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The effects of housing wealth on healthcare utilisation in Australia

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The effects of housing wealth on healthcare utilisation in Australia

Joshua Woodbridge

Abstract

Using data from the Household, Income and Labour Dynamics (HILDA) survey, I explore the effects of housing wealth on healthcare utilisation in Australia. I use exogenous variations in house prices to estimate the potential direct and indirect effects of housing wealth on homeowners' healthcare utilisation. I find no evidence of a direct wealth effect on healthcare utilisation, nor do I find evidence of an indirect healthcare insurance effect. However, my findings indicate an indirect health investment effect. Increases in housing wealth cause improvements in homeowners' health which in turn reduces their use of GP services.

JEL codes: I12, D14, C26

Keywords: Housing wealth, healthcare utilisation, house prices, health wellbeing, Australia, HILDA

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Data supplied by Securities Industry Research Centre of Asia-Pacific (SIRCA) on behalf of CoreLogic

Introduction

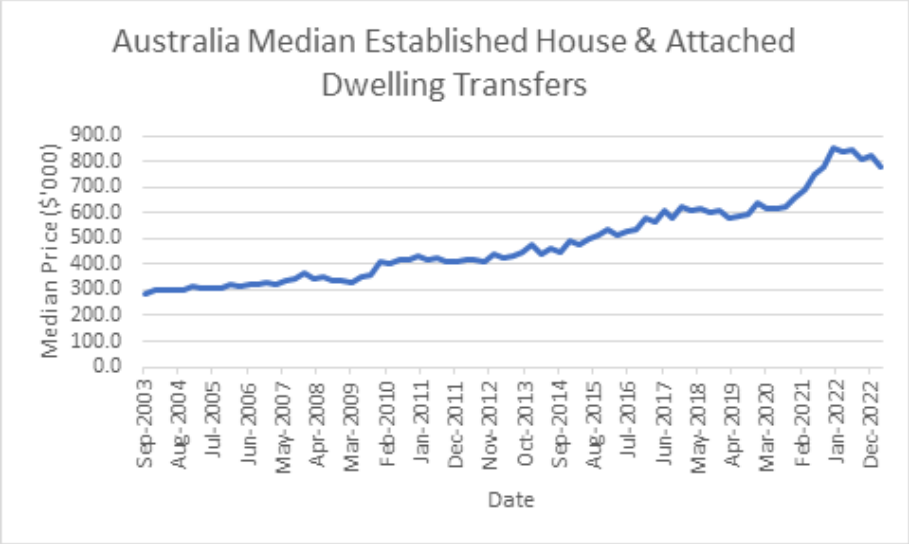
Understanding the determinants of healthcare utilisation by individuals is important to understanding the demands on Australia's healthcare system. To date, there has been limited causal exploration of how changes in the wealth of individuals impact their decisions to use different healthcare services. This paper examines how changes in housing wealth impacts individuals' healthcare utilisation decisions in Australia. Using exogenous variations in housing wealth, I explore a number of direct and indirect channels through which this effect may occur.

Housing wealth and wealth effects

Housing and housing wealth are important components of Australian's wellbeing. The home ownership rate in Australia has remained relatively constant over the last 50 years, with approximately 67-70% of households living in owner-occupied dwellings (Australian Institute of Health and Welfare [AIHW], 2023a). In 2021, 31% of households lived in rental properties (AIHW, 2023a). Housing wealth is an important component of homeowners' wealth. In 2017-18, the average net worth of Australian households was approximately $1,022,000, with the value of owner-occupied dwellings the largest component of this wealth at $501,000 (Australian Institute of Family Studies, 2020).

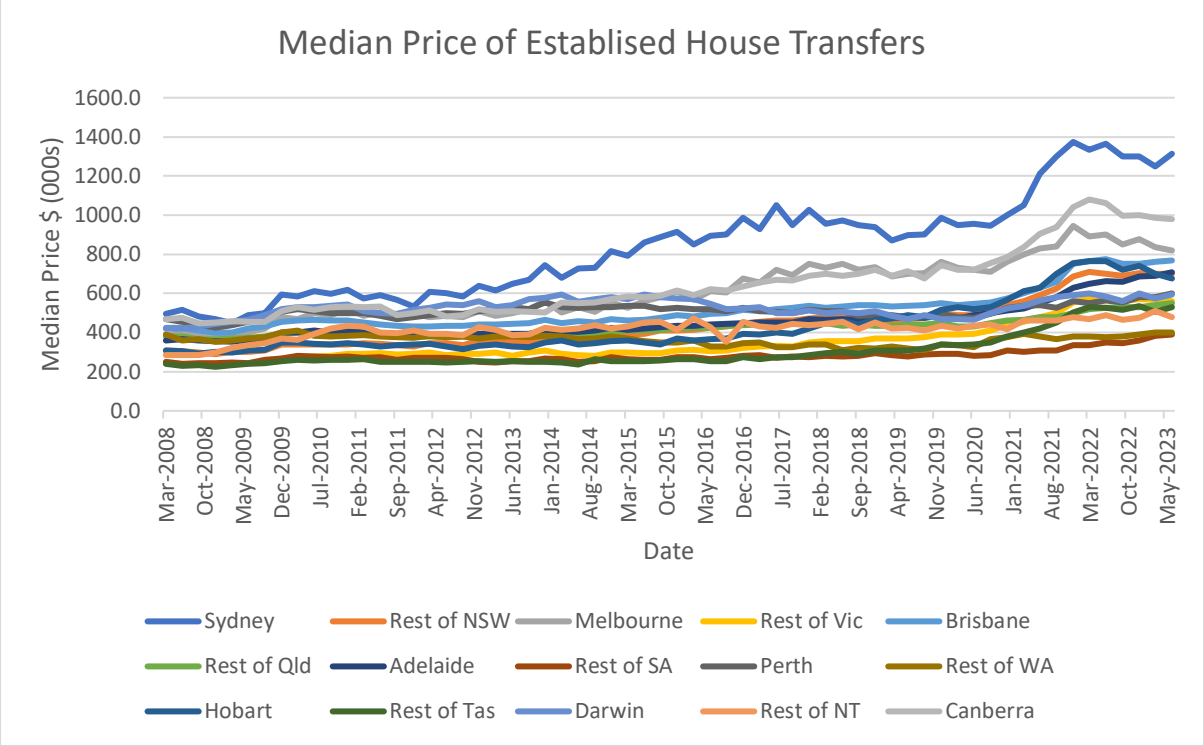
Between 2008 and the end of 2021, the median house price in Australia doubled (Figure 1). The rate at which house prices have increased has varied significantly across regions (Figure 2). Median house prices in capital cities have tended to increase faster than those areas outside capital cities. For instance, the median house price for established dwellings in Sydney increased by 143% between 2008 and 2021, compared to 53% in South Australia (Adelaide excluded).

Figure 1: Median established house prices, Australia



Data source: Australian Bureau of Statistics [ABS], (2023a)

Figure 2: Median established house prices by capital cities and regions



Data source: Australian Bureau of Statistics [ABS], (2023a)

A wealth effect refers to how consumption changes due to changes in an individual's wealth (May, Nodari & Jones, 2019). The theory behind this effect stems from Milton Friedman's (1957) 'Permanent Income Hypothesis' and Ando & Modigliani's (1963) 'Life cycle hypothesis'. Windsor, Jaaskela & Findlay (2015) point out two ways in which this wealth effect could operate through housing wealth. First, improved housing wealth can increase a homeowner's financial resources and hence consumption. Second, an increase in housing wealth can remove credit constraints from individuals (mortgagors) allowing them to borrow more and consume more. Housing wealth, compared to many other components of an individual's wealth is an illiquid asset. When housing wealth rises individuals feel more comfortable in their financial position (have a buffer) and hence consume more.

May et al. (2019) find that, in Australia, an increase in an individual's housing wealth of 1% is associated with a 0.08% increase in consumption expenditure over the next half-year and 0.16% increase in the long run.

This paper examines whether the housing wealth effect on consumption includes healthcare utilisation. That is, if and how increases in housing wealth has affected healthcare utilisation in Australia.

