

# Housing Wealth Effects: Evidence from New Vehicle Registrations

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This article investigates the relationship between housing wealth and consumption using postcode-level variation in housing prices and new passenger vehicle registrations as a proxy for consumption at a postcode level. It is estimated that a one per cent increase in housing wealth is associated with about half a per cent increase in new passenger vehicle registrations – the consumption indicator. But because new vehicle consumption is likely to be particularly sensitive to changes in housing wealth, the results suggest a relatively modest relationship between housing wealth and total consumption.

## Introduction

Understanding the magnitude of the relationship between housing prices and consumption is important because it informs the extent to which developments in the housing sector can have broader macroeconomic effects. There is general agreement among policymakers and academics that there is a positive correlation between housing prices and consumption, but there is disagreement on the magnitude of the relationship. Some have argued that housing wealth is akin to financial wealth, which suggests a potentially large effect of housing wealth on consumption (e.g. Case, Quigley and Shiller 2005). Others argue that housing wealth is fundamentally different from financial wealth because home owners are both owners of housing assets and consumers of housing services (e.g. Sinai and Souleles 2005; Buiter 2010). A home owner could sell their house following a rise in housing prices and realise a capital gain, but they would then have to rent, and may not be better off if higher housing prices are indicative of higher expected future rents. But even if changes in housing prices have little effect on lifetime net wealth, higher housing prices may facilitate an increase

in consumption by relaxing collateral constraints (Iacoviello 2004). Since theory can rationalise both a large and small relationship between housing prices and consumption, identifying its magnitude is ultimately an empirical question.

Much of the literature has used time-series variation to estimate the relationship between housing prices and consumption, either at a national or state level (e.g. Dvornak and Kohler (2007) for Australia). A limitation of this approach is the difficulty of separating the direct effect of housing prices on consumption from ‘third factors’. For example, a rise in expected future incomes may lead to a greater preparedness to pay more for housing (and therefore higher housing prices) and to spend more on non-housing consumption, which would produce a positive correlation between housing prices and consumption in the absence of any direct effect. This article revisits the relationship between housing prices and consumption using cross-sectional postcode-level variation in housing prices. By using cross-sectional variation, we can control for any economy-wide third factors that could otherwise cause comovement between housing prices and consumption.<sup>1</sup>

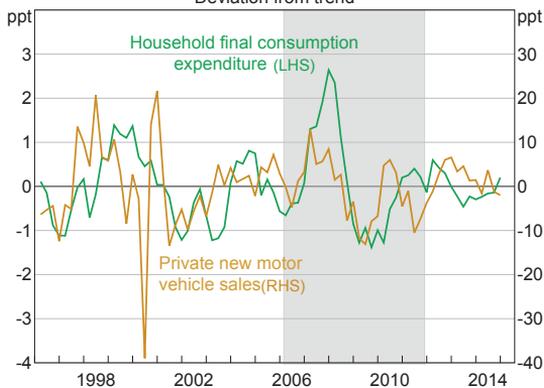
\* The authors are from Economic Group. This article is based on Gillitzer and Wang (2015), by the same authors. Please refer to the paper for details on data, sources and methodology.

1 This methodology implicitly relies on there being relatively few home owners moving between postcodes over the sample period, or on those leaving a postcode being economically similar to those who enter.

## Housing Price and Consumption Data

Unit record data on property sales for Sydney, Melbourne and Brisbane are used to measure housing price changes by postcode. The housing price data are adjusted to account for variation in the size and type of housing sold in each postcode. A limitation of the methodology is the absence of a comprehensive measure of consumption at the postcode level. Instead, new passenger vehicle registrations are used as the proxy for consumption. These are available annually at the postcode level. Vehicle registration data are administrative records rather than survey-based, and therefore have low measurement error.<sup>2</sup> The approach here relies on new vehicle registrations being a suitable proxy for total consumption. Reassuringly, the cyclical behaviour of new vehicle sales and total consumption are similar (Graph 1).<sup>3</sup>

**Graph 1**  
Consumption and Private Motor Vehicle Sales\*  
Deviation from trend



\* Series have been de-trended using a Hodrick-Prescott filter with a smoothing parameter  $\lambda = 1\,600$ , as is standard for quarterly frequency data

Sources: ABS; FCAI/VFACTS; Gillitzer and Wang (2015)

