on health shocks highlight three important features. (1) Health status is not significantly correlated across the five measures employed in this analysis. Thus, the five measures are capturing different aspects of health. (2) Health shocks affect a high proportion of individuals, with 7 to 48 percent of individuals—depending of the health measure employed—reporting experiencing a health shock. (3) Further, there is wide variation in reported health status following an experience of a health shock.

To further illustrate the nature of the health shocks, we examine whether an individual experiences health shocks in any of the 14 years and the number of shocks (count) in 14 years for each of the five health shock measures.

INSERT TABLE 4

Table 4 reports whether an individual experiences shocks in terms of the reported health measures in any of the 14 years. The variable *any* $H_i^K$ is equal to 1 if an individual reports one or more shocks for the measure *K* in 14 years, and is equal to 0 if an individual does not report a shock in any year. A high proportion of individuals report an experiencing a health shock, with 43 percent and 34 percent of individuals, respectively, reporting at least one instance of health shock in 14 years for *health worse* and *expect health worse* measures. Further, 5 percent of the individuals in the sample report a health score for *limitations* which is lower than the average in at least one of the 14 years, and the corresponding proportion for *pain indicator* is even higher, at 15 percent. As reported in the last panel, 32 percent report experiencing a major illness or injury, *health event*, in 14 years.

INSERT TABLE 5

In order to check whether an individual experiences repeated health shocks, we count the number of times that they report a health shock in 14 years (*count* $H_i^K$). The results, reported in Table 5, reinforce the earlier point about the incidence of health shocks, where a sizable proportion of individuals experience health shock, but repeated health shocks are less common. In case of *health worse*, *expect health worse*, and *health event*, more than half (57 percent, 66 percent and 68 percent, respectively) experience no shock, followed by one incidence. The SF36 measures are more evenly distributed, and most individuals report changes in these measures over 14 years. These statistics indicate that health shocks are indeed shocks and that they are not persistent. For *limitations*, 24 percent of individuals report better than average health score 3–4 times in 14 years. For the *pain* measure, 24 percent of individuals report better than average health score 1–2 times in 14 years.

**3. Empirical Methodology**

Before we examine the effects of health shocks on saving, we investigate the incidence and frequency of health shocks by estimating the following two specifications. Firstly, we employ *any* $H_i^K$, an indicator variable taking the value=1 if an individual reports any shock for a health measure *K* in 14 years (and 0 otherwise), and estimate a probit regression as described in Equation (1).

$$any\ H_i^K = \propto_i + X_{1i}\delta + \varepsilon_i \qquad (1)$$

where $X_1$is a vector of individual characteristics including age, marital status, household size, education, occupation, and state and year. Secondly, we define *count* $H_i^K$ as the number of times an individual reports health shocks for a health measure *K* in 14 years, and estimate a

negative binomial regression with *count* $H_i^K$ as the dependent variable:

$$count\ H_i^K = \varphi_i + X_{2i}\theta + \vartheta_i \quad (2)$$

where $X_2$is a vector of individual characteristics including age, marital status, household size, education, occupation, and state and year.

The results of estimations of Equation (1) and Equation (2) are reported in Table 6 and Table 7, respectively.

INSERT TABLE 6

INSERT TABLE 7

Table 6 reports marginal effects at means from probit estimations. The effect of age on health is significant for SF36 measures, with the probability of reporting better health status higher with age, but the effect is diminishing. Being married and holding a tertiary qualification decreases the probability of an adverse health shock. Compared to unemployed persons, having any occupation reduces the probability of an adverse health shock. Table 7 reports the effects of these individual characteristics on the number of times a person reports a health shock (*count* $H_i^K$) and the effects are similar to those discussed earlier.

*The effects of adverse health condition*

We estimate the following reduced form regression models of the impact of ill health on savings:

$$S_{it} = \alpha_i + X_{it}\beta + \sum_{k=k_l}^{k_u} \eta_k H_{it}^k + \sum_{j=1}^{T} \gamma_j year_j + \varepsilon_{it} \quad (3)$$

where $S_{it}$ is the measure of savings for individual or household $i$ in year $t$, the $H_{it}^K$ variables capture the impact of a particular health shock on the outcome (for example, $H_{i(t-1)}$ is health shock at time t-1), $X_{it}$ are the time-varying regressors which represent the household's preferences for savings such as age and education and $\varepsilon_{it}$ is the error term. We use robust standard errors to account for arbitrary forms of serial correlation within individuals and households over time, as well as heteroskedasticity across households.

We run Equation (3) using either OLS fixed effects (for savings) or random effect probit regression (for binary outcome variables such as employment). Thus, the impact of a health problem is identified by comparing outcomes after the event occurs to those prior to the event

occurring for the same individual. In order to allow for past health shocks to have effects on current saving behaviour, we use a distributed lag model. The impact of health shock is measured by comparing outcomes at a particular time to those for the same individual or household up to five years prior to the event. The estimation strategy will lead to unbiased estimates of the impact of a health shock if unobserved individual or household characteristics that are correlated with the likelihood of experiencing a serious health problem and savings decision are time-invariant.

## 4. Results

### *4.1 Health shocks and saving*

INSERT TABLE 8

Table 8 presents the coefficients of savings for an individual, as measured by the difference between income and consumption. The estimated coefficients reported in the first two columns are negative, with both worsening and expected worsening of self-reported health status leading to a decrease in savings. If an individual experiences adverse health compared to last year, saving decreases. Saving also decreases if an individual expects her health to deteriorate next year. On one hand, we expect individuals to try to mitigate or to prepare for expected ill health by saving more. On the other hand, they may be spending more on preventative health measures and reducing work in anticipation of worsening health, leading to the observed decrease in savings. SF-36 health shocks measures of *pain* and *limitations* (columns 3 and 4) are measured on the scale 0–100, with an increase in score denoting better health. These health shocks have a lagged effect on savings, with an improvement in health in terms of *pain* and *limitations* (at $t$-1) increasing savings in the following year ($t$). The effect of serious personal injury or illness on savings is statistically insignificant.