Australia's healthcare system

Important to examining how housing wealth affects healthcare utilisation is an understanding of the arrangements affecting who pays for healthcare services in Australia.

A key part of Australia's healthcare system is Medicare. Medicare, which started in 1984, is a government run universal healthcare scheme (Department of Health and Aged Care [DHAC], n.d(a)). It is available to all Australian and New Zealand citizens living in Australia and permanent residents of Australia (Services Australia, 2022a). It is funded by a levy on taxable incomes (Australian Taxation Office, 2023).

Medicare provides rebates to users of a broad range of healthcare services including GP and specialist visits, X-rays, pathology and eye tests and stays in public hospitals (Services Australia, 2022b). This results in some or all the costs for these services being paid for by the government.

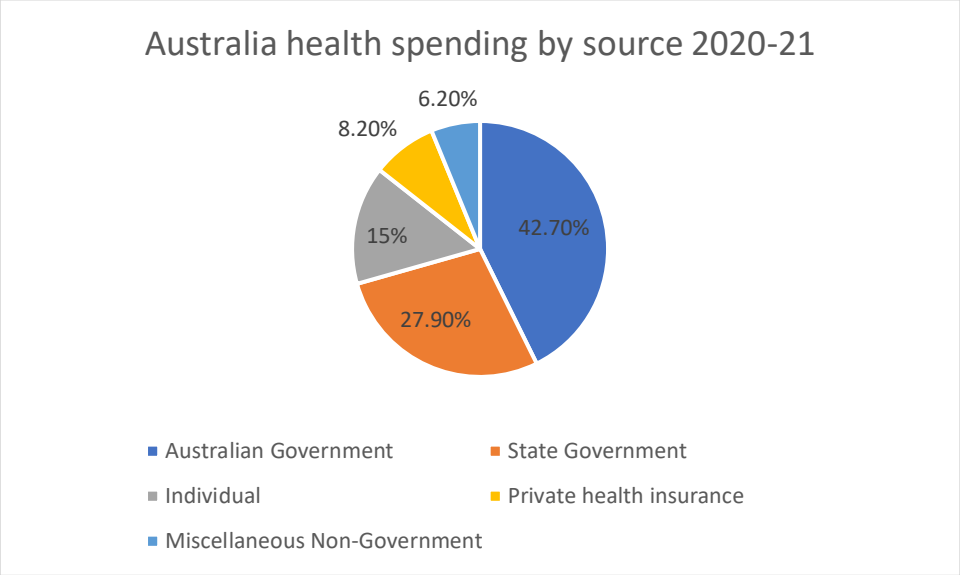
Not all healthcare costs are covered by Medicare. The costs of private hospital care and a range of services such as ambulance, dental, physiotherapy and optometry services are not, or only partially covered (Services Australia, 2022c). Many individuals purchase private health insurance to cover some or all of the costs of these services. In 2023, approximately 13.6 million people in Australia had private health insurance (DHAC, 2023a). Individuals taking out private health insurance have a choice in the services covered. Depending on the type and cost of the insurance policy, the costs of these services are either fully covered by the insurer, or the insured 'copays' by incurring an 'out-of-pocket' cost (DHAC, n.d(b)). Having private health insurance does not preclude the individual from being covered by Medicare. In some cases, individuals can claim on both types of health insurance for the same service (Services Australia, 2022c).

In addition to Medicare, there are other types of government health insurance which reduce the cost of some healthcare services for some individuals. These are the 'Pensioner Concession Card', 'Commonwealth Seniors Health Card' and the 'Health Care Card'. Persons eligible for these cards includes carers, those on unemployment benefits, disabled persons, and those on the age pension (Services Australia, 2023a & 2023b). These cards mostly provide for the bulk-billing (ie no copayment by the user) of GP visits and the cost of prescription medications. Other benefits vary depending on the state or territory.

In 2020-21, an average of $8,617 per person was spent on health goods and services in Australia. As shown in Figure 3, approximately 70% of that total expenditure was funded by state and federal governments with the remaining 30% non-government funded (Australian Institute of Health and Welfare [AIHW], 2023b). From 2010 to 2021, direct funding of health goods and services by

individuals was roughly 15-17.6%, with private health insurance providers and other non-government sources each contributing less than 10% (AIHW, 2022a).

Figure 3: Sources of health spending, Australia, 2020-2021



Data source: Australian Institute of Health and Welfare [AIHW], (2022b)

The six healthcare services analysed in this paper are separated into three groups. Different types of health insurance have differing effects on who pays for the services in each group.

The first group is GP visits which are largely covered by Medicare. In 2016-17, Australians visited the GP six times on average (AIHW, 2018a). Approximately 87% of Australians go to the GP at least once during the year (Duckett, Stobart & Lin, 2022). The percentage of GP services that are bulk-billed has risen from 79.5% in 2009-10 to 88% in 2020 (DHAC, 2023b). In 2019, 7.3 million Australians had out-of-pocket costs for GP visits, with a median spend of $80 per year (Duckett, Stobart & Lin, 2022).

The second group of healthcare services are those that are not covered by Medicare. These are dental, physiotherapy, optometry and chiropractic services. Individuals can reduce the amount they pay for these services by purchasing private health insurance ‘extras’ cover.

The third group is private hospital patient visits. Individuals can reduce the amount they pay for these services by purchasing private health insurance ‘hospital’ cover. Even for private hospital visits, Medicare covers 75% of the cost of many types of services (Better Health Channel, 2015).

The average annual 'out-of-pocket' amounts paid by individuals for these services in 2020-21 are shown in Table 1. In 2016-17, median out-of-pocket costs for those GP visits that required copayment ranged between $12 and $32 depending on the Primary Health Network (PHN) area (AIHW, 2018b).

Decisions to utilise these services varies based on socio-economic characteristics. For example, for dentist visits in 2016-17, where 58% of the cost of a visit was paid by the individual, 27.9% of low-income individuals skipped treatment due to its cost compared to 8.5% of high-income individuals (Duckett, Cowgill & Swerissen, 2019).

Table 1: Out-of-pocket healthcare service expenditure, Australia, 2020-2021

Health care service	**Dental**	**Chiropractic, optometry, and physiotherapy**	**Hospital**
Average annual 'out-of-pocket' spend per person	$253	$58	$149

Data source: Australian Institute of Health and Welfare [AIHW], (2022c)

Related literature

This paper contributes to the existing literature in four ways.

First, I extend the existing international literature examining the causal effect of housing wealth on healthcare utilisation to Australia. Tran, Gannon & Rose (2023) examine this issue in the United States of America (US) which has a vastly different healthcare system to Australia. They find that for health services not covered by Medicare and Medicaid in the US, there are statistically significant positive housing wealth effects. These services include dental and prescription drugs. The dataset used by these authors limited their analysis to homeowners aged over 50. The dataset I use allows me to include homeowners from all age groups.

Second, I develop a model to separately identify the direct and indirect effects of housing wealth on healthcare utilisation. Tran et al. (2023) estimate the direct wealth effect only. That is, the effect of housing wealth on purchases of healthcare services caused by increasing the financial ability of a homeowner to afford these services. As noted below, there are two indirect effects. Housing wealth can affect healthcare utilisation indirectly through its effect on decisions to purchase private health insurance (or more comprehensive cover). It can also affect healthcare utilisation by increasing the ability of homeowners to invest in activities that improve their health.

Third, I extend the existing literature on the causal relationship between housing wealth and an individual's health by examining if these health improvements in turn result in reduced healthcare utilisation. Atalay, Edwards & Liu (2017) find that in Australia increases in housing wealth are associated with increases in physical and mental health. They find this effect for outright homeowners only and it is strongest for household heads. Similarly, Fichera & Gathergood (2016), looking at the United Kingdom (UK), find evidence of a causal effect of housing wealth on self-reported health and the number of health conditions an individual has. Other studies look at the effect of other types of wealth on health outcomes. Au & Johnston (2014) by examining exogenous shocks to wealth such as lottery wins and inheritances, find that increases in wealth reduces individuals' weight in Australia. In the US, Schwandt (2018) examines the effect of stock market shocks on physical and mental health. Schwandt finds that decreases in wealth are associated with reduced physical health and rates of survival. I extend this literature by attempting to quantify whether these improvements in health outcomes, resulting from changes in wealth, result in reductions in healthcare utilisation.

