



# Non-cognitive traits and homeownership in Australia

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## Abstract

We empirically examine the nexus between Locus of Control (LoC) and housing tenure in Australia. Drawing on data from the Household, Income and Labour Dynamics Survey for the period 2001–2021, we find that being internal on LoC is associated with a higher likelihood of homeownership and transitioning from renting to owning a home, while being external on LoC is more likely to lead to the opposite. This result is consistent across multiple robustness checks. We also find evidence that social capital and income are transmission mechanisms through which LoC influences housing tenure. We provide some suggestions for policy.

**Keywords** Non-cognitive traits · Locus of control · Housing · Homeownership · Housing tenure decisions

## 1 Introduction

The positive effects of homeownership on individual and societal outcomes are well-established in the literature. For instance, homeownership has been found to positively impact self-esteem and housing satisfaction (Elsinga & Hoekstra, 2005); yield better educational results and promote future income prospects (Haurin et al., 2002); encourage more active

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and informed citizenry (DiPasquale & Glaeser, 1999); increase overall life satisfaction and happiness (Hu, 2013); increase assets and net worth among low and moderate income earners (Grinstein-Weiss et al., 2013); and promote neighbourhood stability leading to property values appreciation (Rohe & Stewart, 1996). In addition, homeownership is an important decision for individuals and households for two reasons. First, as a consumption good, owning a home provides physical shelter, and second, as an investment asset, it contributes to the financial wealth of households.

Given the benefits of homeownership, transitioning from renting to homeownership is encouraged by policymakers in many countries and supported through various housing policies. Several countries have enacted policies that encourage homeownership through preferential tax treatment for homeowners against renters (Andrews & Sánchez, 2011). In other contexts, policies have focused on financial market reforms that alleviate credit constraints with the aim of promoting homeownership (Andrews et al., 2011). Beyond government interventions and policies that have been put in place to influence housing tenure transitions or homeownership, various factors influence the probability of homeownership. Evidence from the literature suggests that factors such as household income, savings, subsidy policies, and, more generally, socioeconomic factors tend to influence housing tenure transitions or homeownership (see, e.g., Arimah, 1997; Bourassa & Yin, 2006; Constant et al., 2009; Helderan, 2007; Munyanyi et al., 2021; Painter et al., 2001; Robst et al., 1999).

In this paper, we seek to contribute to the literature that has examined the various determinants of homeownership by examining the role of Locus of Control (LoC) in shaping such household tenure transition decisions. According to Rotter (1966, p. 2), LoC is defined as “a generalized attitude, belief, or expectancy regarding the nature of the causal relationship between one’s own behaviour and its consequences.” Simply put, LoC captures the extent to which an individual believes life events are either under or beyond their control (Rotter & Mulry, 1965). Individuals are categorized as being either internal or external on LoC, whereby those with internal LoC believe that events in their life represent consequences of their actions, while those external on LoC tend to blame life events or outcomes on external factors, including fate, luck and other people (Cobb-Clark et al., 2016). It is recognised as a non-cognitive trait.

Several reasons can be advanced for why we expect LoC to influence the probability of homeownership. For instance, it is plausible that people who are internal on LoC may show more commitment toward achieving their homeownership goals and take more responsibility for their actions in pursuing these goals compared to those who are external on LoC (Caliendo et al., 2015; Fanghella et al., 2023). LoC has also been shown to influence various socioeconomic outcomes (see for eg. Coleman & DeLeire, 2003; Schnitzlein & Stephani, 2016; Piatek & Pinger, 2016; Salamanca et al., 2020; Fanghella et al., 2023), which are likely to influence the probability of homeownership. For instance, household income is a potential mediator of the relationship between LoC and homeownership as people who are external on the LoC have lower incomes (Awaworyi Churchill & Smyth, 2020), and people who have lower incomes have a lower probability of transitioning into homeownership (Di & Liu, 2007; Goodman & Mayer, 2018).

Similarly, we expect LoC to influence housing tenure decisions via household income and savings. Evidence suggests that people internal on LoC have higher incomes and are more likely to avoid spending their savings on current consumption (Graham & Isaac, 2002; Thaler, 1990) and thus have higher savings (Buccioli & Trucchi, 2021), which is a major requirement for homeownership (Hargreaves, 2003; Helderan, 2007; Mundra & Uwaifo Oyelere, 2017). Put differently, those who are

internal on LoC are more likely to have savings that enable them to afford required deposits and regular mortgage repayments (Kaufmann et al., 2011), which increases the probability of homeownership.

LoC is also likely to influence the probability of homeownership via social capital. Evidence suggests that being more internal on LoC is associated with higher social capital given that such people tend to maximize resources that are available to them to help shape their experiences (Austrin & Aubuchon, 1979; Gopinath et al., 2000; Mas-sari & Rosenblum, 1972). People more internal on LoC tend to build stronger networks and cultivate social cohesion (Sabatelli et al., 1983), which has been shown to influence the probability of homeownership (Brisson & Usher, 2007).