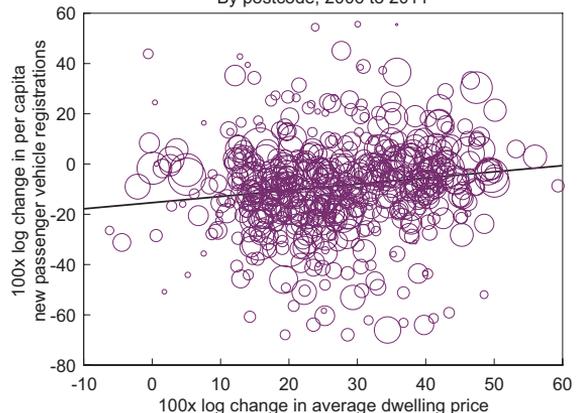
2 Disaggregated consumption data are difficult to come by, and new vehicle registrations are the only high-quality postcode-level consumption measure available in Australia.

3 Graph 1 shows aggregate vehicle sales data because the postcode-level registration data used in this analysis are unavailable at a quarterly frequency. The introduction of the GST in July 2000 caused a substantial re-timing of purchases.

## Descriptive Analysis

A postcode-level plot indicates that growth in per capita new passenger vehicle registrations was generally a bit higher in postcodes experiencing relatively high housing price growth over the period 2006 to 2011 (Graph 2). Attention is restricted to this time period in Graph 2 to align with the Census of Population and Housing (the Census), which is the source for postcode-level data used in the next section. The wide variation in housing price growth across postcodes evident in Graph 2 is highly informative for this analysis; average housing price growth from 2006 to 2011 was 28 per cent with a standard deviation of 11 per cent. However, the small number of postcodes that experienced a fall in average housing prices between 2006 and 2011 limits the scope of the data to determine whether new vehicle registrations respond asymmetrically to rises and falls in housing prices. The line of best fit shown in Graph 2 indicates that (other things equal) each 1 percentage point increase in housing prices is associated with a 0.24 per cent increase in new passenger vehicle registrations per capita.

**Graph 2**  
New Passenger Vehicle Registrations and House Price Growth\*  
By postcode, 2006 to 2011



\* Size of circles is proportional to postcode population in 2006 and the regression line is population weighted; a small number of extreme observations have been excluded from the figure

Sources: ABS; APM; FCAI/VFACTS; Gillitzer and Wang (2015)

## Regression Analysis

### Specification

Having established some preliminary evidence of a relationship between housing prices and new vehicle registrations, a regression framework is now used to provide more formal evidence. This allows the relationship between housing prices and new vehicle registrations to be estimated by controlling for other determinants of new vehicle registration growth. A rich set of postcode-level controls from the Census is used: income, housing tenure type, usual monthly mortgage repayments, educational attainment, and the unemployment rate.

This leads to the following regression:

$$\Delta c_{i,2006-11} = \alpha + \beta(\Delta hp_{i,2006-11} \times s_{i,2006}^{own}) + \sum_j \gamma_j X_{i,j} + \varepsilon_i \quad (1)$$

where  $\Delta c_{i,2006-11}$  is the log change in per capita new passenger vehicle registrations in postcode  $i$  between 2006 and 2011,  $\Delta hp_{i,2006-11}$  is the log change in housing prices over the same period,  $s_{i,2006}^{own}$  is the share of households in postcode  $i$  owning their home outright or with a mortgage, each  $X_{i,j}$  is a control variable for postcode  $i$  (e.g. the unemployment rate in postcode  $i$ ),  $\alpha$  is a constant term, and  $\beta$  is the relationship between gross housing wealth and per capita new passenger vehicle registrations. As both the proxy for consumption and housing prices are expressed as log changes, the coefficient  $\beta$  can be interpreted as an elasticity. Housing price growth is scaled by the share of households owning their home in each postcode under the assumption that new vehicle registrations for renters is unaffected by fluctuations in housing prices, a restriction that cannot be rejected.<sup>4</sup> Without accurate data on housing leverage by postcode, the focus is on gross, rather than net, housing wealth throughout.

4 This was tested by augmenting the right-hand-side of Equation (1) with the term  $(\Delta hp_{i,2006-11} \times s_{i,2006}^{rent})$ , where  $s_{i,2006}^{rent}$  is the share of households in 2006 in postcode  $i$  who rented their home. The point estimate of the coefficient on this term is negative, consistent with higher housing costs making aspiring home owners worse off, but the effect is not statistically significantly different from zero.

