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Revisiting the Wealth Effect on Consumption in New Zealand

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NON-TECHNICAL SUMMARY

Understanding the link between changes in wealth and household consumption is crucial to the Reserve Bank's assessment of business cycle dynamics. In the Reserve Bank's pursuit of price stability, changes in the policy rate influence household spending in part via their impact on asset prices and wealth.

Recent trends have prompted a reassessment of the relationship between household spending and wealth. Since the global financial crisis (GFC), per capita consumption growth in New Zealand has been modest even as housing wealth has been rising rapidly. The modest growth in per capita consumption has coincided with an increase in the household saving rate, a slowing in credit growth, and a positive injection of equity into the housing sector by households.

This Analytical Note estimates the response of household consumption (its elasticity) with respect to housing and financial wealth, and income between 1982 and 2016. To examine the stability of the relationship, the model is also re-estimated across a split sample. The results suggest that there has been a change in the relationship between household consumption and wealth. It finds:

- On a dollar for dollar basis, consumption appears to respond more to changes in financial wealth than fluctuations in housing wealth over the full sample;
- The response of consumption to wealth has fallen in the sample after 2005, particularly the response with respect to housing wealth.

The change in the response of household consumption to wealth could reflect a reassessment of expected future capital gains from each form of wealth following the GFC, particularly given heightened uncertainty in the housing market. It may also reflect a desire by highly indebted households to pay down debt, along with the influence of low interest rates, indicating a prolonged but transitory period of deleveraging and higher savings. Disentangling the aforementioned factors is beyond the scope of this note but could usefully be addressed with cross-sectional data at the household level.

1 Introduction[1]

Household consumption is an important channel by which the Reserve Bank can influence real economic activity and inflation via monetary policy. The wealth effect is one mechanism for this to occur and is the focus of this Analytical Note. The wealth effect occurs, for example, when stimulatory interest rates increase asset prices that then contribute to higher household spending. A greater understanding of the effect of wealth changes on consumption enables the Reserve Bank to better evaluate the strength of aggregate demand in the economy, and the likely effects of monetary policy changes.

This note aims to shed light on the recent dynamic between consumption and wealth by making use of improved household balance sheet[2] and national accounts data, and an up-to-date sample incorporating observations since the global financial crisis (GFC). It does this by estimating the response of consumption to changes in housing and financial wealth, and income, and then examining whether the estimated responses have changed over time.

The estimation approach adopts the cointegration framework presented in De Veirman and Dunstan (2008). The results of the cointegration approach presented in this Analytical Note suggest that the response of consumption to income and wealth, particularly housing wealth, was higher in the sample between 1982 and 2005 relative to the more recent sample (2005 to 2016). Over the full sample, the dollar for dollar response of consumption to financial wealth was greater in magnitude than that to housing wealth.

The baseline methodology is also reinforced using an alternative method developed by Carroll, Otsuka, and Slacalek (2011). The alternative approach provides a cross-check given potential instability in the long-run relationship between wealth and consumption, which may undermine the cointegration approach.

The rest of the Analytical Note proceeds as follows. For background, section 2 presents some key trends of the consumption-wealth dynamic in New Zealand. Section 3 describes the dataset used in the analysis and the baseline cointegration approach according to the De Veirman and Dunstan (2008) method. Section 4 reports the results. Section 5 presents the alternative approach according to the Carroll et al. (2011) method, and section 6 concludes.

[1] I wish to thank Geoff Bascand, Ashley Dunstan, Punnoose Jacob, Adam Richardson, Hayden Skilling, Christie Smith, Tugrul Vehbi, Amber Watson, Rebecca Williams and Fang Yao for their comments and suggestions.

[2] Significant improvements were made to household balance sheet statistics produced by the Reserve Bank in March 2015. This has meant that previously unrecorded components, such as household equity in unincorporated businesses and unlisted shares, have led to upward revisions to financial wealth.

2 Background

This section presents trends on per capita household balance sheet data, household spending, and credit growth to illustrate why a reassessment of the wealth-consumption dynamic may be warranted. Figure 1 shows that housing wealth as a share of total household wealth rose significantly and has been the key driver of overall household net worth since the early 2000s. Prior to the GFC, the rapid increase in housing wealth was broad-based across regions and coincided with strong growth in household consumption and household debt.