INSERT TABLE 9

We then examine the effect of individual health shocks on household net worth (top panel of Table 9) and savings as a change in household net worth (bottom panel of Table 9). In contrast to the effect on individual savings, a change in health status of an individual does not have a significant effect on household net worth. With the exception of variable *limitations*, the coefficients reported in Table 9 are statically insignificant at conventional levels. Similarly, while the initial level of net worth has a clear significant positive effect on further saving, individual health shocks have no effect on changes in household net worth in the four-year

window in which we observe their net worth. This indicates that over the longer term, health shocks experienced by individuals in the household do not have significant impact on households' assets and liabilities. It is possible that changes in net worth are driven by other factors such as change in asset prices such as in housing prices and financial markets, and health shocks have no significant impact on this measure of savings. We further examine two channels within household adjustment to health shocks: changes in labour supply, and access to government benefits.

*4.2 Labour supply and government benefits*

INSERT TABLE 10

We report the effect of health shocks on own labour supply in Table 10. Coefficients of current and lagged values of *health worse* reported in column 1 are negative and significant. A decline in health compared to last year reduces labour supply of the individual, in terms of both the probability of employment and hours worked. Expectation of a decline in health has a smaller but negative effect on the probability of employment, but conditional on being employed, the effect on hours worked is statistically insignificant. An improvement in health in terms of SF63 measures of *pain* and *limitations* leads to an increase in labour supply, while experiencing an adverse *health event* decreases the labour supply. Note that the lags of health shock are significant as well, indicating that a health shock affects labour supply decisions for up to three years following the shock. Thus, adverse health shocks have a significant and continued negative effect on an individual's own labour supply. These results are consistent with two studies showing a significant effect of health shocks in terms of lower working hours (Cai et al. 2008), and an increase in early labour market exits (Zucchelli et al. 2010).

INSERT TABLE 11

In order to understand the adjustment to health shocks at a household level, we estimate the effects of an individual's health on partner's labour supply reported in Table 11. Firstly, current and lagged shocks in terms of *health worse* and *expect health worse* have no significant effect on partner's employment or hours worked. The effect of health shocks, measured by *pain* and *limitations,* is statistically significant. An improvement in an individual's health increases the probability of employment for their partner. Rather than offsetting the adverse effect of health shock on the individual's own labour supply, the partner's labour supply adjusts in the same

direction as the individual experiencing a health shock. Time and effort involved in caring could explain this effect on partner labour supply, and improvement in the health of an individual might free up their partner from caring commitments. Conditional on being employed, there is not much effect on the hours worked by the partner.

INSERT TABLE 12

Table 12 reports the change in household and individual public transfers received in response to a health shock. The top panel reports the coefficient of benefits received by the household, while the bottom panel reports the coefficient of individual benefits. In general, a negative health shock is associated with an increase in benefits received from the government. However, health shocks have a lagged effect on the receipts of benefits. A worsening in general health compared to last year (*health worse*) leads to an increase in individual benefits, not in the current year but 1 to 3 years forward. A change in expectations about health (*expect health worse*) does not have a significant effect on benefits received. On the other hand, improvement in health, measured by *pain* and *limitations*, leads to a sustained drop in individual and household benefit receipts, not immediately but with a lag. The effect of *health event* is statistically insignificant.

*4.3 Heterogeneous effects of health shocks*

INSERT TABLE 13

We report differences in the effect of health shocks on savings between individuals who are Australian-born (natives) and born elsewhere (migrants). The first column of Table 13 reports the estimates for natives. We then pool the sample of migrant and native individuals and interact the migrant indicator variable with health shock. The estimated coefficients for these interactions are reported in column 2 in Table 13. Note that the level differences in savings between natives and migrants are captured by the individual fixed effect. Deterioration in current health status compared to last year (*health worse*) and expected deterioration in health status next year (*expect health worse*) both have a significant negative effect on saving. However, the adverse effects of these health shocks on savings is higher for migrants compared to natives. For example, a decline in current health status decreases savings of Australian-born individuals by 3.6 percent, while migrant saving decreases 13 percent. Similarly, in cases of an

expected decline in health next year, the savings of Australian-born individuals decrease by 7 percent, while migrant saving decreases by 19 percent.

INSERT TABLE 14

Table 14 reports the differences by income groups. Again, health shocks as measured by *health worse* and *expect health worse* have a significant effect on savings across income percentiles. While in absolute terms the higher income groups experience a greater decline in savings, this reflects their higher level of savings. As a proportion, in case of *health worse*, the lower 25-50 income percentiles experience a 17 percent decline in savings, while the savings of the top 25 percent income group decreases by 9.5 percent. Similarly, for *expect health worse*, the savings of individuals in the 25–50 income percentile drops by 23 percent, while the saving of those in the 75–100 percentile drops by only 8 percent if health is expected to be worse next year. We report the results without controlling for income (left panel of Table 14) and after controlling for income (right panel of Table 14), and the results are comparable across the two specifications. This suggests that the differences in savings across the income distribution in response to health shocks are not solely driven by differences in income levels.

INSERT TABLE 15

Table 15 reports the coefficient of savings disaggregated by whether the individual holds private health insurance. Interestingly, individuals with private health insurance have a bigger saving response to health shocks compared to individuals who do not hold such insurance. This is true both in terms of levels of savings and percentage change in savings. Given the universal health coverage in Australia through the government-funded public health system, it is possible that individuals select themselves in opting for private health insurance. That is, only those who are more vulnerable to health shock, either in terms of the probability and severity of adverse health shock or in terms of income changes, choose to be covered by private health insurance. It is also possible that privately insured individuals could be seeking more and more costly medical services. This explanation is supported by the estimates for *pain* and *limitation*, which imply that savings for a privately insured person decline even in the case of an improvement in health. Again, results from estimations without controlling for income (left panel) are consistent with results after controlling for income (right panel), suggesting factors other than current income levels.

We check the robustness of the reported analysis by varying our definition of savings, allowing for different treatment of durable goods. The results are robust across alternative definitions.