New passenger vehicle registrations are expressed in per capita terms to control for differences in population growth across postcodes and the equation is estimated using weighted least squares, using the 2006 population for each postcode as weights. This makes postcodes with a large population relatively more influential in estimating the regression parameters, which is appropriate because each postcode-level observation represents an average over a relatively large number of households. To reduce the influence of extreme observations, postcodes experiencing a change in per capita new vehicle registrations greater than 75 per cent in magnitude between 2006 and 2011 are excluded. Postcodes with more than three times the national average level of per capita new vehicle registrations are also excluded because these postcodes are likely to contain a large number of business registrations, which introduce noise into our data.<sup>5</sup>

The set of controls  $X_{i,j}$  includes the change in all relevant Census variables between 2006 and 2011, and the level of each variable in 2006. The set of controls also includes each postcode's distance to the central business district (CBD), and an indicator variable for waterfront postcodes. These geographic variables absorb any predictable variation in relative housing price growth that is correlated with proximity to the CBD or the waterfront. They also allow for the possibility that households living in postcodes at greater distances from the CBD have a higher average level of per capita new vehicle registrations than households in inner city postcodes, possibly because of a greater need for private transportation.

## Results

The first column in Table 1 reports the coefficient estimate  $\beta$  for Equation (1) excluding the control

5 These sample restrictions result in the exclusion of 30 postcodes. The OLS estimate for the elasticity of new vehicle registrations with respect to housing wealth is larger if outliers are not removed, but quantile regression estimates using the full set of data are similar; in both cases, the estimated effects remain statistically significantly different from zero.

**Table 1: Housing Wealth and New Vehicle Registration Growth<sup>(a)</sup>**

Dependent variable: 100 x change in log per capita new passenger vehicle registrations between 2006 and 2011

	OLS	OLS	Median regression
	(1)	(2)	(3)
Change in the log of the dwelling price x share of households owning a dwelling	0.48*** (0.08)	0.56*** (0.17)	0.42** (0.17)
Observations	563	526	526
$R^2$	0.07	0.23	0.17
State fixed effects	No	Yes	Yes
Controls	No	Yes	Yes

(a) \*\*\*, \*\* and \* represent statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are shown in parentheses  
Sources: ABS; APM; Gillitzer and Wang (2015)

variables, indicating an elasticity of new vehicle registrations with respect to gross housing wealth of about one-half. This is about twice the size of the relationship between new vehicle registrations and housing prices shown by the line of best fit in Graph 2. The effect is larger because only home owners experience an increase in housing wealth when housing prices rise, and the effect of housing wealth on new vehicle registrations is assumed to operate only through home owners.<sup>6</sup>

The second column in Table 1 reports estimates for Equation (1) including the full set of control variables; the regression also includes state fixed effects, to allow for divergent trends in new vehicle registrations in Sydney, Melbourne and Brisbane. For brevity, Table 1 omits the coefficient estimates for the control variables, which are reported in Table A1. The estimated elasticity between new vehicle registrations and housing wealth remains about one-half and is significant at a 1 per cent level.

To assess the extent to which the estimated relationship is driven by large changes in new vehicle registrations, estimates for Equation (1) in the third column using a median regression estimator

are reported, which minimises the sum of absolute rather than squared errors, and therefore provides parameter estimates that are less influenced by large changes. The estimated relationship between new vehicle registrations and housing wealth is similar, indicating that the relationship is not driven primarily by postcodes experiencing unusually large changes in new vehicle registrations. Overall, the results indicate a robust cross-sectional relationship between growth in new vehicle registrations and gross housing wealth.

### Longevity of the effect

Thus far, the relationship between new vehicle registrations and housing wealth over a five-year period has been estimated. However, the cumulative effect of a change in housing wealth on new vehicle registrations depends on whether the effect on spending is sustained over time. If households use greater housing wealth to fund a one-time increase in current spending, then spending will tend to revert to its prior level in the next period, in which case current new vehicle registration growth will tend to be negatively related to past changes in housing wealth. Conversely, if spending that is funded by an increase in housing wealth is smoothed over time, no relationship between past changes in housing wealth and current new vehicle registration growth should be expected. To

<sup>6</sup> Mechanically, gross housing wealth for owner-occupiers in a postcode is equal to the price of housing multiplied by the home ownership share, and so varies less than one for one with housing prices. The correlation between the home ownership rate in 2006 and house price growth for the period 2006 to 2011 is very close to zero.

investigate these possibilities, Equation (1) has been augmented with changes in gross housing wealth over the periods 1996 to 2001 and 2001 to 2006.<sup>7</sup> Estimation results are reported in Table A2.<sup>8</sup>

Growth in new vehicle registrations over the period 2006 to 2011 is negatively related to housing price growth over the period 2001 to 2006, but the sum of the estimated housing price growth coefficients remains positive, and about four-fifths the size of the contemporaneous coefficient alone. This indicates that the contemporaneous relationship between housing wealth and new vehicle registrations is largely sustained over time. Overall, it can be concluded that an increase in housing wealth is associated with an elevated level of new vehicle registrations for a sustained period of time, but that the short-run relationship is likely to be larger than the long-run relationship.