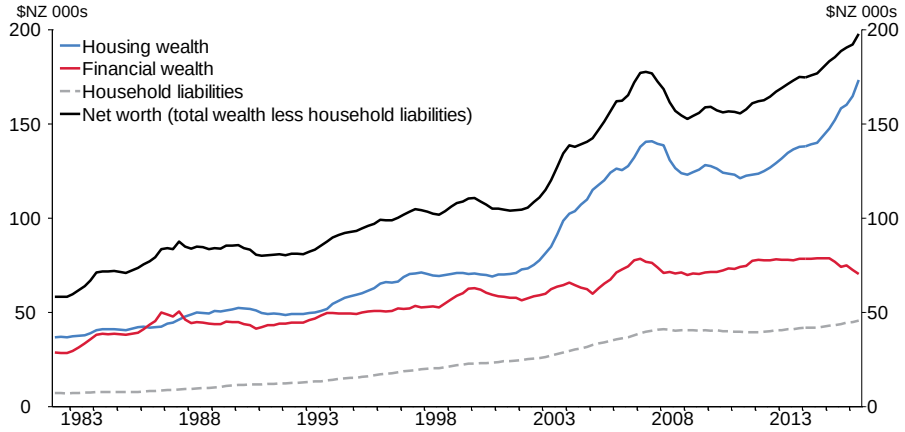
One explanation for the observed dynamic between housing wealth, household debt, and consumption is the effect of housing wealth via the collateral channel. As housing wealth is commonly used as security for household debt, a rise in housing wealth unlocks borrowing capacity for liquidity-constrained households. The increased housing equity could be used to finance consumption or to refinance existing debt. This 'collateral effect' is partly captured by housing equity withdrawal — when the overall flow of household mortgage debt exceeds the investment in the housing stock.[3]

From figure 2, it can be observed that there was a withdrawal of household equity from the housing sector in the mid-2000s, which also coincided with the significant build-up in household liabilities seen in figure 1. Reserve Bank balance sheet data shows that mortgage debt, as a share of total household liabilities, rose from 83 percent in 2002 to 87 percent by 2009.

Since the GFC in 2008, per capita household spending growth in annual terms has been modest despite housing wealth growing rapidly (figure 1 and figure 3). Figure 2 shows that lower-than-expected household spending appears consistent with observed housing equity *injection*.[4] The introduction of loan-to-value restrictions for housing loans since 2013 has played some part in offsetting housing credit growth related to the resurgence in housing market activity (Price, 2014), thereby contributing to housing equity injection. The slower build-up in household debt since 2008 relative to wealth gains has led to an improvement in household balance sheets as a result.

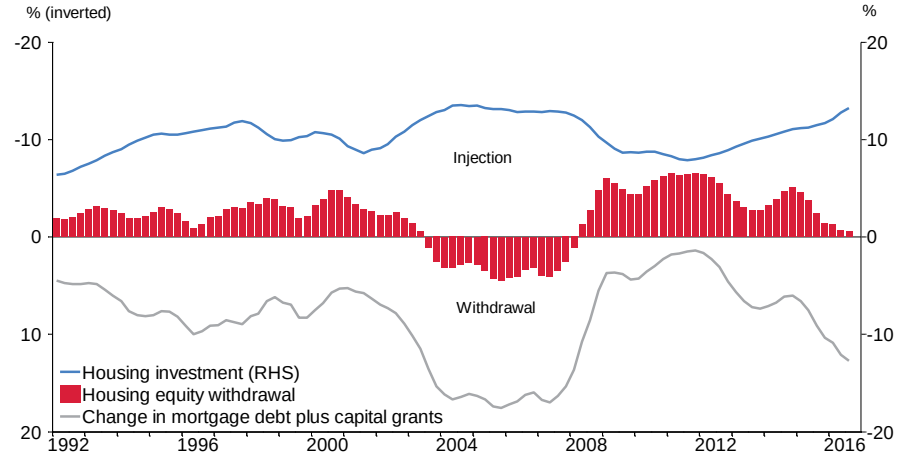
[3] See appendix (I) for details of the measurement methodology.
[4] A similar dynamic can be observed for Australia (Kent, 2015).

Figure 1: Household balance sheet trends (real, per capita)



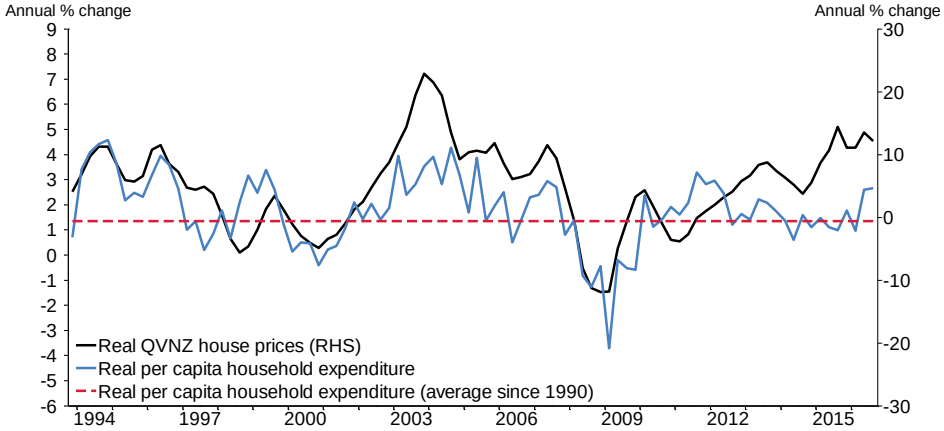
Source: RBNZ, Statistics New Zealand.