To examine the role of LoC in homeownership, we use 21 waves of panel data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey, covering 2001 to 2021. We find that being internal on LoC corresponds to a higher probability of homeownership. Internal LoC is also associated with a higher likelihood of transitioning from renting to owning a home. We also find evidence that social capital and income are channels through which LoC transmits to homeownership.

Our empirical evidence for Australia is relevant given recent and historic trends in house prices and homeownership rates. House prices in Australia are among the highest in the world (IMF, 2018), and despite suggestions the COVID-19 pandemic would lower house prices, they continue to increase in Australia (Heath, 2020). With house prices increasing at a rate faster than income, homeownership rates have consistently declined in Australia, with a 20% decline between the early 1980s and 2020 (Ong et al., 2015). There is, therefore, a growing interest in understanding the factors that influence homeownership rates in Australia. Understanding the association between LoC and housing tenure transitions can thus potentially influence policy decisions aimed at curbing the decline in homeownership rates in Australia.

We contribute to at least three segments of the existing literature. First, we add to the wider strand of literature that has examined the determinants of housing tenure. We add to this literature by being the first to examine the nexus between LoC and housing tenure. This relationship is important as it provides a unique perspective worth exploring to better understand how to shape housing policy. LoC is generally considered a personality trait that can be shaped early in life with appropriate training or education, but remains relatively stable during one's working life (Cobb-Clark & Schurer, 2013; Lekfuangfu et al., 2018). Thus, our findings that LoC influences homeownership lends support to policies that can shape personality in childhood with the aim of improving socioeconomic outcomes in adulthood. Such policies can include educational programs and curriculum development to focus on positive control beliefs among children (Cahill et al., 2014). Second, we contribute to the literature that demonstrates a link between being internal on LoC and various socioeconomic outcomes. We show that, in addition to several socioeconomic outcomes explored in the literature, LoC also contributes to homeownership rates. Third, by examining social capital as a channel of influence, we add to literature that has examined the relationship between LoC and social capital on the one hand, and the link between social capital and homeownership on the other hand.

The rest of the paper is structured as follows. In Sect. 2, we present the data and variables. In Sect. 3, we discuss the empirical methodology. The results are presented and discussed in Sect. 4, and the paper is concluded in Sect. 5.

## 2 Data

We use the HILDA survey, which is a nationally representative household longitudinal survey that focuses on the health, wellbeing, work life and socioeconomic dynamics of Australians. The survey commenced in 2001 and has since produced 21 annual waves. The design of the HILDA Survey is akin to other household panel surveys such as the German Socio-Economic Panel (GSOEP) and the British Household Panel Survey (BHPS). The sampling unit of the HILDA survey is the household with sampling done using a multi-stage approach as detailed in Watson and Wooden (2012). The data collected during the HILDA Survey are almost entirely self-reported, interviews conducted for individuals aged 15 years and above. All household members that provided at least one interview in the first wave formed the basis of the panel and were thus reinterviewed in each subsequent wave. The initial sample had 19,914 people in 7682 households (Summerfield et al., 2019).

We use Release 21 of the HILDA survey, which covers 21 years spanning the period 2001 to 2021. Because homeownership is a household level variable, consistent with the literature on the determinants of homeownership, our main explanatory variable and associated covariates focus on the household reference person (Awaworyi Churchill et al., 2021; Borjas, 2002; Constant et al., 2009; Mintah et al., 2022).<sup>1</sup>

### 2.1 Measuring LoC

LoC is measured in the HILDA survey using the Mastery Scale (Pearlin & Schooler, 1978). The seven-item scale captured in waves 3, 4, 7, 11, 15 and 19 are: “(1) I have little control over the things that happen to me; (2) There is really no way I can solve some of the problems I have; (3) There is little I can do to change many of the important things in my life; (4) I often feel helpless in dealing with the problems of life; (5) Sometimes I feel that I’m being pushed around in life; (6) What happens to me in the future mostly depends on me; and (7) I can do just about anything I really set my mind to do”. The response to each item on the Mastery Scale ranges from one to seven where one is “strongly disagree” and seven is “strongly agree”. Individuals who believe that things are within their control are deemed to be internal on LoC, while those who believe that forces outside of their control determine what happens to them in life are deemed external on LoC (Rotter & Mulry, 1965). Accordingly, on the Mastery Scale, higher scores on the first five items suggest being more external on the LoC scale, while higher values on the sixth and seventh items denote being more internal.