## Marginal Propensity to Consume

### New vehicles

The estimation results indicate the percentage change in new vehicle registrations associated with a 1 percentage point change in gross housing wealth, but other studies often report estimates in terms of a marginal propensity to consume (MPC) – the change in spending from a dollar change in housing wealth. A straightforward means to infer an MPC for new vehicles from these results is to scale the estimated elasticity by the ratio of the value of new vehicle registrations to housing wealth for home owners. Using ABS household wealth, expenditure and national accounts data, the estimated elasticity for new vehicle registrations implies an MPC for

new vehicles of about one-sixth of a cent per dollar increase in gross housing wealth.<sup>9</sup>

A drawback of this approach is that it does not allow for variations in MPCs at different points in the income and wealth distribution and so can be unreliable. An alternative methodology is to re-specify Equation (1) in dollar terms, regressing the dollar change in new vehicle consumption on the dollar change in gross housing wealth. This approach requires the dollar value of new vehicle consumption to be estimated, which is done by scaling the quantity of new vehicle registrations by an estimate of the average price of a new passenger vehicle; a number of additional assumptions are detailed in Gillitzer and Wang (2015). The results indicate an average MPC for new vehicles of about one-sixteenth of a cent per dollar increase in gross housing wealth, a bit less than half the estimate inferred from the elasticity estimate. The difference between these estimates arises because of variations in MPCs by income groups, which the preferred methodology takes into account. As is shown in Gillitzer and Wang (2015), the relationship between new vehicle registrations and housing wealth is smaller for high-income postcodes than it is for low-income postcodes. A common percentage change in housing prices results in large dollar increases in housing wealth for high-income postcodes, because high-income households tend to own relatively expensive homes, but a relatively modest change in new vehicle registrations.

### Aggregate consumption

To infer an MPC for total consumption from the estimated MPC for new vehicle consumption, an assumption needs to be made about whether the relationship between new vehicle consumption and housing wealth is different to the relationship

7 The postcode-level correlation in house price growth between these five-year periods is low, providing statistical power for this analysis.

8 Housing price data for a smaller number of postcodes is available prior to 2006. The first column in Table A2 reports estimates excluding changes in gross housing wealth prior to 2006 for comparison with the results in the second column of Table 1. Reassuringly, the smaller dataset makes little difference to the main parameter of interest.

9 This calculation uses data from the latest 2009–10 ABS Household Expenditure Survey, and the 2009–10 ABS Household Wealth and Wealth Distribution data. The elasticity of new vehicle registrations with respect to gross housing wealth is assumed to be 0.45, and vehicle consumption is assumed to be 2.9 per cent of total consumption, its average since 2000 based on national accounts data. The price of new vehicles is assumed to be unaffected by changes in housing prices.

between total consumption and housing wealth. Assuming that new vehicle and total consumption have the same sensitivity to a change in housing wealth, the estimated MPC for new vehicle consumption can simply be scaled by the ratio of total consumption to new vehicle consumption. Doing so implies an MPC for total consumption of about 2 cents per dollar change in gross housing wealth. For comparison, Dvornak and Kohler (2007) report an MPC for total consumption of 3 cents per dollar change in housing wealth.

But evidence from the United States (Mian, Rao and Sufi 2013) indicates that new vehicle consumption is much more sensitive to a change in housing wealth than is total consumption. This may be because housing wealth is often used to finance the purchase of durable goods such as new vehicles. This proposition is also supported by the observation that new vehicle sales are much more cyclically sensitive than total consumption (indicated by the respective scales for the lines on Graph 1). Using the estimate from Mian *et al* (2013) on the relative sensitivities of new vehicle and total consumption to a change in housing wealth, the Australian data implies an MPC for total consumption of less than one-quarter of a cent per dollar change in housing wealth.