Finally, I add to the broader literature examining the impact of housing wealth on consumption. As noted above, May et al. (2019) find that increases housing wealth results in increased consumption across a range of goods and services. They find that housing wealth largely affects the consumption of discretionary items such as clothing and motor vehicle expenditure. I extend this literature by examining the effects of housing wealth on the consumption of healthcare services.

Data

The Household, Income and Labour Dynamics in Australia (HILDA) Survey

This paper uses data from the Household, Income and Labour Dynamics in Australia (HILDA) survey (Department of Social Services; Melbourne Institute of Applied Economic and Social Research, 2022). HILDA is a household panel survey that follows individuals over time (waves). HILDA currently consists of 21 waves, one for each year since 2001. The sample is designed to be nationally representative. In its first year there were 7,638 households in the sample and 13,969 individuals were interviewed (Summerfield et al., 2021).

Healthcare utilisation is captured in HILDA's 'health' module. Participants were asked questions in the health module in waves 9, 13, 17 and 21 of the survey. These waves capture the years 2009, 2013, 2017 and 2021 respectively. The healthcare utilisation variables in the health module capture the use of GP, hospital, dental, physiotherapy, optometry, and chiropractic services.

In addition to healthcare utilisation, the health module includes four indexes (0-100) related to the physical health of participants. These indexes are created using the SF-36 method, which is a health survey developed to assist in health policy research and evaluation (Ware & Sherbourne, 1992). These indexes capture bodily pain, general health, physical functioning and role-physical. I follow the approach of Atalay et al. (2017) and generate a 'physical health index' (0-100) for each respondent as the average of the four indexes listed above. In my analysis I require exogenous instruments for the 'physical health index'. I use other measures related to health, including frequency of participating in physical activity, sporting or community clubs, meeting socially with friends and relatives, and smoking and drinking habits for this purpose (Melbourne Institute of Applied Economic and Social Research, 2021).

In each of the four waves, participants were also asked to report their demographic characteristics (eg; age, marital and employment status), their incomes and whether they had private health insurance. They were also asked to report what they think their house is worth (self-reported house price). The LGA and statistical area where the individuals reside is also provided.

There are 537 Local Government Areas (LGAs) in Australia (Australian Local Government Association, 2023). In the waves of the HILDA survey that I use there is at least one observation from 442 LGAs. In some cases, observations of variables I used in my analysis were unavailable which caused a number of observations to be dropped. This left 405 LGAs in my final sample.

House price data

I obtained LGA median house price data from CoreLogic's Suburb Scorecard provided by Securities Industry Research Centre of Asia-Pacific (SIRCA) (Core Logic; Securities Industry Research Centre of Asia-Pacific [SIRCA], 2023). This dataset contains monthly observations of the median sale price of properties sold in each LGA during the previous 12-month period. The data is monthly from 1990-2023 depending on the availability of house price observations in each LGA and period. I extracted the observations for December of each year from 2008-2021 for each LGA. I used this variable as an exogenous instrument for the endogenous self-reported house price variable from the HILDA dataset. Across the years where healthcare utilisation is available in HILDA (2009, 2013, 2017, 2021), median house price data is observed in at least one of these years in 481 LGAs.

Unemployment data

I sourced unemployment data collected by the Australian Bureau of Statistics (2023b). Labour Market Insights publishes the unemployment data on a Statistical Area Level 4 basis. This is the most disaggregated unemployment data available covering my period of interest. Australia has 107 Statistical Area Level 4s (SA4). The dataset provides a six-monthly moving average of the unemployment rate in 88 SA4s from 2004 to present. There are 88 SA4s observed in my final sample. Similar to the housing price data, I used the observation for each SA4 reported in December of each year.

Sample selection

I restricted the dataset to waves 9, 13, 17 and 21 in HILDA. These are the waves where healthcare utilisation is recorded. I further restricted the dataset to individuals over the age of 18 and to those individuals who responded to the survey in at least the last two waves of waves 9, 13, 17, 21. This has the effect of eliminating individuals who leave the survey during this period. This was done to eliminate potential biases due to a correlation between healthcare utilisation and the reason for leaving the survey (such as ill-health or death). As this paper is concerned with the effect of changes in housing wealth, renters were also removed from the sample. Table 2 below displays the effects of the sample selection on the number of observations.

Table 2: Sample selection

	Individuals remaining	**Observations remaining (across waves)**
Population (across 21 waves)	45,570	433,115
Drop waves other than 9, 13, 17 & 21	32,482	86,807
Keep individuals who respond in waves 17 & 21 or 13, 17 & 21 or 9, 13, 17 & 21	18,992	65,737
Keep individuals over the age of 18	14,096	48,476
Drop renters	11,385	33,778
Final Sample	11,385	33,778

Summary statistics

Summary statistics for the sample are presented below.

Table 3: Summary statistics

Variable	Mean	Standard deviation
Demographics		
Age	50.11	16.86
Gender		
- Male	0.47	0.5
- Female	0.53	0.5
Highest education attainment		
- University degree	0.32	0.47
- Cert/Diploma	0.34	0.47
- Completed year 12	0.14	0.34
- Year 11 or below	0.21	0.41
Marital status		
- Married/De Facto	0.75	0.43
- Separated/Divorced/Widowed	0.12	0.32
- Single	0.13	0.34
Number of dependent kids		
- Aged 0 to 14	0.52	0.94
- Aged 15 to 24	0.16	0.47
Labour force status		
- Employed	0.67	0.47
- Unemployed	0.02	0.17
- Not in labour force	0.31	0.46
Total Income ($)	55,607	73,351
Housing		
- Outright homeowner	0.42	0.49
- Mortgagor homeowner	0.58	0.49
- Self-reported house price ($)	738,710	620,169
- Median LGA house price ($)	658,432	478,600
Unemployment rate		
- SA4 Unemployment rate (%)	5.13	1.57
Health utilisation		
- Visited dentist at least once (0 or 1)	0.60	0.49
- Visited physiotherapist at least once (0 or 1)	0.25	0.43
- Visited chiropractor at least once (0 or 1)	0.19	0.49
- Visited optometrist at least once (0 or 1)	0.45	0.49
- Overnight hospital patient at least one night (0 or 1)	0.12	0.33
- Doctor (GP) visits (count)	4.41	5.7
Health Insurance		
- Private health insurance Hospital cover	0.59	0.49
- Private health insurance Extras Cover	0.62	0.48
- Commonwealth seniors' health card	0.04	0.20
- Pensioner concession card	0.18	0.39
- Health care card	0.07	0.25
Health		
- Physical health index (0-100)	76.3	20.6
Household head (0 or 1)	0.53	0.50

For Doctor (GP) visits, respondents were asked how many times they visited a GP in the last 12-month period. For the remaining variables, dentistry, physiotherapy, chiropractic, optometry and overnight hospital stays, individuals were only asked whether they used these services at least once during the last 12 months. The nature of these binary outcome variables limits the variation in the utilisation of healthcare services that is observed.

I define household heads as the individual with the highest income for that household in that year. Atalay et al. (2017) argue that these persons are more likely to be aware of changes in housing value and be the decision maker on financial matters in the household.