Our main indicator of LoC is a 7-point scale where higher values indicate more internal LoC (see, e.g., Awaworyi Churchill et al., 2020; Cobb-Clark & Schurer, 2013). We derive this indicator by reverse coding responses to the first five items and then combining them with items six and seven by taking the average. This ensures a consistent scale for all seven items such that an increase on the scale indicates internal LoC. We also consider internal and external LoC separately, where we use the first five items on the Mastery Scale to capture external LoC and the sixth and seventh items on the scale to measure internal LoC.

<sup>1</sup> Given that the HILDA survey does not identify a household head. We follow the literature and identify a household reference person as the individual with the highest income in each household (see, e.g., Awaworyi Churchill & Smyth, 2020, 2021; Farrell & Fry, 2021).

Evidence suggests that LoC is generally stable among working-class adults given that for this group of individuals, LoC remains independent of changes in life events. Thus, for people between the ages of 21 and 59 years, the literature typically treats LoC as exogenous (Awaworyi Churchill & Smyth, 2021; Buddelmeyer & Powdthavee, 2016; Cobb-Clark & Schurer, 2013). Hence, we restrict our analysis to respondents in this age group in our main analysis and use the average of LoC across all the waves which report on LoC.

## 2.2 Measuring housing tenure

Our main indicator of housing tenure capture transition from renting to owning a home. To measure transition into homeownership, we use a dummy variable set equal to one if the respondent transitioned from being a renter to homeowner. We derive this variable using the HILDA survey question which asks respondents: “Do you (or any other members of this household) own this home, rent it, or do you live here rent free?” We focus our analysis on respondents that are either renting or own their homes and derive binary variable that captures those who transitioned from renting to homeownership. Consistent with the broader literature that focuses on homeownership status (see, e.g., Awaworyi Churchill et al., 2021; Borjas, 2002; Constant et al., 2009; Mintah et al., 2022), in our baseline results, we also include an indicator of homeownership status. Here, using the response from the above question, we derive a binary variable for homeownership (*Owner*) set equal to one if the respondent owns their home, and zero if renting. Given that this is a household level question, our analysis focuses on the household reference person as defined earlier.

## 2.3 Mediators

We examine social capital and income as mechanisms through which LoC influences housing tenure. We use two indicators to measure social capital. The first indicator captures generalized trust (see, e.g., Awaworyi Churchill et al., 2019; Awaworyi Churchill & Smyth, 2021; Leigh, 2006), and is based on the HILDA survey question: “To what extent do you agree or disagree with the following statement: generally speaking, most people can be trusted?” The responses are on a seven-point scale, where one is “strongly disagree” and seven “strongly agree”. Trust is often considered one of the most important indicators of social capital (see, e.g., Awaworyi Churchill et al., 2019; Awaworyi Churchill & Mishra, 2017; Galindo-Pérez-de-Azpillaga et al., 2014; Poortinga, 2006). Social capital refers to resources that groups and individuals can benefit from as part of their relationships and networks (Poortinga, 2006; Putnam, 2000). Trust is typically considered the most fundamental component of social capital given that building and maintaining relationships depend on trust. People are more likely to share resources, cooperate and engage in mutually beneficial transactions when they trust each other. Trust is, therefore, the foundation of many social relationships including personal, professional and community-based relationships (Putnam, 1996, 2000). The importance of trust as an indicator of social capital is reflected in Arrow’s (1972) summary which notes that “virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period. It can be plausibly argued that much of the economic backwardness in the world can be explained by the lack of mutual confidence” (Arrow, 1972, p. 357). The use of trust as a measure of social capital is therefore common in the literature given that it reflects the strength and quality of social networks, and the extent to which people would make

relevant resources available to each other (see, e.g., Awaworyi Churchill et al., 2023; Kwon et al., 2013; Mayer et al., 1995; Poortinga, 2006; Rousseau et al., 1998).

Our second indicator of social capital is an index that focuses on the dimensions of social cohesion and networking, and reflects the extent to which respondents agree or disagree with sentiments about the level of social cohesion with their neighbors (Clark & Lisowski, 2018). Cohesion and networks are two important components of social capital. Cohesion refers to the extent to which there is solidarity, unity or togetherness within a community or social group (Schiefer & van der Noll, 2017). High levels of cohesion signal strong social ties and trust within a group or community and reflects in the willingness of group or community members to cooperate and support each other. Social cohesion fosters a sense of belonging, mutual responsibility and shared identity (Schiefer & van der Noll, 2017; Stanley, 2003). Similarly, social network is an important indicator of social capital, which reflects the connections that individuals or groups have with each other and others within a community or society (Son & Feng, 2019). These networks can be based on personal, professional, and community relationships. The importance of networks as a fundamental indicator of social capital is reflected in the definition of Putnam (1996), who popularized the concept of social capital and defines it as “networks, norms, and trust that enable participants to act together more effectively to pursue shared objectives” (Putnam, 1996, p. 56).