In further robustness analysis, we also allow for potential "anticipation" effects, where we also include a control variable for a health shock occurring 1–2 years in the future. We further check if the results are being driven by the top 10% and/or bottom 10% of the sample by excluding these in estimations. The results (available from the authors) are consistent with the results from the specifications reported here.

## 5. Conclusion

We estimate the effect of health shocks on savings using self-reported health status and expectations of changes in health status, SF36 measures of bodily pain and role limitations, and serious personal injury or illness to comprehensively measure heath shocks in various dimensions. While we find a significant negative effect of an adverse health shock on savings, there are considerable heterogeneities in impact of the health shock. While individual current savings, defined as income minus consumption, declines due to health shock, we do not find a statistically significant effect on household net worth or changes in household net worth.

Individuals who experience a health shock reduce their labour supply, as do their partners. This suggests that changes in the partner's labour supply do not offset the reduction in labour supply and, hence, do not offset the reduction in the labour income in response to ill health. Instead, individuals and households rely on the receipt of benefits and transfers from the government to mitigate the adverse economic effects of a health shock.

Migrants, and low-income earners experience bigger declines in savings. Surprisingly, individuals holding private health insurance experience a greater decrease in savings in the event of an adverse health shock compared those who are not covered by the private health insurance. This suggests that in the context of Australia's comprehensive universal public healthcare system, individuals who are more exposed to health shock may be selecting to hold an optional private health insurance. Health shocks have significant effects on individuals, particularly immigrants and low income groups, even in the context of a developed country with public health and welfare systems.

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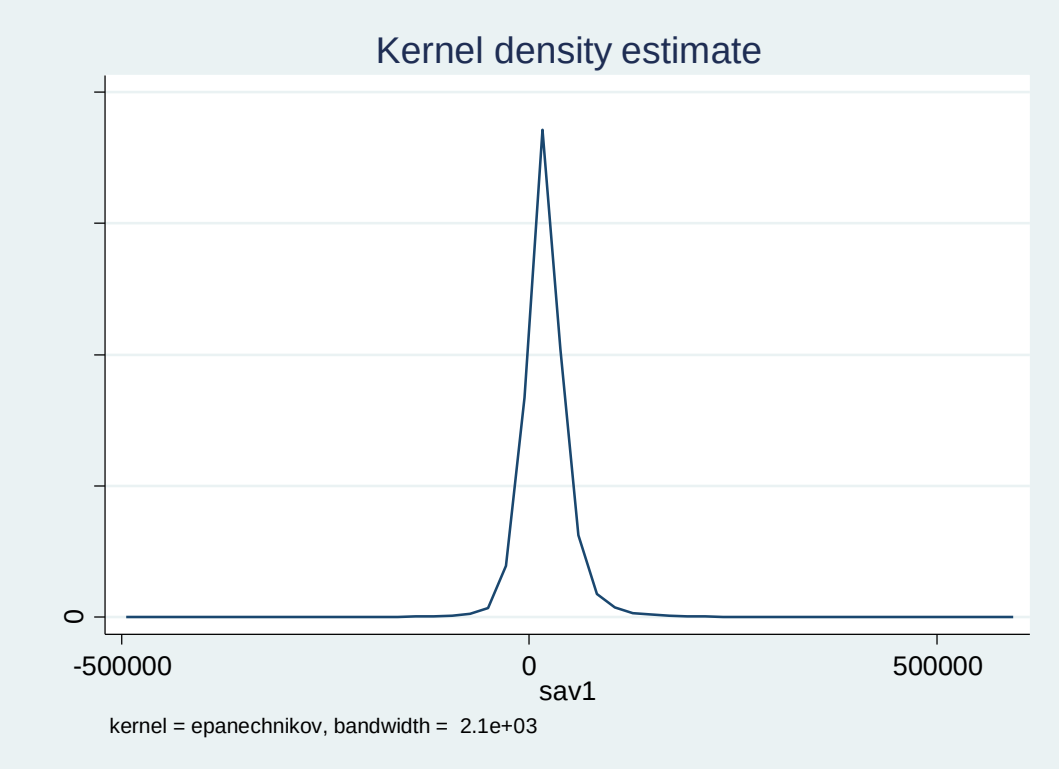
**Figure 1: Saving**




Notes: Figure 1 plots the kernel density for savings, defined as Income less Consumption for individuals.

**Table 1: Descriptive statistics**

| Variable | Mean | Standard deviation |
|---|---|---|
| *health worse* | 0.105 | 0.306 |
| *expect health worse* | 0.129 | 0.335 |
| *pain* | 75.26 | 22.19 |
| *limitations* | 84.47 | 31.51 |
| *health event* | 0.073 | 0.260 |
| Savings ($) | 19898 | 33395 |
| Net worth ($) | 712037 | 1041867 |
| Age | 42.15 | 9.600 |
| Married (0 = no, 1 = yes) | 0.588 | 0.492 |
| Has partner (0 = no, 1 = yes) | 0.171 | 0.377 |
| Household Size | 2.200 | 0.944 |
| Education: tertiary | 0.313 | 0.464 |
| Education: Certificate | 0.357 | 0.479 |
| Education: Year 12 | 0.127 | 0.333 |
| Employed | 0.869 | 0.338 |
| ln weekly hours | 0.958 | 6.673 |
| Household benefits ($) | 6036 | 10020 |
| Individual benefits ($) | 2962 | 5868 |
| Migrant (0 = no, 1 = yes) | 0.214 | 0.410 |
| Private health insurance (0 = no, 1 = yes) | 0.394 | 0.489 |

Notes: The table reports means and standard deviation for variables across individuals and time in the sample. Measures of health shock: *health worse* is equal to 1 if the respondent reports that general health is somewhat or much worse compared to last year, *expect health worse* is equal to 1 if the respondent definitely or mostly expects their health to get worse, physical role limitations (*limitations*) and bodily pain (*pain*) are reported on a 0–100 scale, with 0 denoting poor health and 100 denoting excellent health, *health event* is equal to 1 if the respondent reports experiencing serious injury or illness to self in the past year.