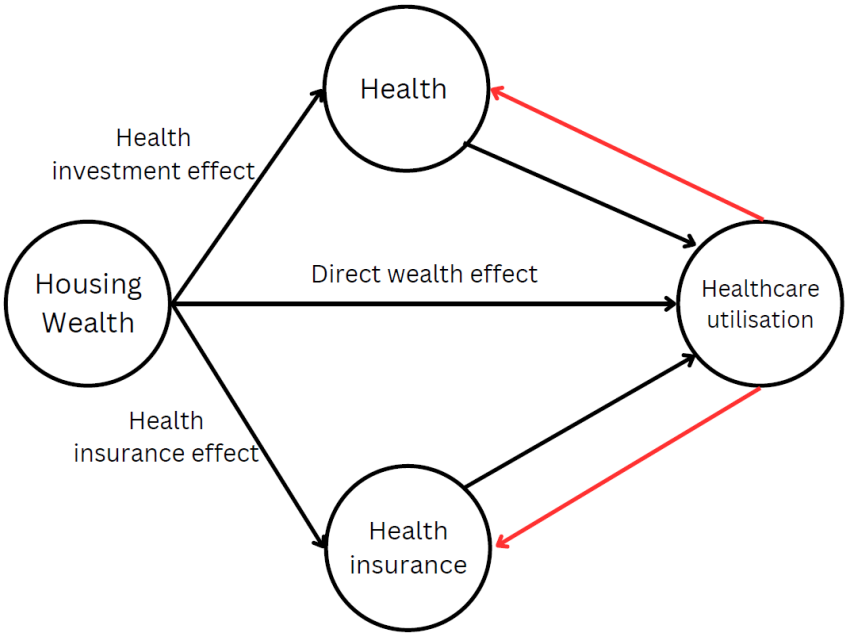
In my analysis I use visits not expenditure as my measure of healthcare utilisation for several reasons. First, expenditure data in the HILDA dataset is at the household level, not the individual level. Second, the expenditure data is less specific about the type of healthcare service than visits. For instance, the healthcare expenditure data in HILDA doesn't separately identify expenditure on dental care. Finally, as Tran et al. (2023) point out, expenditure picks up both quantity and quality of healthcare services.

In my sample, 42% of homeowners owned their house outright (i.e. without a mortgage). In 2007-08 48% of homeowners across Australia owned their house outright. This fell to 44% in 2019-20 (AIHW, 2023a).

Empirical strategy

This paper examines whether there is a wealth effect on healthcare utilisation in Australia, and what the nature of that effect may be. There are three mechanisms through which changes in wealth may directly or indirectly affect healthcare utilisation. These are illustrated in Figure 4.

Figure 4: Housing wealth effects on healthcare utilisation



The first effect is a direct effect. As housing wealth increases, owners become more confident about their financial situation and increase their consumption of many goods and services, including healthcare both now and in the future (direct wealth effect). Conversely as housing wealth falls, owners become less confident about their financial situation resulting in less consumption, including the utilisation of healthcare services.

The second effect is an indirect effect. Increases in housing wealth increases the owner's financial ability to purchase private health insurance (hospital and/or extras cover) or enable the owner to purchase a more comprehensive private health insurance policy. This reduces the 'out of pocket' cost of some healthcare services, which, all else being equal, is likely to increase the homeowners use of those services (health insurance effect).

The third effect is also an indirect effect. Increases in housing wealth increase the financial ability of homeowners to invest in activities or services that improve their physical health. This could occur in multiple ways such as being able to allocate more time to leisure or physical activity. These consequential improvements in physical or mental health are in turn likely to reduce the homeowners need for certain healthcare services (health investment effect).

While the first two effects predict that increases in housing wealth will increase healthcare utilisation, the third effect works in the opposite direction. Depending on which of these three effects is dominant, an increase in housing wealth could either increase or decrease healthcare utilisation.

There are a number of identification issues that must be addressed in order to properly explore these effects.

It is possible that housing wealth and healthcare utilisation are determined by other variables. For example, a person's age, income, employment status, or education could impact both their housing wealth and healthcare utilisation decisions. There may be individual characteristics that we don't observe which determine both, for example cognitive ability and risk aversion (Au & Johnston, 2014). Additionally, there could be observed or unobserved national or local macroeconomic effects or other shocks that impact housing prices and an individual's healthcare utilisation decisions.

Another problem for identification is the possibility of reverse causality. Individuals who increase their use of healthcare services may become healthier and be able to earn more and increase their wealth. Self-reported housing prices are also subject to a more general measurement error. For example, people may not be completely aware of changes in their housing value. Goodman & Ittner (1992) and Benetiz-Silva, Eren, Heiland & Jimenez-Martin (2015) estimate that in the US, on average, homeowners overestimate the value of their house by 6 and 8 percent respectively.

Furthermore, private health insurance and healthcare utilisation may be jointly determined. Individuals who have private health insurance may use healthcare services where their insurer copays more intensively. It is also plausible that those who are more likely utilise these services intensively are more likely to take out private health insurance in the first instance (Einav & Finkelstein, 2018).

Finally, physical or mental health and the use of healthcare services are also likely to be jointly determined. Physical and mental health determines the use of healthcare services (you feel sick, so you go to the doctor). Also, the use of healthcare services is likely to improve an individual's health (after receiving treatment from the doctor, you feel better).

As a starting point for my analysis, I use the same empirical strategy employed by Tran et al. (2023) (Tran model). This strategy uses instrumental variables and fixed effects to examine the effect of housing wealth on healthcare utilisation by individuals who own their houses outright or have a mortgage on their house. The Tran model consists of the following two equations:

$$Utilisation_{ict} = \gamma HP_{ict} + \beta_1 X_{ict} + \beta_2 U_{ct} + \eta_t + \theta_c + \mu_i + \varepsilon_{1ict}$$

$$HP_{ict} = \delta Z_{ct} + \beta_3 X_{ict} + \beta_4 U_{ct} + \vartheta_t + \xi_c + \psi_i + \varepsilon_{2ict}$$

where $Utilisation_{ict}$ is a measure of the healthcare utilisation of individual i at time t living in LGA c. X_{ict} is a range of demographic control variables such as age, education attainment, martial status, employment status and log of income. U_{ct} is the statistical area unemployment rate. HP_{ict} is the log of the individual's i's self-reported house price at time t living in LGA c; and Z_{ct} is the log LGA median house price in LGA c at time t. In addition, time (η, ϑ), LGA (θ, ξ) and individual (μ, ψ) fixed effects are included. The LGA house price acts as an instrument for the plausibly endogenous self-reported house price.

Tran et al. (2023) use this model to estimate the direct wealth effect. They state that the instrument for self-reported house price controls for the possibility that "wealthier individuals may make larger (unobserved) investments in the health than less wealthy individuals".

The outcome variable is healthcare utilisation. The LGA median house price instruments for the endogenous self-reported house price. The instrument deals with the reverse causality and measurement error issues in identification. An instrument must be valid and relevant (Huntington-Klein, 2022). To be a relevant and valid instrument, the LGA median house prices must be correlated with self-reported house prices and must not be endogenous. It seems likely that LGA median house prices are highly correlated with self-reported house prices. Tran et al. (2023) argue, this model with its controls and the instrument plausibly isolates the exogenous effect of housing wealth on healthcare utilisation.

The demographic variables control for the time variant socio-economic characteristics that may explain healthcare utilisation decisions. The LGA unemployment rate controls for localised macroeconomic shocks that may act as confounder. The time fixed effects control for time-variant unobserved factors that affect healthcare utilisation (e.g., Covid-19 pandemic). The LGA fixed effects control for heterogeneity between LGAs (such as different accessibility of healthcare services in different regions) and unobserved localised shocks. Individual fixed effects controls for the time-invariant individual effects. For example, unobserved characteristics that impact an individual's healthcare use.

As noted above, in this paper I examine the effects of housing wealth on the utilisation of six healthcare services: dentist, physiotherapy, chiropractic, optometry, GP visits and overnight hospital status. These services are covered by different types of health insurance in Australia. Dentist, physiotherapy, chiropractic, and optometry services are not covered by Medicare. Individuals who

purchase private extras health insurance are liable for only some, or in some cases none of the cost of these services. Some or all of the cost of doctor visits (GP) are covered by Medicare.

Finally, overnight hospital visits may be covered by Medicare or hospital private health insurance, depending on the hospital and the type of visit. It is possible that overnight hospital stays are mostly determined by the doctor and their recommendation, not the patient. For the other services, it is assumed that the decision to utilise these services is primarily made by the individual.

Extending the Tran model

In this paper I endeavour to isolate the three wealth effects detailed in Figure 4. In order to do so it is necessary to modify and significantly extend the Tran model. The major extension involves identifying the indirect health investment effect and the indirect private health insurance effect. This involves two parts. The first is to separately identify the effect of housing wealth on the decisions of individuals to improve their health (health investment) and to purchase private health insurance. The second is to identify the effect of health outcomes and private health insurance (where relevant) on the use of the healthcare services.