Consistent with the literature, we use two sets of questions available in waves 6, 10, 14, and 18 of HILDA to derive our composite indicator of social capital (Awaworyi Churchill & Farrell, 2020; Clark & Lisowski, 2018). The first set of questions asks respondents: “How common are the following things in your local neighbourhood? (1) Neighbours helping each other out, and (2) Neighbours doing things together”. The responses to these questions are on a five-point scale where one is ‘never happens’ and five is ‘very common’. The second set of questions, asks respondents: “To what extent do you agree or disagree with the following statements about your neighbourhood? (1) This is a close-knit neighbourhood, (2) People in this neighbourhood can be trusted, (3) People in this neighbourhood generally do not get along with each other, and (4) People in this neighbourhood generally do not share the same values”. The responses to these questions are on a seven-point response scale where one is ‘strongly disagree’ and seven is ‘strongly agree’. We reverse code the responses to questions (3) and (4). The index of social capital is the average across the six questions with higher values representing higher levels of social capital (i.e., social cohesion and networking) within the neighbourhood.

We measure income as annual household financial year disposable regular income, and this is captured in the HILDA survey.

## 2.4 Control variables

In line with studies that have examined the determinants and antecedents of homeownership and housing tenure transitions, we control for a set of covariates (Awaworyi Churchill et al., 2021; Borjas, 2002; Constant et al., 2009). These covariates include age, gender, education, employment status, marital status, household size, household income, country of birth and geographic location. We also control for the Socio-Economic Indexes for Areas (SEIFA) Decile of Index of relative socio-economic advantage/disadvantage available in the HILDA survey and average house prices taken from the Securities Industry Research Centre of Asia-Pacific (SIRCA) database. Appendix Table 5 presents a description and summary statistics of variables included in our analysis.

**Table 1** Mean Values of LoC by Housing Tenure Status

Variables	Owner	Renter	Total	Gap	Absolute t-stat
<i>Panel A: overall LoC</i>					
LoC	5.526 (0.004)	5.326 (0.005)	5.449 (0.003)	- 0.199 (0.006)	- 34.943***
<i>Panel B: internal LoC</i>					
LoC	5.489 (0.004)	5.456 (0.005)	5.477 (0.003)	- 0.031 (0.005)	- 4.977***
<i>Panel C: external LoC</i>					
LoC	2.459 (0.004)	2.727 (0.006)	2.563 (0.003)	0.267 (0.007)	41.003***

Standard errors are in parentheses. \*\*\* Denotes significance at 1% level for the t-statistics of mean differences

### 3 Methodology

We estimate the following equation:

$$HT_{it} = \beta_1 LoC_i + \sum_n \beta_n X_{n,it} + L_s + \tau_t + \varepsilon_{it} \quad (1)$$

$HT$  is the indicator of housing tenure of household  $i$  at time  $t$ ;  $LoC$  represents the household reference person's of locus of control;  $X$  is a set of covariates that are likely to influence housing tenure;  $L_s$  and  $\tau_t$  denote state and year fixed effects, respectively; and  $\varepsilon_{it}$  is the error term. We estimate Eq. (1) using ordinary least squares (OLS). However, in robustness checks, we also consider the probit model.

### 4 Results

Table 1 reports the mean differences in LoC by homeownership status. Panel A shows statistics for overall LOC that combines the items on the external and internal scales. The statistics show that people who live in rented homes are, on average, more external on LoC, while homeowners are more internal on LoC. The mean difference in LoC by homeownership status is 0.199. Similar statistics are reported in Panel B for the separate construct of internal LoC, and in Panel C for external LoC. The statistics from these columns support the conclusion that homeowners have higher internal LoC, while renters have higher external LoC.

Table 2 presents results for the effects of LoC on homeownership status and the transition from renting to ownership.<sup>2</sup> Column (1) presents unconditional estimates on the effects of LoC on homeownership (*owner*), while Column (2) presents estimates conditioned on a set of control variables previously discussed. Similarly, Column (3) presents unconditional estimates on the effects of LoC on the transition from renting to ownership (*transition*), while Column (4) controls for the relevant covariates. In Panel A, we

<sup>2</sup> The full set of results with all covariates are reported in Table A2 in the appendix.