**Table 2: Correlation between health measures**

| **Health shock** | *health worse* | *expect health worse* | *pain* | *limitations* |
|---|---|---|---|---|
| *health worse* | 1 | | | |
| *expect health worse* | 0.20 | 1 | | |
| *pain* | -0.34 | -0.22 | 1 | |
| *limitations* | -0.38 | -0.20 | 0.60 | 1 |
| *health event* | 0.26 | 0.07 | -0.28 | -0.31 |

Notes: The table reports correlation between five health measures. Measures of health shock: *health worse* is equal to 1 if the respondent reports that general health is somewhat or much worse compared to last year, *expect health worse* is equal to 1 if the respondent definitely or mostly expects their health to get worse, physical role limitations (*limitations*) and bodily pain (*pain*) are reported on a 0–100 scale, with 0 denoting poor health and 100 denoting excellent health, *health event* is equal to 1 if the respondent reports experiencing serious injury or illness to self in the past year.

**Table 3: Transition probabilities for health shocks**

| Health shock | | 0 | 1 | Total |
|---|---|---|---|---|
| *health worse* | | | | |
| | | (No) | (Yes) | |
| (No) | 0 | 91.48 | 8.52 | 100 |
| (Yes) | 1 | 70.32 | 29.68 | 100 |
| | Total | 89.32 | 10.68 | 100 |
| *expect health worse* | | | | |
| | | (No) | (Yes) | |
| (No) | 0 | 93.01 | 6.99 | 100 |
| (Yes) | 1 | 43.50 | 56.50 | 100 |
| | Total | 86.76 | 13.24 | 100 |
| *limitations indicator* | | | | |
| | | (< mean) | (> mean) | |
| (< mean) | 0 | 53.60 | 46.40 | 100 |
| (> mean) | 1 | 14.92 | 85.08 | 100 |
| | Total | 23.97 | 76.03 | 100 |
| *pain indicator* | | | | |
| | | (< mean) | (> mean) | |
| (< mean) | 0 | 70.73 | 29.27 | 100 |
| (> mean) | 1 | 28.28 | 71.72 | 100 |
| | Total | 48.27 | 51.73 | 100 |
| *health event* | | | | |
| | | (No) | (Yes) | |
| (No) | 0 | 94.27 | 5.73 | 100 |
| (Yes) | 1 | 73.49 | 26.51 | 100 |
| | Total | 92.81 | 7.19 | 100 |

Notes: The table reports transition probabilities, the change in categorical variable over time, for the five health measures. Measures of health shock: *health worse* is equal to 1 if the respondent reports that general health is somewhat or much worse compared to last year, *expect health worse* is equal to 1 if the respondent definitely or mostly expects their health to get worse. Physical role limitations (*limitations*) and bodily pain (*pain*) are reported on a 0–100 scale, with 0 denoting poor health and 100 denoting excellent health. For clarity in reporting, we covert the SF36 measures of *pain* and *limitations* into indicator variables, taking value = 1 if reported measure is greater than the mean – that is, if the SF36 measure reported better than the average score – and 0 otherwise. *Health event* is equal to 1 if the respondent reports experiencing serious injury or illness to self in the past year.

**Table 4: Experience of health shock in any of 14 years**

| *any* $H_i^K$ | Percent |
|---|---|
| Report (*health worse* = 1) in any year | |
| (No) 0 | 56.94 |
| (Yes) 1 | 43.06 |
| Total | 100 |
| Report (*expect health worse* = 1) in any year | |
| (No) 0 | 65.63 |
| (Yes) 1 | 34.38 |
| Total | 100 |
| Report (*limitations indicator* = 1) in any year | |
| (< mean) 0 | 5.14 |
| (> mean) 1 | 94.86 |
| Total | 100 |
| Report (*pain indicator* = 1) in any year | |
| (< mean) 0 | 15.47 |
| (> mean) 1 | 84.53 |
| Total | 100 |
| Report (*health event* =1) in any year | |
| (No) 0 | 68.40 |
| (Yes) 1 | 31.60 |
| Total | 100 |
| | (*n* = 10944) |

Notes: The table reports frequency of the five health measures employed in the analysis for an individual in any of the 14 years in the sample. The variable *any* $H_i^K$ is equal to 1 if an individual reports one or more shocks for the measure *K* in 14 years, and is equal to 0 if an individual does not report a shock in any year.

**Table 5: Number of health shocks in 14 years**

| **Health shock** *count* $H_i^K$ | *health worse* (percent) | *expect health worse* (percent) | *limitations indicator* (percent) | *pain indicator* (percent) | *health event* (percent) |
|---|---|---|---|---|---|
| 0 | 56.94 | 65.63 | 5.14 | 15.47 | 68.40 |
| 1 | 21.33 | 12.93 | 6.84 | 12.22 | 18.83 |
| 2 | 10.40 | 6.40 | 8.28 | 12.03 | 7.43 |
| 3 | 5.17 | 3.86 | 12.25 | 11.40 | 2.79 |
| 4 | 2.58 | 2.67 | 12.02 | 10.13 | 1.27 |
| 5 | 1.51 | 1.88 | 7.19 | 6.61 | 0.72 |
| 6 | 0.98 | 1.44 | 6.85 | 6.12 | 0.30 |
| 7 | 0.54 | 1.29 | 6.24 | 5.35 | 0.12 |
| 8 | 0.26 | 0.90 | 5.21 | 4.29 | 0.07 |
| 9 | 0.16 | 0.99 | 5.35 | 3.99 | 0.04 |
| 10 | 0.08 | 0.58 | 5.14 | 3.32 | 0.02 |
| 11 | 0.03 | 0.43 | 4.94 | 3.31 | 0.01 |
| 12 | 0.03 | 0.48 | 5.32 | 2.60 | |
| 13 | | 0.31 | 4.90 | 1.94 | |
| 14 | | 0.21 | 4.33 | 1.22 | |
| Total | 100 | 100 | 100 | 100 | 100 |
| Observations | 10944 | 10944 | 10944 | 10944 | 10944 |

Notes: The table reports frequency of health shocks for an individual across 14 years for the five health measures employed in the analysis. The variable *count* $H_i^K$ is the number of times an individual reports a health shock in 14 years. For *health worse*, *expect health worse*, and *health event*, *count* $H_i^K$ counts the numbers of times individual reports value = 1 for the health measure. For *limitations indicator* and *pain indicator*, *count* $H_i^K$ counts the numbers of times individual reports value = 1, or health score > mean, for the health measure.