The HILDA dataset provides information on individuals' physical health and whether they have private health insurance (extras or hospital cover).

An empirical challenge in identifying the three effects is the potential endogeneity of the intermediate variables (physical health and private health insurance coverage). As discussed above, an estimate of the effects of improved health/health investment on healthcare utilisation could be biased due to the role healthcare utilisation has on determining health. This is because an individual's feeling about their physical health may improve as a result of the utilisation of healthcare services. For the other indirect effect, estimating the effect of obtaining health insurance on utilisation may also be biased as individuals who utilise healthcare more may be more likely to have private health insurance.

I employ an IV-2SLS approach to address these endogeneity issues. In addition to instrumenting for the endogenous self-reported house price, I find instruments for an individual's physical health (physical health index) and their private health insurance coverage. This analysis uses three slightly different models, depending on the type of healthcare service, to take into account the differing relevance of private health insurance. One model is used for doctor visits (where private health insurance coverage does not affect the cost of the service to the individual); another is used for dentist, physiotherapy, chiropractic and optometry services (where private health insurance (extras cover) reduces the cost of the service to the individual); and a final model for overnight hospital stays

(where private health insurance (hospital cover) may reduce the cost of the service to the individual). These models are detailed below.

Doctor visits (GP) model

For doctor visits only the direct wealth effect and the health investment indirect effect can play a role in utilisation. As GP visits are not covered by private health insurance, there is no wealth effect through the indirect private health insurance channel. The model to be estimated is:

$$Doctor\ visits_{ict} = \beta_1 HP_{ict} + \beta_2 Health\ index_{ict} + \beta_3 X_{ict} + \beta_4 HC_{ict} + \beta_5 U_{ct} + \eta_t + \theta_c + \mu_i + \varepsilon_{ict}$$

where all variables are the same as the previous model except for the following. $Doctor\ visits_{ict}$ is the number of visits to a GP by individual i at time t living in LGA c. $Health\ index_{ict}$ refers to the Physical Health Index of individual i at time t living in LGA c. HC_{ict} represents whether individual i at time t living in LGA c holds a health care card, a pensioner concession card or a commonwealth seniors' health card.

As before, the log of LGA median house price is an instrument for individuals self-reported house price. Because my measure of health, the physical health index is endogenous, I look for additional instruments to identify the model. These instruments need to be correlated with the physical health index and only effect healthcare utilisation through physical health (Wooldridge, 2020). I use six instruments that fit these criteria: BMI, whether the individual smokes or drinks alcohol, frequency of socialising with friends, sporting/hobby club/association membership and frequency of physical activity.

Dentist, physiotherapy, chiropractic, and optometry services model

Unlike doctor visits, private health insurance (extras cover) is likely to play a significant role in the utilisation of dentist, physiotherapy, chiropractic, and optometry services. Therefore, there is an additional indirect wealth effect to be explored, the private health insurance (extras) effect.

The model to be estimated includes extras cover as an explanatory variable.

$$Utilisation_{ict} = \beta_1 HP_{ict} + \beta_2 Health\ index_{ict} + \beta_4 Extras\ cover_{ict} + \beta_5 X_{ict} + \beta_6 HC_{ict} + \beta_7 U_{ct} + \eta_t + \theta_c + \mu_i + \varepsilon_{ict}$$

where $Utilisation_{ict}$ is whether or not individual i who lives in LGA c used dental, physiotherapy, chiropractic, or optometry services at least once in time t. $Extras\ cover_{ict}$ is whether the individual i who lives in LGA c had private extras health insurance cover at time t. Note that separate models are estimated for each of these services.

The same instruments for health index and the housing price used in the previous model are used again. As noted above, variables that meet the requirement for instruments are required to deal with the potential endogeneity of the extras cover variable. I use two types of variables as instruments for private health insurance cover. The first is hospital private health insurance cover. This is likely to be highly correlated with private health insurance extras cover (individuals who take out private hospital insurance are more likely to take out private extras insurance). The second set of instruments are the healthcare services that are likely to be influenced by private health insurance. For example, when estimating the dentist model, I use (in addition to hospital private health insurance cover) physiotherapy, chiropractic, and optometry visits as instruments for extras cover. These other healthcare services are also likely to be correlated with extras cover, as I expect their usage to be higher among those who have private health insurance. Neither type of instrument determines the use of dental services.

Overnight hospital stay model

As with dentist, physiotherapy, chiropractic and optometry services, the effect of housing wealth on overnight hospital stays can occur through three channels (direct wealth effect, the health insurance effect and the health investment effect). The difference is that the health insurance effect works through the take-up of private hospital insurance cover. The model to be estimated is:

$$Hospital\ Overnight_{ict} = \beta_1 HP_{ict} + \beta_2 Health\ index_{ict} + \beta_4 Hospital\ cover_{ict} + \beta_5 X_{ict} + \beta_6 HC_{ict} + \beta_7 U_{ct} + \eta_t + \theta_c + \mu_i + \varepsilon_{ict}$$

where $Hospital\ Overnight_{ict}$ is whether or not individual i who lives in LGA c had an overnight hospital stay in time t. $Hospital\ cover_{ict}$ is whether the individual the individual i in LGA c had private health insurance hospital cover at time t.

I use the same instruments as the previous model for housing price and physical health. For the endogenous hospital cover variables, I use private extras health insurance cover as the instrument.

Results

Instrumental variable model (Tran model)

The results of the estimation of the Tran model are reported below. The results in Table 4 display the first stage of the IV-2SLS estimation of the Tran model for dentist use. As found by Tran et al. (2023), there is a strong and highly significant correlation between individuals' self-reported house price and LGA median house prices. A 1% increase in LGA median house prices is associated with a 0.823% increase in self-reported house prices. This indicates that the LGA median house price is an appropriate and effective instrument for self-reported house price.

Table 4: First stage estimation – Tran model – Dentist use

VARIABLES	(1) Log Self-Reported House Price
Log LGA Median House Price	0.823*** (0.009)
Observations	31,728
Controls	YES
Fixed Effects	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 displays the results from estimating the second stage of the Tran model for dentist visits (did you visit a dentist at least once in the last 12 months?). Average annual total 'out-of-pocket' spend for dental services was $253 in 2020 (AIHW, 2022c). This was higher than the 'out-of-pocket' spend for physiotherapy, chiropractic, or optometry services. As a result, among these services, I expect any direct wealth effect to be the strongest for dental services.

Table 5: Second stage estimation – Tran model - Dentist use

VARIABLES	(1) Dentist Use
Log Self-Reported House Price	-0.0332* (0.0201)
Constant	-0.155 (0.366)
Observations	31,728
Controls	YES
Fixed Effects	YES
Number of individuals	10.996

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results of my estimations of the Tran model for dental services reported in Table 5 are counterintuitive. The direct effect of housing wealth on the use of dental services is negative. It is estimated that a 1 percent increase in housing prices reduces the likelihood of an individual having visited the dentist at least once during the previous 12 months by 0.03 percentage points. This is different from the results of Tran et al. (2023) who find that a 1% increase in housing prices increased the use of dental services by 0.054 percentage points.

The results for the other healthcare services are presented in Table 6. For the healthcare services not covered by Medicare; physiotherapy, chiropractic and optometry, the estimated effect of housing wealth on utilisation are either statistically significant and negative, or not statistically significant from zero. These results are counterintuitive, as one would not expect a direct wealth effect to reduce the use of these services. The only positive and statistically significant wealth effect is for overnight hospital stays. However, as noted above, this is a healthcare service where utilisation is likely to largely be determined by a doctor's decision/recommendation rather than the decision of the individual. Also, many overnight hospital stays are covered at least partially by Medicare. A limitation of this analysis is that for all the variables apart from Doctor Visits which is a count variable, a person who used the healthcare service once in the past year is considered the same as a person who used it ten times.

It is possible that the effect of housing wealth on the use of these healthcare services is capturing more than just the direct wealth effect. It is possible that it is capturing the indirect wealth effects as well as the direct effects, including the indirect health investment effect which predicts a negative effect of housing wealth on healthcare utilisation. This is explored below using my extended model which separately identifies each of the three wealth effects.