**Table 2** LoC and Housing Tenure (Baseline)

Variables	(1)	(2)	(3)	(4)
	Owner	Owner	Transition	Transition
<i>Panel A: overall LoC</i>				
LoC	0.056*** (0.004) [0.106]	0.020*** (0.004) [0.041]	0.026*** (0.003) [0.069]	0.018*** (0.003) [0.050]
Controls	No	Yes	No	Yes
State and Time FE	Yes	Yes	Yes	Yes
Observations	107,649	105,546	107,649	105,546
<i>Panel B: effect of internal LoC</i>				
Internal LoC	0.050*** (0.005) [0.099]	0.022*** (0.004) [0.045]	0.007** (0.003) [0.021]	0.008*** (0.003) [0.023]
Controls	No	Yes	No	Yes
State and Time FE	Yes	Yes	Yes	Yes
Observations	107,649	105,546	107,649	105,546
<i>Panel C: effect of external LoC</i>				
External LoC	− 0.057*** (0.004) [− 0.120]	− 0.021*** (0.004) [− 0.043]	− 0.025*** (0.003) [− 0.078]	− 0.017*** (0.003) [− 0.051]
Controls	No	Yes	No	Yes
State and Time FE	Yes	Yes	Yes	Yes
Observations	107,649	105,546	107,649	105,546

The outcome variable in Columns (1) and (2) is homeownership status

The outcome variable in Columns (3) and (4) is the indicator capturing transition from renting to ownership

Standardized coefficients in brackets

Robust standard errors in parentheses

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

use the overall indicator of LoC based on all seven items. In Panels B and C, we use the separate constructs of internal LoC and external LoC, respectively.

Consistently, we find that being internal on LoC corresponds to an increase in the likelihood of homeownership and transition from renting to ownership. In Column (1) of Panel A, an increase in the LoC scale by one standard deviation (i.e., being more internal on LoC) corresponds to an increase of 0.106 standard deviations in the likelihood of homeownership. In Column (2), the inclusion of covariates causes a decline in the magnitude of the coefficient. Here, an increase in the LoC scale by one standard deviation corresponds to an increase of 0.041 standard deviations in the likelihood of homeownership. Turning to the results for transition from renting to ownership, the findings from Column (3) demonstrate that an increase in the LoC scale by one standard deviation corresponds to an increase of 0.069 standard deviations in the likelihood of transitioning from renting to owning a home. Similarly, when we control for covariates in Column (4), an increase in the LoC scale by one standard deviation corresponds to an increase of 0.050 standard deviations in the likelihood of transitioning from renting to owning a home.

**Table 3** LoC and Rent to Ownership Transition

Variables	(1) Transition	(2) Transition	(3) Transition
<i>Panel A: contemporaneous effect of LoC</i>			
LoC	0.012*** (0.002)	0.004*** (0.001)	– 0.011*** (0.002)
Controls	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
State and Time FE	Yes	Yes	Yes
Observations	29,642	29,642	29,642
<i>Panel B: lag effect of LoC</i>			
LoC (lag)	0.013*** (0.002)	0.007*** (0.002)	– 0.011*** (0.002)
Controls	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
State and Time FE	Yes	Yes	Yes
Observations	23,552	23,552	23,552

The outcome variable is the indicator capturing transition from renting to ownership

Column (1) reports results for Overall LoC;

Column (2) reports results for Internal LoC;

Column (3) reports results for External LoC

Robust standard errors in parentheses

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

From Panels B and C, being more internal on LoC corresponds to an increase in the likelihood of homeownership, while being external on LoC corresponds to a decline in the likelihood of homeownership. Similarly, being more internal on LoC corresponds to an increase in the likelihood of transitioning from renting to owning a home, while being external on LoC corresponds to a decline in the likelihood of transitioning from renting to owning a home. Focusing on the conditional estimates in Column (2), being more internal on LoC corresponds to an increase of 0.045 standard deviations in the likelihood of homeownership, while being more external on LoC corresponds to a 0.043 standard deviation decline in the likelihood of homeownership. From Column (4), the conditional estimates show that a one standard deviation increase in the internal LoC scale (i.e., being more internal on LoC) corresponds to an increase of 0.023 standard deviations in the likelihood of transitioning from renting to owning a home, while a standard deviation increase on the external LoC scale (i.e., being more external on LoC) corresponds to a 0.051 standard deviation decline in the likelihood of transitioning from renting to owning a home.

In Table 3, we take advantage of the panel dimension of the HILDA survey and focus only on the waves for which data on LoC is available (i.e., 3, 4, 7, 11, 15 and 19) to run an individual fixed effect model. Taking advantage of the panel dimension also allows us to examine the impact of the lag of LoC on the transition from renting to owning a home in the next period. Thus, in Table 3, we focus on the transition from renting to owning as the outcome of interest and run two set of models. The first set of models in Panel A focus on the contemporaneous effect of LoC on the transition from renting to owning a home,

**Table 4** Causal mediation analysis

	Indirect effect		Direct effect	
	Estimate	95% confidence interval	Estimate	95% confidence interval
LoC = > trust = > Transition	0.457*** (0.025)	[0.408, 0.506]	0.025*** (0.002)	[0.021, 0.029]
LoC = > social capital = > Transition	0.171*** (0.005)	[0.161, 0.181]	0.021*** (0.001)	[0.018, 0.024]
LoC = > Income = > Transition	0.190*** (0.003)	[0.184, 0.197]	0.021*** (0.001)	[0.019, 0.023]

Bootstrap standard errors in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

while the second set of models in Panel B focus on the lag effect of LoC. Column (1) reports results for the overall LoC scale while Columns (2) and (3) report results for the internal and external LoC scales, respectively. We find that the findings in Table 3 reinforce those from Table 2. Specifically, we find that being more internal on LoC is associated with an increase in the likelihood of transitioning from renting to owning a home, while being more external on LoC is associated with a decrease in the likelihood of transitioning from renting to owning a home.