**Table 6: Probit, dependent variable: Health shock in any year**

| **Marginal effects (at means)** | *health worse* | *Expect health worse* | *limitations indicator* | *Pain indicator* | *health event* |
|---|---|---|---|---|---|
| Age | 0.024 | -0.034 | 0.025** | 0.099** | 0.048+ |
| | (0.027) | (0.026) | (0.009) | (0.016) | (0.026) |
| $Age^2$ | 0.014 | 0.128* | -0.052* | -0.226** | -0.064 |
| | (0.065) | (0.064) | (0.021) | (0.040) | (0.063) |
| Married | -0.022+ | -0.026* | 0.017** | 0.034** | -0.054** |
| | (0.012) | (0.012) | (0.004) | (0.007) | (0.012) |
| Has partner | -0.005 | -0.010 | 0.014** | 0.022** | -0.033* |
| | (0.014) | (0.014) | (0.004) | (0.008) | (0.013) |
| Household size | -0.001 | -0.001 | 0.000 | -0.004 | -0.009* |
| | (0.005) | (0.005) | (0.002) | (0.003) | (0.005) |
| Education: Tertiary | 0.054** | 0.021 | 0.012* | 0.056** | -0.012 |
| | (0.017) | (0.016) | (0.005) | (0.010) | (0.016) |
| Education: Certificate | 0.008 | 0.003 | 0.005 | 0.019* | 0.019 |
| | (0.015) | (0.014) | (0.004) | (0.009) | (0.014) |
| Education: Year 12 | 0.004 | -0.017 | 0.011+ | 0.043** | -0.015 |
| | (0.019) | (0.019) | (0.006) | (0.011) | (0.018) |
| Managers | -0.150** | -0.060** | 0.039** | 0.092** | -0.119** |
| | (0.016) | (0.015) | (0.005) | (0.010) | (0.015) |
| Professionals | -0.118** | -0.069** | 0.043** | 0.101** | -0.103** |
| | (0.015) | (0.014) | (0.005) | (0.009) | (0.014) |
| Technicians & Trades | -0.187** | -0.029+ | 0.039** | 0.078** | -0.112** |
| | (0.017) | (0.016) | (0.005) | (0.010) | (0.016) |
| Community and Service Workers | -0.128** | -0.102** | 0.040** | 0.084** | -0.102** |
| | (0.018) | (0.018) | (0.006) | (0.011) | (0.017) |
| Clerical and Admin Workers | -0.142** | -0.126** | 0.042** | 0.099** | -0.124** |
| | (0.015) | (0.015) | (0.005) | (0.010) | (0.015) |
| Sales Workers | -0.118** | -0.075** | 0.040** | 0.101** | -0.122** |
| | (0.020) | (0.020) | (0.006) | (0.012) | (0.019) |
| Machinery Operators and Drivers | -0.204** | -0.008 | 0.046** | 0.086** | -0.086** |
| | (0.022) | (0.020) | (0.007) | (0.013) | (0.020) |
| Labourers | -0.153** | -0.046** | 0.034** | 0.047** | -0.067** |
| | (0.018) | (0.018) | (0.005) | (0.010) | (0.017) |
| Observations | 67975 | 67975 | 67975 | 67975 | 67975 |

Notes: Marginal effects calculated at means for probit estimations with dependent variable, health shock in any year (equal to 1 if the individual reports health shocks in any years and 0 otherwise). Standard errors clustered at the individual level are reported in parentheses, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Probit regressions include controls for state and year dummies.

**Table 7: Regression, dependent variable: Number of health shocks in 14 years**

| | *health worse* | *expect health worse* | *limitations indicator* | *pain indicator* | *health event* |
|---|---|---|---|---|---|
| Age | 0.170* | -0.039 | 0.349** | 0.443** | 0.219* |
| | (0.082) | (0.113) | (0.029) | (0.041) | (0.100) |
| $Age^2$ | -0.157 | 0.378 | -0.638** | -0.879** | -0.286 |
| | (0.198) | (0.269) | (0.071) | (0.100) | (0.240) |
| Married | -0.083* | -0.051 | 0.146** | 0.131** | -0.206** |
| | (0.037) | (0.053) | (0.014) | (0.020) | (0.045) |
| Has partner | -0.010* | -0.061 | 0.005 | -0.017 | -0.171** |
| | (0.041) | (0.060) | (0.016) | (0.023) | (0.051) |
| Household size | -0.016 | -0.005 | -0.001 | -0.009 | -0.024 |
| | (0.015) | (0.021) | (0.006) | (0.008) | (0.019) |
| Education: Tertiary | 0.096* | 0.115+ | 0.056** | 0.183** | 0.0188 |
| | (0.049) | (0.066) | (0.018) | (0.026) | (0.059) |
| Education: Certificate | -0.015 | -0.023 | 0.026 | 0.070** | 0.105* |
| | (0.045) | (0.057) | (0.016) | (0.024) | (0.051) |
| Education: Year 12 | -0.068 | -0.110 | 0.085** | 0.163** | -0.084 |
| | (0.058) | (0.080) | (0.020) | (0.029) | (0.067) |
| Managers | -0.509** | -0.205** | 0.237** | 0.289** | -0.544** |
| | (0.047) | (0.062) | (0.019) | (0.026) | (0.056) |
| Professionals | -0.420** | -0.175** | 0.232** | 0.284** | -0.515** |
| | (0.042) | (0.060) | (0.018) | (0.025) | (0.052) |
| Technicians & Trades | -0.600** | -0.115+ | 0.209** | 0.196** | -0.469** |
| | (0.052) | (0.064) | (0.020) | (0.029) | (0.061) |
| Community and Service Workers | -0.463** | -0.338** | 0.230** | 0.230** | -0.461** |
| | (0.052) | (0.079) | (0.021) | (0.031) | (0.064) |
| Clerical and Admin Workers | -0.439** | -0.470** | 0.276** | 0.324** | -0.583** |
| | (0.045) | (0.065) | (0.018) | (0.026) | (0.055) |
| Sales Workers | -0.485** | -0.321** | 0.213** | 0.253** | -0.533** |
| | (0.057) | (0.085) | (0.023) | (0.033) | (0.066) |
| Machinery Operators and Drivers | -0.605** | -0.005 | 0.220** | 0.181** | -0.428** |
| | (0.072) | (0.076) | (0.024) | (0.037) | (0.071) |
| Labourers | -0.456** | -0.206** | 0.161** | 0.112** | -0.342** |
| | (0.054) | (0.068) | (0.023) | (0.033) | (0.060) |
| Observations | 67975 | 67975 | 67975 | 67975 | 67975 |