Table 6: Second stage estimation – Tran model - Other healthcare services

VARIABLES	(1) Physiotherapy Use	(2) Chiropractic Use	(3) Optometry Use	(4) Doctor (GP) Visits	(5) Overnight Hospital Stay
Log Self-Reported House Price	-0.0562** (0.0234)	0.0118 (0.0176)	-0.0608** (0.0267)	0.0799 (0.217)	0.0327** (0.0155)
Constant	1.146** (0.450)	0.0523 (0.339)	-0.778 (0.515)	-0.483 (3.958)	-0.592** (0.283)
Observations	22,852	22,852	22,852	31,709	31,744
Controls	YES	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES	YES
Number of individuals	9,635	9,635	9,635	10,996	10,997

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Extended model

As noted above, the extended model endeavours to separately identify the direct wealth effect from the indirect health investment effect and, where relevant, the indirect health insurance effect. Instrumental variable (IV-2SLS) estimation is used to address the potential endogeneity issues.

Doctor (GP) visits model

The results of the IV-2SLS estimation of the Doctor (GP) visits model are reported in Table 7. The first two columns report the results from the first stage regression. The third column reports the results from the second stage. The LGA median house price variable is a strong instrument for self-reported house price (column 1). The six instruments for the physical health index are strongly correlated with physical health, also indicating that they are good instruments (column 2). While the positive coefficient on housing prices in column 2 suggests that increases in housing wealth may increase an individual's physical health, the effect is not statistically significant.

The results in column 3 examine the effects of housing prices and physical health on the number of doctor visits. There are two key outcomes. First, that there is no direct effect of housing wealth on the number of doctor visits. The hypothesis that there is no relationship between housing wealth and doctor visits cannot be rejected.

Second, improved physical health has a negative and statistically significant effect on the number of doctor visits. A one percentage point increase in the physical health index (from 50 to 51 for instance) reduces doctor visits by 0.063 visits per year. However, this does not indicate there is an indirect health investment effect of housing wealth on doctor visits. As noted above, an increase in housing wealth is not associated with improvements in physical health. Therefore, while improved physical health is associated with fewer doctor visits, physical health is not impacted by housing wealth.

Table 7: Extended model - Doctor (GP) visits

VARIABLES	(1) Log Self-Reported House Price	(2) Physical Health Index	(3) Doctor (GP) Visits
First stage – Instrument for Housing Price			
Log LGA Median House Price	0.825***	0.844	
	(0.0109)	(0.5601)	
First stage – Instruments for Physical Health Index			
Socialisation	-0.002	0.312***	
	(0.0014)	(0.0737)	
Smoker	-0.007	1.08**	
	(0.0084)	(0.4296)	
BMI	-0.0002	-0.385***	
	(0.0008)	(0.0384)	
Drinking	0.0001	0.310**	
	(0.0025)	(0.1274)	
Sporting/Community club	0.006	0.505**	
	(0.0041)	(0.2109)	
Physical activity	-0.0007	1.739***	
	(0.0013)	(0.0686)	
Second stage			
Log Self-Reported House Price			0.303
			(0.2133)
Physical Health Index			-0.063***
			(0.0106)
Observations	23,600	23,600	23,600
Controls	YES	YES	YES
Fixed Effects	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dentist, physiotherapy, chiropractic, and optometry model

The extended model for the use of dental, physiotherapy, chiropractic and optometry services separately identify the indirect health insurance effect in addition to the direct wealth and indirect health investment effects. The results for the use of dental services are reported in Table 8. The first three columns of Table 8 report the results of the first stage regressions. The fourth column reports the results of the second stage.

As with GP visits, the instruments for housing prices and physical health are highly statistically significant (columns 1 and 2). While the positive coefficient on housing prices (in column 2) suggests that increases in housing wealth may increase an individual's physical health, the hypothesis that there is no relationship cannot be rejected at the 10% level of significance.

The third column reports the results of the first stage estimation for the private extras insurance variable. The instruments for extras insurance cover are the use of physiotherapy, chiropractic and optometry services and the take-up of hospital private health insurance. These instruments are highly correlated with the take-up of private extras health insurance. The coefficient on housing prices (in column 3) however is small and is not statistically significant. This indicates that there is little or no relationship between housing wealth and the take-up of private extras health insurance.

The results in column 4 examine the effects of housing prices, physical health, and private extras health insurance cover on the use of dental services. When interpreting these results, it is important to note that the use of dental services is measured by a (0,1) binary variable, whether the individual went to the dentist in the last 12 months or not. It provides no information on the number of visits.

The results in column 4 present no support for a direct wealth effect or the indirect health investment effect on the use of dental services. Similar to the estimation results of the Tran model (see Table 5), the estimated coefficient on log housing prices is negative, but in this case not statistically significant. The results also indicate that physical health has no impact on the use of dental services. This is not surprising as the need for dental services is at best loosely determined by physical health, especially compared to other healthcare services such as GP and physiotherapy services and hospital stays.

The coefficient on private extras health insurance in column 4 is positive and statistically different from zero. It is estimated that a person who has extras private health insurance cover is more likely by a probability of 0.124 to have been to the dentist in the last 12 months. This is not surprising as dentist visits, all else being equal, are cheaper for individuals with extras cover as their insurer copays. While this is the case, there is no indirect health insurance wealth effect on the use of dental services. That is, while the take-up of private health extras insurance increases the likelihood of attending the dentist (column 4), housing wealth does not affect the take-up of private health insurance extras cover (column 3).

Table 8: Extended Model – Dentist use

VARIABLES	(1) Log Self-Reported House Price	(2) Physical Health Index	(3) Private Insurance Extras Cover	(4) Dentist Use
First stage – Instrument for Housing Price				
Log LGA Median House Price	0.802***	1.05	-0.006	
	(0.0126)	(0.6996)	(0.0113)	
First stage – Instruments for Physical Health Index				
Socialisation	-0.004**	0.473***	0.003*	
	(0.0017)	(0.0939)	(0.0015)	
Smoker	0.0016	1.93***	0.005	
	(0.0105)	(0.5820)	(0.0094)	
BMI	0.0012	-0.356***	0.002***	
	(0.0008)	(0.0472)	(0.0007)	
Drinking	-0.0021	0.770***	-0.008***	
	(0.0031)	(0.1762)	(0.0029)	
Sporting/Community club	0.0037	0.931***	-0.002	
	(0.0048)	(0.2622)	(0.0042)	
Physical activity	0.0014	2.11***	0.001	
	(0.0016)	(0.0868)	(0.0014)	
First stage – Instruments for Private Insurance Extras Cover				
Physiotherapy	-0.003	-3.607***	0.007*	
	(0.0044)	(0.2445)	(0.0040)	
Chiropractor	-0.0057	-0.967***	0.013**	
	(0.0058)	(0.3207)	(0.0052)	
Optometrist	-0.003	0.439**	0.024***	
	(0.0038)	(0.2124)	(0.0034)	
Private Health Insurance Hospital Cover	0.052***	-1.424***	0.0578***	
	(0.0087)	(0.4794)	(0.0078)	
Second stage				
Log Self-Reported House Price				-0.032
				(0.0274)
Physical Health Index				0.0008
				(0.0010)
Private Health Insurance Extras Cover				0.124***
				(0.0262)
Observations	16,999	16,999	16,999	16,999
Controls	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix A reports the estimation results for physiotherapy, chiropractic, and optometry visits. The results are not dissimilar to the results for the use of dentist services, indicating no direct or indirect housing wealth effects on utilisation.

Overnight hospital stays model

The extended model for overnight hospital stays separately identifies the indirect health insurance effect in addition to the direct wealth and indirect health investment effects. In this case the relevant insurance variable is private hospital insurance cover. The results are reported in Table 9.

The instruments for housing prices, physical health index and private hospital insurance cover are again highly statistically significant (columns 1, 2 and 3). As was the case with GP visits and the use of dental services, the positive coefficient on housing prices (column 2) suggests increases in housing wealth may increase individuals' physical health. In this case, the hypothesis that there is no relationship can be rejected at the 10% level of significance. The coefficient on housing prices (in column 3) indicates that there is little or no relationship between housing wealth and the take-up of private hospital health insurance.