#### 4.1 Social capital and income as channels

To examine whether social capital and income mediate the relationship between LoC and housing tenure, we adopt the causal mediation analysis described in Imai et al., (2010a, 2010b). Unlike the linear structural equation model, which has stronger functional form assumptions, the causal mediation analysis relaxes these assumptions and allows for non-parametric identification of causal mediation effects (Imai et al., 2010a, 2010b). This approach allows us to apply a framework where the observed mediation (in our case for social capital and income) is independent of all potential outcomes given the observed pre-treatment and treatment covariates (Imai et al., 2010a). Thus, the causal mediation analysis takes into account the potential endogenous nature of the mediators and appropriately accounts for this in the analysis.

We report the results from the causal mediation analysis in Table 4. We find that LoC increases the likelihood of transitioning from renting to owning a home through each of our mediators. The indirect effects suggest that being more internal on LoC is associated with an increase in income, trust, and the composite indicator of social capital. Coupled with the direct effect, which is positive and significant, our results suggest that LoC increases the likelihood of transitioning from renting to owning a home by positively influencing trust, the composite indicator of social capital and income, which are relevant for homeownership.

#### 4.2 Robustness checks and extensions

We examine the robustness and sensitivity of our results under different scenarios. In a first set of checks, we consider alternative ways of measuring LoC. First, we use an alternative

indicator based on a 7–49 point scale, where 7 means external LoC and 49 means internal LoC (see, e.g., Awaworyi Churchill & Smyth, 2021; Buddelmeyer & Powdthavee, 2016; Caliendo et al., 2015). To derive this indicator, we reverse code the responses to ensure that on each of the items, higher values on the scale reflect more internal on LoC. We then sum up the scores on the responses from the first five items, less the scores on responses from the sixth and seventh items, plus 16. Second, we use the predicted factor derived from a principal component analysis (PCA) to generate an LoC index (Caliendo et al., 2020; Piatek & Pinger, 2016). We assign weights, which we determine from the PCA, to each of the items on the LoC scale, and then standardize the LoC index. This index has been shown to address potential measurement and accentuation bias that may affect LoC (Piatek & Pinger, 2016). A different approach to dealing with measurement error, if any, is to use the predicted LoC drawn from a regression where LoC is the outcome and conditioned on the standard set of control variables included in our model (Awaworyi Churchill et al., 2020; Buddelmeyer & Powdthavee, 2016). Last, while the stability of LoC for working-age populations is well-established and thus reverse causality is not much of a concern, in another check, we use the indicator of LoC from the first HILDA wave which collected information on LoC as way to minimize any possibility of reverse causality (Etilé et al., 2020). The results, which are reported in Table 7, reinforce the positive association between being internal on LoC and homeownership.

In a second set of robustness checks, we consider alternative estimation methods. Our main results are based on linear probability models given that they are easier to interpret. However, given that our dependent variables are binary variables, a probit model could also be used to estimate Eq. (1). Thus, in Table 8 we examine the robustness of our results to the probit model. Additionally, we examine the robustness of our results to the Lewbel (2012) 2SLS approach, which is an estimation strategy used to address endogeneity and does not rely on a valid exclusion restriction. This approach relies on heteroskedasticity in the data to achieve identification (Lewbel, 2012), which we satisfy in our data using the Breusch and Pagan test for heteroskedasticity (Breusch & Pagan, 1979). This approach has been widely used in the literature when valid external instruments are not available or as a robustness check on findings with external instruments (see, e.g., Amega et al., 2023; Baako et al., 2023; Koomson & Awaworyi Churchill, 2022; Koomson & Churchill, 2021; Mishra & Smyth, 2015; Munyanyi et al., 2020; Prakash et al., 2020, 2022). The results from both the probit model and the Lewbel 2SLS analysis are consistent with our main finding.