Notes: Table reports estimates from a negative binomial regression model with number of health shocks reported in 14 years as a dependent variable. Standard errors clustered at the individual level are reported in parentheses. ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Regressions include controls for state and year.

**Table 8: Effect of health shocks on individual saving**

| **Coefficient of saving** | *health worse* | *expect health worse* | *pain* | *limitations* | *health event* |
|---|---|---|---|---|---|
| Health shock (*t*) | -2297** | -2508** | 20.15+ | 9.65 | -986.6 |
| | (423.8) | (521.1) | (10.9) | (5.94) | (730.2) |
| Lag(*t*-1) | -1213** | 97.99 | 22.71* | 19.59** | -567.9 |
| | (395.8) | (504.1) | (9.65) | (6.22) | (605.5) |
| Lag(*t*-2) | -434.5 | -455.3 | -1.76 | 3.99 | -474 |
| | (456.2) | (578.3) | (9.28) | (5.61) | (615.5) |
| Lag(*t*-3) | -1243** | -216.4 | 11.19 | 2.44 | 280.7 |
| | (441.9) | (521.4) | (9.54) | (5.27) | (603.2) |
| Observations | 46701 | 46701 | 33880 | 33470 | 29922 |
| Number of individuals | 7638 | 7638 | 6272 | 6235 | 5936 |

Notes: Standard errors clustered at the individual level are reported in parentheses, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Fixed effects regressions include controls for up to five period lags of health shock, age, marital status, occupation, household size, and state and year dummies.

**Table 9: Effect of health shocks on household net worth and changes in net worth**

| **Coefficient of net worth** | *health worse* | *expect health worse* | *pain* | *limitations* | *health event* |
|---|---|---|---|---|---|
| Health shock (*t*) | 18962 | 12703 | 497.9 | 716.1* | -14273 |
| | (21835) | (23626) | (508.4) | (299.4) | (44109) |
| Lag(*t*-1) | -17244 | 37786 | -90.9 | 77.4 | -4703 |
| | (21809) | (23715) | (497.7) | (312.6) | (41707) |
| Lag(*t*-2) | 10836 | -44559+ | -142.5 | -26.6 | -21095 |
| | (21139) | (23274) | (474.2) | (293.5) | (38775) |
| Lag(*t*-3) | -13099 | 6504 | 774.7 | 272.5 | 20924 |
| | (21261) | (23169) | (478.7) | (300.8) | (38705) |
| Observations | 16191 | 16191 | 11948 | 11752 | 8012 |
| Number of individuals | 7885 | 7885 | 6266 | 6195 | 5129 |
| | **Coefficient of change in net worth** | | | | |
| Health shock (t) | 7909 | -14186 | 275.5 | 81.79 | 18562 |
| | (20576) | (22281) | (458.2) | (270.50) | (40530) |
| Lag(*t*-1) | -6136 | -16011 | -621.4 | -249.5 | -9293 |
| | (20564) | (22343) | (448.6) | (282.7) | (38400) |
| Lag(*t*-2) | -11237 | 11545 | -144.6 | -56.36 | 30749 |
| | (19950) | (21947) | (427.5) | (265.2) | (35669) |
| Lag(*t*-3) | 7229 | 4845 | -304.7 | -257.1 | -57561 |
| | (20058) | (21872) | (431.5) | (271.8) | (35615) |
| net worth | 1.135** | 1.136** | 1.107** | 1.092** | 1.128** |
| | (0.010) | (0.010) | (0.012) | (0.012) | (0.017) |
| Observations | 16146 | 16146 | 11929 | 11733 | 7996 |
| Number of individuals | 7870 | 7870 | 6258 | 6187 | 5122 |

Notes: Standard errors clustered at the individual level are reported in parentheses, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Fixed effects regressions include controls for up to five period lags of health shock, age, marital status, occupation, household size, and state and year dummies.

**Table 10: Effects of health shocks on labour supply**

| | *health worse* | *expect health worse* | *pain* | *limitations* | *health event* |
|---|---|---|---|---|---|
| | | | **Employed** | | |
| Health shock (*t*) | -0.433** | -0.133** | 0.009** | 0.007** | -0.475** |
| | (0.039) | (0.041) | (0.001) | (0.001) | (0.061) |
| Lag(*t*-1) | -0.313** | -0.103* | 0.005** | 0.005** | -0.329** |
| | (0.037) | (0.041) | (0.001) | (0.001) | (0.061) |
| Lag(*t*-2) | -0.264** | -0.120** | 0.004** | 0.004** | -0.321** |
| | (0.038) | (0.040) | (0.001) | (0.001) | (0.061) |
| Lag(*t*-3) | -0.234** | -0.109** | 0.003** | 0.002** | -0.179** |
| | (0.040) | (0.040) | (0.001) | (0.000) | (0.062) |
| Observations (No. of individuals) | 46699 (7637) | 46699 (7637) | 33880 (6272) | 33470 (6235) | 29922 (5936) |
| | | | **Log Weekly Hours** | | |
| Health shock (*t*) | -0.926** | -0.178+ | 0.016** | 0.015** | -0.755** |
| | (0.108) | (0.103) | (0.003) | (0.002) | (0.154) |
| Lag(*t*-1) | -0.674** | -0.112 | 0.008** | 0.010** | -0.409** |
| | (0.104) | (0.107) | (0.002) | (0.002) | (0.150) |
| Lag(*t*-2) | -0.511** | -0.125 | 0.005* | 0.0060** | -0.403** |
| | (0.106) | (0.106) | (0.002) | (0.002) | (0.150) |
| Lag(*t*-3) | -0.447** | -0.158 | 0.005* | 0.004** | -0.021 |
| | (0.109) | (0.108) | (0.002) | (0.001) | (0.148) |
| Observations (No. of individuals) | 46616 (7636) | 46616 (7636) | 33827 (6271) | 33419 (6234) | 29877 (5935) |

Notes: Standard errors clustered at the individual level are reported in parentheses, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Marginal effects calculated at means using panel probit regressions for employed and estimated coefficients from fixed effects regressions for log weekly hours include controls for up to five period lags, age, marital status, occupation, household size, and state and year dummies. Log weekly hours defined for employed persons only.