The results in column 4 examine the effects of housing prices, physical health and private hospital health insurance on overnight hospital stays. Overnight hospital stays is a (0,1) binary variable indicating whether or not the individual spent at least one night in hospital in the last 12 months.

The estimated coefficient on housing prices in column 4 is consistent with a positive direct wealth effect. The coefficient suggests that a 1% increase in housing prices increases the probability of an overnight hospital stay by 0.03 percentage points. The hypothesis that there is no relationship between housing prices and overnight hospital stays can be rejected at the 10% level of significance.

However, I draw caution on this result as overnight hospital stays are a healthcare service that is likely to be more determined by the doctor rather than the individual/patient. In addition, many hospital stays are covered by Medicare. To the extent there is a direct housing wealth effect on overnight hospital stays, it must be limited to stays that are partially or fully self-funded by the patient and where the patient has the choice whether to stay or not. To assess this, further information on the type of hospital stay (for example, private or public hospital stays) which is not recorded in the HILDA survey is required.

There is some evidence of an indirect health investment wealth effect on hospital stays. The results reported in column 4 indicate that improved physical health reduces the likelihood of overnight hospital stays. The results in column 2 suggest that housing prices improves physical health. Multiplying the coefficient on housing prices in the physical health equation (0.952) by the coefficient on physical health in the overnight hospital stays equation (- 0.0037) yields -0.0035. This indicates that a 100% increase in house prices is associated with a decrease in the probability of having to stay overnight at the hospital by 0.035. This is much smaller than the direct wealth effect.

There is however no evidence of an indirect health insurance wealth effect on hospital stays. While private health insurance cover increases the probability of an overnight hospital stay, house prices do not affect the take-up of private insurance hospital cover.

Table 9: Extended model - Overnight hospital stays

VARIABLES	(1) Log Self-Reported House Price	(2) Physical Health Index	(3) Private Insurance Hospital Cover	(4) Overnight Hospital Stay
First stage – Instrument for Housing Price				
Log LGA Median House Price	0.825***	0.952*	0.002	
	(0.0110)	(0.5607)	(0.0088)	
First stage – Instruments for Physical Health Index				
Socialisation	-0.002	0.325***	-0.003**	
	(0.0015)	(0.0740)	(0.0012)	
Smoker	-0.006	1.117***	-0.015**	
	(0.0084)	(0.4311)	(0.0068)	
BMI	-0.0004	-0.378***	-0.002***	
	(0.0008)	(0.0384)	(0.0060)	
Drinking	-0.0001	0.318**	-0.0007	
	(0.0025)	(0.1280)	(0.0020)	
Sporting/Community club	0.006	0.537**	0.004	
	(0.0042)	(0.2115)	(0.0033)	
Physical activity	0.0009	1.744***	-0.002**	
	(0.0014)	(0.0689)	(0.0011)	
First stage – Instruments for Private Insurance Hospital Cover				
Private Health Insurance Extras Cover	0.008	-0.294	0.443***	
	(0.0060)	(0.3075)	(0.0048)	
Second stage				
Log Self-Reported House Price				0.0302*
				(0.0176)
Physical Health Index				-0.0037***
				(0.009)
Private Health Insurance Hospital Cover				0.059***
				(0.0180)
Observations	23,515	23,515	23,515	23,515
Controls	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Household heads who are outright homeowners

Atalay et al. (2017) find that housing wealth has a positive effect on individuals' health in Australia. They make this finding using the HILDA dataset. That is, an increase in housing wealth is associated with improvements in things such as physical health and BMI. Importantly, the authors find that these results are strongest for outright homeowners and household heads. Atalay et al. (2017) suggest that outright owners compared to mortgage house owners are more likely to change their behaviour as housing prices vary. Moreover, household heads are more likely to be the household's financial decision maker. Arguably, the direct and indirect effects of housing wealth on healthcare utilisation are likely to be strongest for this group of individuals.

I adjusted my sample to include only outright homeowners who are household heads. The household head is the highest income earner in the household for that year. For this sample, I focused on the housing wealth effects on doctor (GP) visits. This is the case for two reasons. First, the use of GP services is more likely to be determined by an individual's physical health (compared to dentist or optometry etc). Second, doctor visits is a count variable, not a binary outcome. As this more precisely measures usage than a binary variable there is a greater likelihood of detecting any wealth effects. The results are reported in Table 10.

The first two columns report the results from the first stage regressions. The third column reports the results from the second stage. Looking in the first stage estimation for physical health index in column 2, I find a similar effect to Atalay et al. (2017). For outright homeowners who are household heads a 100% increase in housing prices is associated with a 3.5 percentage point increase in physical health. The results from the second stage estimation shows a 1 percentage point increase in physical health is associated with a reduction in doctor visits by 0.084. The total indirect effect is 3.488 x (-0.084) = -0.3. So, a 100% increase in house prices is associated with a reduction in doctor visits over the previous 12 months of 0.3. The average number of doctor visits per year is 4.4, meaning this is a fall in doctor visits by approximately 6.8% compared to the sample average.

Table 10: Extended model - Doctor (GP) visits, household heads who are outright homeowners

VARIABLES	(1) Log Self-Reported House Price	(2) Physical Health Index	(3) Doctor (GP) Visits
First stage – Instrument for Housing Price			
Log LGA Median House Price	0.749***	3.488***	
	(0.0204)	(1.1835)	
First stage – Instruments for Physical Health Index			
Socialisation	0.006**	0.400**	
	(0.0028)	(0.1606)	
Smoker	-0.016	2.461*	
	(0.0218)	(1.2683)	
BMI	-0.003**	-0.220**	
	(0.0016)	(0.0904)	
Drinking	0.0006	0.987***	
	(0.0064)	(0.3736)	
Sporting/Community club	0.009	0.790	
	(0.0084)	(0.4875)	
Physical activity	-0.007***	2.240***	
	(0.0026)	(0.1508)	
Second stage			
Log Self-Reported House Price			-0.114
			(0.4725)
Physical Health Index			-0.084***
			(0.0182)
Observations	5,482	5,482	5,482
Controls	YES	YES	YES
Fixed Effects	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Other analysis

I explored a number of other adjustments to my extended version of the Tran model. First, it may be that the housing wealth effect operates with a lag as it may take time for the variation in housing wealth to impact healthcare utilisation. I replaced the housing price variables with values for the previous year. This did not affect many of the results with the exception of the indirect health investment effect (see Appendix B Table B1). The results using lagged house price suggest an increase in housing wealth reduces GP visits through improvements in physical health. This effect however is small. Second, following Tran et al. (2023) who focus on an older demographic, I restricted the sample to individuals whose age is over 65. At this age it is more likely that the individual is retired, and earning less income so wealth may be more important for the use of healthcare services. This did not affect the results in a meaningful way (see Appendix B Table B2).

Discussion and conclusion

House prices in Australia doubled over the last 15 years. Using exogenous variation in housing prices I estimate direct and indirect effects of housing wealth of healthcare utilisation in Australia. I explore these effects on a range of healthcare services; doctor (GP), dentist, physiotherapy, chiropractic, optometry, and overnight hospital stays. These services are covered differently by healthcare insurance in Australia, either through Australia's universal healthcare Medicare, or by private (extras or hospital) cover, if the individual has paid for this insurance.

In contrast to the findings of Tran et al. (2023) in the US, I do not find evidence of a direct housing wealth effect on healthcare utilisation in Australia. This is likely due to differences in the healthcare systems and out-of-pocket costs for healthcare services between the countries. My analysis is however limited due to many of the healthcare utilisation variables in the HILDA survey being binary outcome variables. This limits the reported variation in the use of healthcare services by individuals.