## Conclusion

There is a robust cross-sectional relationship between changes in housing wealth and new vehicle registrations. Even though new vehicle registrations are a relatively narrow measure of consumption, because this measure is available across postcodes, it is well suited to identifying a relationship between housing wealth and consumption.

The preferred estimate suggests that a 1 per cent increase in housing wealth is associated with a one-half per cent increase in new vehicle registrations. Evidence from the United States indicates that new vehicle consumption is particularly sensitive to a change in housing wealth and, under the assumption that this is also true for Australia, the estimates imply that each dollar increase in housing wealth is associated with an increase in total consumption of less than one-quarter of a cent. ✎

## References

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## Appendix A – Additional Results

**Table A1: Housing Wealth and New Vehicle Registration Growth<sup>(a)</sup>**

Dependent variable: 100 x change in log per capita new passenger vehicle registrations between 2006 and 2011

	OLS		OLS		Median regression	
	(1)		(2)		(3)	
Log of the dwelling price × share of households owning a dwelling			12.17*	(6.34)	9.80*	(5.24)
Change in the log of the dwelling price × share of households owning a dwelling	0.48***	(0.08)	0.56***	(0.17)	0.42**	(0.17)
Change in log of median annual income			0.05	(0.10)	0.08	(0.07)
Change in the share of households owning a dwelling			-0.02	(0.38)	-0.20	(0.34)
Change in mortgagor repayment-to-income ratio			-1.12	(31.30)	0.22	(26.19)
Change in the unemployment rate			-0.22	(1.24)	-1.60	(1.05)
Log of median annual income			-2.41	(8.29)	-3.31	(6.46)
Share of households who own a dwelling			-1.73**	(0.79)	-1.34**	(0.68)
Mortgagor repayment-to-income ratio			-5.65	(12.92)	-9.79	(11.81)
Unemployment rate			-2.28***	(0.74)	-1.99***	(0.58)
Share of people with a bachelor's degree or higher			-0.61***	(0.22)	-0.46**	(0.19)
Share of people with a certificate qualification			-1.94**	(0.97)	-1.32*	(0.73)
Distance to CBD			0.20*	(0.12)	0.23**	(0.11)
Waterfront dummy			2.43	(1.75)	0.52	(1.73)
Observations	563		526		526	
R <sup>2</sup>	0.07		0.23		0.17	
State fixed effects	No		Yes		Yes	

(a) \*\*\*, \*\* and \* represent statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are shown in parentheses  
Sources: ABS; APM; Gillitzer and Wang (2015)

**Table A2: Longevity of Housing Wealth Effects<sup>(a)</sup>**

Dependent variable: 100 x change in log per capita new passenger vehicle registrations between 2006 and 2011

	OLS (1)		OLS (2)	
Log of the dwelling price × share of households owning a dwelling	11.53	(8.09)	11.59	(8.24)
Change in the log of the dwelling price between 2006 and 2011 × share of households owning a dwelling	0.62***	(0.19)	0.66***	(0.20)
Change in the log of the dwelling price between 2001 and 2006 × share of households owning a dwelling			-0.14	(0.16)
Change in the log of the dwelling price between 1996 and 2001 × share of households owning a dwelling			0.06	(0.07)
Change in log of median annual income	0.07	(0.12)	0.09	(0.12)
Change in the share of households owning a dwelling	-0.24	(0.55)	-0.26	(0.55)
Change in mortgagor repayment-to-income ratio	6.59	(36.82)	13.35	(37.34)
Change in the unemployment rate	-0.23	(1.78)	0.07	(1.76)
Log of median annual income	-3.80	(10.00)	-1.80	(10.15)
Share of households who own a dwelling	-1.61	(1.05)	-1.63	(1.06)
Mortgagor repayment-to-income ratio	-4.25	(15.27)	-3.03	(16.22)
Unemployment rate	-2.46***	(0.89)	-2.23**	(0.91)
Share of people with a bachelor's degree or higher	-0.55*	(0.30)	-0.58*	(0.30)
Share of people with a certificate qualification	-2.05*	(1.07)	-1.98*	(1.07)
Distance to CBD	0.24	(0.15)	0.28*	(0.15)
Waterfront dummy	0.93	(2.38)	0.82	(2.35)
Observations	375		375	
<i>R</i> <sup>2</sup>	0.27		0.27	
State fixed effects	Yes		Yes	

(a) \*\*\*, \*\* and \* represent statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are shown in parentheses  
Sources: ABS; APM; Gillitzer and Wang (2015)