**Table 11: Effect of health shocks on partner's labour supply**

| | *health worse* | *expect health worse* | *pain* | *limitations* | *health event* |
|---|---|---|---|---|---|
| | | | **Partner: Employed** | | |
| Health shock (*t*) | -0.031 | -0.017 | 0.001 | 0.003** | -0.059 |
| | (0.048) | (0.049) | (0.001) | (0.001) | (0.077) |
| Lag(*t*-1) | -0.073 | -0.067 | 0.003** | 0.003** | -0.140+ |
| | (0.051) | (0.050) | (0.001) | (0.001) | (0.078) |
| Lag(*t*-2) | -0.085 | -0.053 | 0.003** | 0.001* | -0.127 |
| | (0.052) | (0.049) | (0.001) | (0.001) | (0.081) |
| Lag(*t*-3) | -0.056 | -0.006 | 0.003** | 0.001+ | -0.094 |
| | (0.051) | (0.050) | (0.001) | (0.001) | (0.076) |
| Observations (No of individuals) | 33539 (5993) | 33539 (5993) | 25491 (4984) | 25218 (4959) | 22619 (4683) |
| | | | **Partner: Log Weekly Hours** | | |
| Health shock (*t*) | 0.073 | 0.009 | 0.001 | 0.004* | -0.126 |
| | (0.108) | (0.120) | (0.002) | (0.002) | (0.164) |
| Lag(*t*-1) | 0.004 | -0.098 | 0.004 | 0.003+ | -0.212 |
| | (0.120) | (0.130) | (0.003) | (0.002) | (0.176) |
| Lag(*t*-2) | 0.043 | -0.059 | 0.005* | 0.001 | -0.133 |
| | (0.124) | (0.126) | (0.003) | (0.002) | (0.184) |
| Lag(*t*-3) | 0.083 | 0.020 | 0.005* | 0.000 | -0.075 |
| | (0.122) | (0.133) | (0.003) | (0.002) | (0.177) |
| Observations (No of individuals) | 33472 (5989) | 33472 (5989) | 25437 (4980) | 25164 (4955) | 22571 (4679) |

Notes: Standard errors clustered at the individual level are reported in parentheses, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$ Marginal effects calculated at means using panel probit regressions for employed and estimated coefficients from fixed effects regressions for log weekly hours include controls for up to five period lags, age, marital status, occupation, household size, and state and year dummies. Log weekly hours defined for employed persons only.

**Table 12: Effect of health shocks on government benefits**

| | *health worse* | *expect health worse* | *pain* | *limitations* | *health event* |
|---|---|---|---|---|---|
| | | | **Household Benefits** | | |
| Health shock (*t*) | -29.88 | 133.6 | -1.27 | -2.14 | -156 |
| | (117.7) | (127.9) | (2.54) | (1.744) | (163.6) |
| Lag(*t*-1) | 284.9* | 131.1 | -9.860** | -10.91** | 113.6 |
| | (118.0) | (131.2) | (2.610) | (1.729) | (165.1) |
| Lag(*t*-2) | 98.43 | 113.3 | -7.279** | -8.169** | 96.28 |
| | (122.6) | (126.0) | (2.566) | (1.682) | (170.9) |
| Lag(*t*-3) | 230.4+ | -21.3 | -6.854** | -9.011** | 292.5+ |
| | (125.2) | (134.7) | (2.434) | (1.658) | (172.0) |
| Observations (No of individuals) | 46699 (7637) | 46699 (7637) | 33880 (6272) | 33470 (6235) | 29922 (5936) |
| | | | **Individual benefits** | | |
| Health shock (*t*) | 39.83 | 115.6 | -1.249 | -0.807 | -93.59 |
| | (72.120) | (71.610) | (1.539) | (1.007) | (98.75) |
| Lag(*t*-1) | 244.9** | 137.2+ | -6.211** | -7.766** | -11.27 |
| | (71.530) | (72.290) | (1.610) | (1.061) | (103.2) |
| Lag(*t*-2) | 176.0* | 129.5+ | -4.630** | -4.668** | 113.5 |
| | (73.990) | (71.210) | (1.542) | (1.077) | (106.7) |
| Lag(*t*-3) | 214.7** | 36.9 | -4.150** | -4.648** | 120 |
| | (75.45) | (77.01) | (1.54) | (1.05) | (110.4) |
| Observations (No of individuals) | 46699 (7637) | 46699 (7637) | 33880 (6272) | 33470 (6235) | 29922 (5936) |

Notes: Standard errors clustered at the individual level are reported in parentheses, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Fixed effects regressions include controls for up to five period lags of health shock, age, marital status, occupation, household size, and state and year dummies.