In a last check, we examine the robustness of our results to omitted variable bias. To do so, in Table 9, we conduct the Oster (2019) bounds analysis, which allows us to examine the extent of bias due to unobserved variables (see, e.g., Avendano et al., 2020; Awaworyi Churchill & Asante, 2023; García-López et al., 2020; Hailemariam et al., 2021; Liu et al., 2021). Column (1) of Table 9 reports the unconditional effect of LoC on homeownership, while Column (2) reports the conditional effect of LoC. Column (3) reports the identified set for the effects of LoC on homeownership, while Column (4) shows whether the identified set excludes zero. Column (5) reports the value of  $\delta$ , which is the ratio of the impact of unobserved control variables relative to the observed control variables that would hypothetically push the estimate of LoC to zero.  $\delta$  is 2.682, which implies that if omitted variables are potentially biasing the estimates, the effect would have to be at least 2.7 times greater than the effect of the included independent variables, and this is unlikely. Here, as delta gets larger, the assumption is that omitted variable bias is unimportant as the influence of omitted variables is minimal. Specifically, because we have controlled for an extensive range of covariates in the model, the value of delta (i.e., 2.7) implies that for omitted

variable to be a problem, the effect of any missed unobservable factor should be 270% more important than the observed covariates to influence the estimates. This is unlikely and thus, we conclude that omitted variable bias is not a concern.

## 5 Conclusion

Drawing on 21 waves of HILDA survey data spanning 2001 to 2021, we examine the effect of LoC on homeownership in Australia. We find that being internal on LoC corresponds to a higher probability of homeownership and transition from renting to owning a home. We explore social capital and income as possible channels through which LoC influences homeownership. We argue that people who are more internal on LoC have higher levels of social capital and income (Khan et al., 2014; Sharan & Romano, 2020), which impacts on various socioeconomic outcomes including homeownership.

On the practical implications of this study, we argue that developing the LoC of individuals can increase the probability of their homeownership despite the rising prices of homes in Australia. Over the last decade, it is widely known that house prices in Australia have experienced significant growth compared to incomes. Consequently, for many Australians, homeownership may remain only a dream. For those who are internal on LoC, this may seem a challenge to surmount, but they may adopt measures to realise their homeownership objective due to the trait of believing that they are responsible for the events that occur in their lives. However, those who are more external on LoC may give up on the dream of homeownership. To this end, it is suggested that policies aimed at developing the LoC of individuals be pursued by the Australian government to improve the LoC of those external on LoC to influence their response and motivation to realise their homeownership dream despite soaring house prices.

These results highlight an important policy consideration. That LoC influences the probability of homeownership suggests that efforts to promote (internal) LoC has implications for homeownership. This is a new policy avenue that will complement existing efforts that have so far centred primarily on financial support through grants that support homeownership (AIHW, 2021). This is a viable approach as existing research has demonstrated that LoC can be influenced during childhood before it stabilizes. Thus, by incorporating curriculums that focus on positive self-control beliefs (Schurer, 2017), and encouraging parenting that promotes internal LoC (Ahlin & Antunes, 2015), improvements in socioeconomic outcomes in later life, including homeownership, can be expected.

Finally, our finding that social capital is indeed a channel of transmission through which LoC can influence homeownership rates can potentially influence practical and policy considerations. In addition to efforts to promote (internal) LoC during childhood as identified immediately above, policies that empower people, young and old, to build social capital will also potentially influence housing tenure outcomes. In effect, social policies can be used to indirectly augment homeownership rates, especially after LoC has stabilised in adults.

## Appendix

See Tables 5, 6, 7, 8, 9.

**Table 5** Description and summary statistics of variables

Variable	Descriptions	Mean	SD
Owner	Housing tenure is 'own' as opposed to renting or living rent-free	0.612	0.487
Rent to own	Transitioned from renter to an owner	0.855	0.352
LoC	Locus of control index on 1–7 scale	5.449	1.111
Internal LoC	Internal LoC scale	5.477	0.989
External LoC	External LoC scale	2.563	1.052
Age	Age of household reference person	40.571	10.810
Age squared	Square of age/100	17.629	8.780
Male	Household reference person is male	0.616	0.486
Female	Household reference person is female	0.384	0.486
Dependents	Number of dependents in household aged 0–24 years	0.886	1.151
Separated	Household reference person stated their marital status as separated	0.049	0.215
Divorced	Household reference person stated their marital status as divorced	0.091	0.288
Widowed	Household reference person stated their marital status as widowed	0.012	0.108
Single	Household reference person stated their marital status as single	0.232	0.422
Married/De facto	Household reference person stated their marital status as married or in a de facto relationship	0.616	0.486
Income	Log of household income	10.601	0.615
Employed	Household reference person stated their labor force status as employed	0.862	0.344
Unemployed	Household reference person stated their labor force status as unemployed	0.028	0.166
Not in Labor Force	Household reference person stated their labor force status as not in labor force	0.109	0.311
Postgraduate	Household reference person stated their highest education level achieved as masters or doctorate	0.063	0.243
Graduate Diploma	Household reference person stated their highest education level achieved as graduate diploma or certificate	0.068	0.252
Bachelor	Household reference person stated their highest education level achieved as bachelor or honours	0.173	0.379
Diploma	Household reference person stated their highest education level achieved as advanced diploma or diploma	0.100	0.301
Certificate	Household reference person stated their highest education level achieved as certificate I, II, III or IV	0.262	0.439
Year 12	Household reference person stated their highest education level achieved as year 12 or below	0.333	0.393
City	Household lives in a metropolitan area	0.409	0.499
Australia born	Household reference person is born in Australia	0.611	0.483