In addition to analysing direct wealth effects, I explore two possible indirect housing wealth effects on utilisation through health investment and health insurance. For the homeowner population of Australia, I find no evidence of a housing wealth effect on healthcare utilisation through either of these indirect channels. However, when I restrict the sample to household heads who are outright homeowners, I find evidence in support of an indirect 'health investment effect'. From previous literature, including Atalay et al. (2017) the effect of housing wealth on health is expected to be particularly salient for this part of the population. My results indicate a 100% increase in house prices is associated with a reduced probability of having been to the GP in the previous 12 months of 0.3 visits. This is a fall of 6.8% from the mean. This negative indirect of housing wealth on GP visits is an important finding. The literature on the impact of housing wealth on consumption suggests greater wealth increases purchases of goods and services. The opposite appears to be the case for GP services in Australia.

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Appendix

Appendix A

Table A1: Extended Model – Physiotherapy use

VARIABLES	(1) Log Self-Reported House Price	(2) Physical Health Index	(3) Private Insurance Extras Cover	(4) Physio Use
First stage – Instrument for Housing Price				
Log LGA Median House Price	0.801***	1.211	-0.006	
	(0.0127)	(0.7041)	(0.011)	
First stage – Instruments for Physical Health Index				
Socialisation	-0.004**	0.458***	0.003*	
	(0.0017)	(0.0946)	(0.0015)	
Smoker	0.002	1.857***	0.006	
	(0.0105)	(0.5858)	(0.0094)	
BMI	0.001	-0.349***	0.002***	
	(0.0009)	(0.0475)	(0.0008)	
Drinking	-0.002	0.730***	-0.008***	
	(0.0032)	(0.1774)	(0.0029)	
Sporting/Community club	0.004	0.850***	-0.002	
	(0.0048)	(0.2639)	(0.0042)	
Physical activity	0.001	2.102***	0.001	
	(0.0016)	(0.0874)	(0.0014)	
First stage – Instruments for Private Insurance Extras Cover				
Dentist	0.0009	0.117	0.017***	
	(0.0044)	(0.2453)	(0.0039)	
Chiropractor	-0.0056	-0.823**	0.013**	
	(0.0058)	(0.3227)	(0.0052)	
Optometrist	-0.003	0.593***	0.024***	
	(0.0038)	(0.2136)	(0.0034)	
Private Health Insurance Hospital Cover	0.052***	-1.667***	0.577***	
	(0.0087)	(0.4826)	(0.0078)	
Second stage				
Log Self-Reported House Price				-0.054*
				(0.0278)
Physical Health Index				0.003**
				(0.0011)
Extras cover				0.099***
				(0.0265)
Observations	16,999	16,999	16,999	16,999
Controls	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A2: Extended Model – Chiropractic use

	(1)	(2)	(3)	(4)

VARIABLES	Log Self-Reported House Price	Physical Health Index	Private Insurance Extras Cover	Chiropractic Use
First stage – Instrument for Housing Price				
Log LGA Median House Price	0.802***	1.037	-0.006	
	(0.0126)	(0.6698)	(0.0113)	
First stage – Instruments for Physical Health Index				
Socialisation	-0.004**	0.470***	0.003*	
	(0.0017)	(0.0940)	(0.0013)	
Smoker	0.002	1.948***	0.005	
	(0.0105)	(0.5822)	(0.0094)	
BMI	0.001	-0.356***	0.002***	
	(0.0009)	(0.047)	(0.0008)	
Drinking	-0.002	0.769***	-0.008***	
	(0.0032)	(0.1763)	(0.0029)	
Sporting/Community club	0.004	0.919***	-0.002	
	(0.0048)	(0.2623)	(0.0042)	
Physical activity	0.001	2.117***	0.001	
	(0.0016)	(0.0869)	(0.0014)	
First stage – Instruments for Private Insurance Extras Cover				
Dentist	0.0009	0.126	0.017***	
	(0.0044)	(0.2438)	(0.0039)	
Physio	-0.003	-3.585***	0.006	
	(0.0044)	(0.2444)	(0.0039)	
Optometrist	-0.003	0.448**	0.024***	
	(0.0039)	(0.2125)	(0.0034)	
Private Health Insurance Hospital Cover	0.052***	-1.443***	0.576***	
	(0.0087)	(0.4799)	(0.0078)	
Second stage				
Log Self-Reported House Price				0.022
				(0.0208)
Physical Health Index				0.00004
				(0.0008)
Private Health Insurance Extras Cover				0.009
				(0.0198)
Observations	16,999	16,999	16,999	16,999
Controls	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A3: Extended Model – Optometry use

VARIABLES	(1) Log Self-	(2) Physical	(3) Private	(4) Optometrist

	Reported House Price	Health Index	Insurance Extras Cover	Use
First stage – Instrument for Housing Price				
Log LGA Median House Price	0.802***	1.042	-0.007	
	(0.0127)	(0.6997)	(0.0113)	
First stage – Instruments for Physical Health Index				
Socialisation	-0.004**	0.472***	0.002	
	(0.0017)	(0.0940)	(0.0015)	
Smoker	0.002	1.927***	0.005	
	(0.0105)	(0.5822)	(0.0094)	
BMI	0.001	-0.356***	0.002***	
	(0.0009)	(0.0472)	(0.0008)	
Drinking	-0.002	0.762***	-0.008***	
	(0.0032)	(0.1763)	(0.0028)	
Sporting/Community club	0.004	0.926***	-0.002	
	(0.0048)	(0.2623)	(0.0043)	
Physical activity	0.001	2.111***	0.001	
	(0.0016)	(0.0869)	(0.0014)	
1st stage – Instruments for Private Insurance Extras Cover				
Dentist	0.0009	0.140	0.017***	
	(0.0044)	(0.2437)	(0.0040)	
Physio	-0.003	-3.633***	0.005	
	(0.0044)	(0.2442)	(0.0040)	
Chiropractor	-0.006	-0.979***	0.013**	
	(0.0058)	(0.3208)	(0.0052)	
Private Health Insurance Hospital Cover	0.052***	-1.414***	0.577***	
	(0.0087)	(0.4794)	(0.0078)	
Second stage				
Log Self-Reported House Price				-0.033
				(0.0314)
Physical Health Index				0.002**
				(0.0011)
Private Health Insurance Extras Cover				0.080***
				(0.0301)
Observations	16,999	16,999	16,999	16,999
Controls	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix B

Table B1: Extended model – Doctor (GP) visits, lagged house price

	(1)	(2)	(3)

VARIABLES	Log Self-Reported House Price	Physical Health Index	Doctor (GP) Visits
First stage – Instrument for Housing Price			
Log LGA Median House Price	0.767***	1.105*	
	(0.0119)	(0.6178)	
First stage – Instruments for Physical Health Index			
Socialisation	0.0001	0.341***	
	(0.0015)	(0.0759)	
Smoker	0.008	1.195***	
	(0.0087)	(0.4521)	
BMI	-0.001	-0.389***	
	(0.0008)	(0.0396)	
Drinking	0.0006	0.400***	
	(0.0026)	(0.1339)	
Sporting/Community club	-0.004	0.543**	
	(0.0042)	(0.2167)	
Physical activity	0.001	1.777***	
	(0.0014)	(0.0705)	
Second stage			
Log Self-Reported House Price			0.185
			(0.2525)
Physical Health Index			-0.063***
			(0.0107)
Observations	22,487	22,487	22,487
Controls	YES	YES	YES
Fixed Effects	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B2: Extended model – Doctor (GP) visits, sample aged 65+

VARIABLES	(1) Log Self-Reported House Price	(2) Physical Health Index	(3) Doctor (GP) Visits

First stage – Instrument for Housing Price			
Log LGA Median House Price	0.677***	0.891	
	(0.0230)	(1.3951)	
First stage – Instruments for Physical Health Index			
Socialisation	0.004	0.295	
	(0.0030)	(0.1890)	
Smoker	-0.069**	9.952***	
	(0.0290)	(1.7604)	
BMI	-0.005***	-0.116	
	(0.0018)	(0.1074)	
Drinking	-0.002	0.946*	
	(0.0084)	(0.5097)	
Sporting/Community club	0.013	0.155	
	(0.0090)	(0.2167)	
Physical activity	-0.003	2.647***	
	(0.0027)	(0.1614)	
Second stage			
Log Self-Reported House Price			-0.999
			(0.6656)
Physical Health Index			-0.094***
			(0.0184)
Observations	4,703	4,703	4,703
Controls	YES	YES	YES
Fixed Effects	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1