**Table 13: Effect of health shocks by migrant status**

| | Australian-born | Interaction: migrant*health shock |
|---|---|---|
| *health worse* | -713.9** | -2723** |
| | (267.9) | (768.6) |
| Observations | 28022 | 46692 |
| Number of individuals | 5646 | 7635 |
| *expect health worse* | -1387** | -3977** |
| | (304.7) | (988.1) |
| Observations | 28022 | 46692 |
| Number of individuals | 5646 | 7635 |
| *pain* | -3.302 | 15.92 |
| | (5.670) | (26.90) |
| Observations | 20406 | 33873 |
| Number of individuals | 4571 | 6270 |
| *limitations* | -0.112 | 12.08 |
| | (3.436) | (15.53) |
| Observations | 20174 | 33463 |
| Number of individuals | 4542 | 6233 |
| *health event* | 177.8 | -1622 |
| | (375.7) | (1658) |
| Observations | 18058 | 29916 |
| Number of individuals | 4323 | 5934 |
| Mean saving | 19772 | 20346 |

Notes: Standard errors clustered at the individual level are reported in parentheses, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Fixed effects regressions for log weekly hours include controls for age, marital status, occupation, household size, lags of health shock, and state and year dummies. The first column reports the results with sample restricted to Australian-born individuals only. The second column includes both Australian-born and migrants, and reports the coefficient of interaction between migrant indicator and health shock variable.

**Table 14: Effect of health shocks by income groups**

| | Income Group (percentiles) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Health shock** | **0-25** | **25-50** | **50-75** | **75-100** | **0-25** | **25-50** | **50-75** | **75-100** |
| *health worse* | -1171+ | -2165** | -2757** | -4213** | -1286* | -2036** | -2827** | -3126** |
| | (632.6) | (573.4) | (914.2) | (1019) | (519.6) | (553.9) | (906.8) | (813.1) |
| *expect health worse* | -519.7 | -3019** | -2149* | -3572** | -1267* | -3077** | -1950* | -2854** |
| | (646.4) | (703.7) | (893.1) | (1275) | (556.8) | (691.3) | (884.3) | (766.9) |
| *pain* | 11.54 | 23.21+ | -10.73 | 78.66* | 8.76 | 20.51 | -10.7 | 41.17 |
| | (12.44) | (13.79) | (15.21) | (32.02) | (11.18) | (13.62) | (14.80) | (28.15) |
| *limitations* | 2.69 | 15.38 | -6.02 | 16.89 | 3.53 | 14.71 | -6.537 | 7.01 |
| | (7.88) | (9.544) | (10.86) | (17.56) | (6.05) | (9.30) | (10.58) | (15.39) |
| *health event* | 541.4 | 1554 | -990.7 | -5231* | 312.1 | 1458 | -938.7 | -4273* |
| | (1005) | (971) | (1013) | (2030) | (790.9) | (951.5) | (994.5) | (2012) |
| Control for income | No | No | No | No | Yes | Yes | Yes | Yes |
| Mean saving | -2856 | 12731 | 20852 | 44188 | | | | |

Notes: Standard errors clustered at the individual level are reported in parentheses, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Fixed effects regressions for log weekly hours include controls for age, marital status, occupation, household size, lags of health shock, and state and year dummies.

**Table 15: Effect of health shocks by private health insurance status**

| | No health insurance | Interaction: health insurance*health shock | No health insurance | Interaction: health insurance*health shock |
|---|---|---|---|---|
| *health worse* | -1896** | -7014** | -1763** | -6900** |
| | (504.0) | (715.5) | (360.9) | (566.8) |
| Observations | 27617 | 46701 | 27617 | 46701 |
| Number of individuals | 5927 | 7638 | 5927 | 7638 |
| *expect health worse* | -1750** | -10119** | -2126** | -9455** |
| | (543.7) | (959.5) | (306.7) | (647.9) |
| Observations | 27617 | 46701 | 27617 | 46701 |
| Number of individuals | 5927 | 7638 | 5927 | 7638 |
| *pain* | 13.9 | -201.3** | -2.71 | -211.9** |
| | (10.14) | (8.27) | (5.94) | (6.92) |
| Observations | 18124 | 33880 | 18124 | 33880 |
| Number of individuals | 4326 | 6272 | 4326 | 6272 |
| *limitations* | 11.7* | -149.6** | -2.63 | -157.0** |
| | (5.20) | (6.67) | (3.19) | (5.71) |
| Observations | 17877 | 33470 | 17877 | 33470 |
| Number of individuals | 4296 | 6235 | 4296 | 6235 |
| *health event* | 510.8 | -6621** | 609.5+ | -6842** |
| | (600.0) | (1341) | (323.80) | (1329) |
| Observations | 15994 | 29922 | 15994 | 29922 |
| Number of individuals | 4041 | 5936 | 4041 | -6900** |
| Control for income | No | No | Yes | Yes |
| Mean saving | 24551 | 12733 | | |

Notes: Standard errors clustered at the individual level are reported in parentheses, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Fixed effects regressions for log weekly hours include controls for age, marital status, occupation, household size, lags of health shock, and state and year dummies.

**Appendix 1: Saving**

Saving can be measured as change in the stock of wealth or as the difference between income and consumption flows. In this analysis, we employ both approaches. Saving, as defined as any of employed variables, can be positive, zero, or negative.

The first measure of saving at individual level is defined as difference between income and consumption. Income is the sum of wage and salary disbursements, tips, other labour income, farm income, business income (net proprietor's income from unincorporated business), net rental income, interest on savings and dividends, and transfer income from government, private institutions and other households, employer and employee contributions to pension funds, inheritance, gifts and other income from family members. Taxes are subtracted from this estimate of income to arrive at real financial disposable income.

The consumption measure we use in HILDA data is collected from Wave 6 onwards. The consumption data is collected by a survey of how much was spent at the household level and the amount is averaged across individuals providing response. Expenditure on durable goods can be treated as consumption or investment expenditure. Consumer durables are typically treated as final consumption expenditure when purchased by households. Alternatively, the fact that they generate a stream of services or income that raises future consumption possibilities suggests they should be treated as investment expenditure (Browning and Lusardi 1996; Jalava and Kavonius 2009; Reinsdorf 2004; Perozek and Reinsdorf 2002). For the analysis reported in the paper, we treat durables as investment and, hence, include them as a part of saving (variable *sav1*). We construct an alternative measure (variable *sav2*) which treats durables as consumption expenditure. The results for consistent for the two measures.

Net worth is defined as difference between assets and liabilities and collected at household level in waves 2, 6, 10 and 14. Changes in net worth between these waves provides a measure of household saving.