**Table 5** (continued)

Variable	Descriptions	Mean	SD
SEIFA	Socio-Economic Indexes for Areas (SEIFA) Index	5.542	2.862
Trust	Indicator of generalized trust (1–7 scale)	4.562	1.353
Social capital	Social capital composite index	3.567	1.085

**Table 6** LoC and Housing Tenure (Full Results)

Variables	(1) Owner	(2) Transition
LoC	0.020*** (0.004) [0.041]	0.018*** (0.003) [0.050]
Female	– 0.001 (0.001)	– 0.046*** (0.005)
Age	0.002*** (0.000)	0.026*** (0.002)
Age squared	– 0.002*** (0.000)	– 0.028*** (0.002)
Dependants	– 0.004*** (0.000)	– 0.011*** (0.002)
Separated	0.003*** (0.001)	0.060*** (0.009)
Divorced	0.005*** (0.001)	0.057*** (0.008)
Widowed	0.009*** (0.002)	0.058*** (0.014)
Single	– 0.000 (0.001)	0.009 (0.007)
Income	0.006*** (0.000)	0.018*** (0.001)
Employed	0.006*** (0.001)	0.046*** (0.007)
Postgrad	– 0.012*** (0.001)	0.005 (0.009)
Graduate diploma	0.007*** (0.001)	0.021*** (0.008)
Bachelor	0.007*** (0.001)	0.025*** (0.007)
Diploma	0.003*** (0.001)	0.006 (0.008)
Certificate	0.002*** (0.001)	– 0.004 (0.006)
Metro	– 0.010*** (0.001)	– 0.033*** (0.005)
Disability	– 0.002*** (0.001)	– 0.013** (0.005)
House prices	– 0.077*** (0.000)	– 0.022*** (0.000)
SEIFA	0.004*** (0.000)	0.003*** (0.001)
Constant	0.064*** (0.005)	0.231*** (0.041)
Observations	105,546	105,546
R-squared	0.995	0.261

**Table 6** (continued)

Standardized coefficients in brackets  
 Robust standard errors in parentheses  
 $***p < 0.01$ ,  $**p < 0.05$ ,  $*p < 0.1$

**Table 7** Alternative Measures of LoC

Dependent Variable: Transition to Homeownership				
Variables	(1)	(2)	(3)	(4)
LoC	0.002*** (0.000) [0.030]	0.019*** (0.004) [0.043]	0.154*** (0.013) [0.217]	0.013*** (0.003) [0.020]
Observations	105,546	105,546	105,546	105,546

The dependent variable for each column is the transition from renting to ownership binary variable

Column (1) is LoC based on the 7–49 point scale; Column (2) is LoC index based on factor analysis;

Column (3) is LoC index based on predicted values; Column (4) Is LoC from the earliest wave of HILDA

Robust standard errors in parentheses

$***p < 0.01$ ,  $**p < 0.05$ ,  $*p < 0.1$

**Table 8** Alternative estimation methods

Variables	(1) Ownership	(2) Transition
<i>Panel A: probit</i>		
LoC	0.091*** (0.013)	0.106*** (0.016)
Observations	105,546	105,546
<i>Panel B: lewbel 2SLS</i>		
LoC	0.086*** (0.009)	0.029*** (0.003)
Observations	105,546	105,546

All regressions include relevant covariates consistent with Table 2

Cluster robust standard errors in parentheses

$***p < 0.01$ ,  $**p < 0.05$ ,  $*p < 0.1$

**Table 9** Parameter stability and robustness to omitted variable bias

Treat- ment variable	(1) Baseline effect, $\beta$	(2) Controlled effect, $\tilde{\beta}$	(3) Identified set	(4) Exclude zero?	(5) $\bar{\delta}$ for $\beta = 0$ given $R_{max}$
	(Std. error)[ $\hat{R}$ ]	(Std. error)[ $\tilde{R}$ ]	$[\tilde{\beta}, \beta^*(\min\{1.3\tilde{R}, 1\}, 1)]$		
LoC	0.056*** (0.004) [0.014]	0.020*** (0.004) [0.246]	[0.005, 0.057]	Yes	2.682
N	105,546	105,546			

Results of the uncontrolled and controlled models are from OLS regressions

The controlled regression includes full set of control variables

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

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