Figure 2: Housing equity withdrawal in New Zealand (annual moving-sum, percent of household disposable income)



Source: RBNZ estimates.

Figure 3: Consumption and house price growth



Source: Statistics New Zealand, Quotable Value New Zealand (QVNZ).

3 The baseline model and data

The transmission channel of monetary policy via house prices has become increasingly important owing to the collateral effect and the rising share of housing wealth in net worth. Hence, it is useful to isolate the consumption elasticity[5] of housing wealth from financial wealth in the estimation approach. There are other reasons why we might expect the response of household spending to fluctuations in housing wealth to differ from financial wealth:[6]

- Housing wealth is generally less liquid than financial wealth given the transaction costs of buying and selling a property to realise wealth gains. Relatedly, the bequest motive (i.e. transferring private property to an individual or organisation in a will) also means that households are less inclined to immediately realise valuation gains;

- Households arguably have less up-to-date information on the *true* market value of their properties relative to their financial wealth (e.g. equities) and therefore the extent to which spending behaviour is affected by valuation changes may differ.

There have been a number of studies examining the relative effect of housing wealth and financial wealth on household consumption in advanced economies. For a panel of advanced economies, Case, Quigley and Shiller (2005) report housing wealth elasticities ranging between 0.11 and 0.14 percent, while the effect from stock market wealth was found to be insignificant. For the US specifically, Case et al. (2005) found the housing wealth effect on consumption to exceed the stock market wealth effect. More recent studies for the US (Aron et al., 2012 and Carroll et al., 2011) also supported this finding. On the other hand, studies for Australia, find that the effect from financial wealth is stronger than housing wealth (Muellbauer and Williams, 2011 and Dvornack and Kohler, 2003).

This Analytical Note follows the cointegration approach of De Veirman and Dunstan (2008) who use a dynamic ordinary least squares (DOLS) model to estimate the relationship between consumption, wealth, and income.[7] This technique of estimating aggregate consumption functions is similar to Dvornak and Kohler (2003) and Tan and Voss (2003) for Australia; and Ludvigson and Steindel (1999) for the US. De Veirman and Dunstan (2008) found that, in New Zealand, permanent changes in wealth have economically important effects on consumption.

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[5] The elasticity is defined as how many *percent* consumption increases if wealth increases by one percent. This contrasts with the marginal propensity to consume (MPC) which measures by how many *dollars* consumption increases if wealth increases by one dollar.
[6] See Case, Quigley and Shiller (2005), Dvornak and Kohler (2003), and Aron, Duca, Muellbauer, Murata, and Murphy (2012) for further discussion.
[7] Refer to De Veirman and Dunstan (2008) for full details of the estimation approach.

As in De Veriman and Dunstan (2008), this note uses the intertemporal budget constraint outlined in Lettau and Ludvigson (2001) to examine the long-run relationship between wealth and consumption. This log-linear identity is shown in equation 1.[8]

$$c_t - \tau - \omega_y y_t - \omega_h h_t - \left(1 - \omega_y - \omega_h\right) f_t = \eta_t \quad (1)$$

On the left-hand side of equation 1, aggregate wealth is equal to the sum of human wealth (y),[9] housing wealth (h) and net financial wealth (f) where ω_y and ω_h are the steady-state shares of human and housing wealth, respectively, in total lifetime resources and τ is a constant.

Equation 1 shows that, *ex ante*, rational households can only sustainably consume (c) in excess of their current wealth if their expected future wealth returns more than offset expected future consumption growth. Assuming that the left-hand side variables are I(1), η should be a stationary cointegrating residual reflecting future consumption growth and returns to wealth. For example, if consumption is high relative to wealth in the current period (η is positive) and this reflected higher expected future wealth gains, then in the next period wealth would increase to restore equilibrium.

A cointegrating relationship can be observed in the New Zealand data between the level of consumption, housing and financial wealth, and household income, which allow the long-run elasticities with respect to consumption to be estimated.[10] The observed cointegration relationship is expected as permanent changes in wealth lead to an upward shift in the future path of consumption through its effect on expected lifetime resources.

The long-run cointegrating relationship is estimated with a DOLS model according to equation 2. Since the variables are defined in natural logarithms, the coefficients β_y, β_h and β_f can be interpreted as consumption elasticities. The DOLS estimation helps to deal with regressor endogeneity by including lead and lagged differences of the explanatory variables from $t-3$ to $t+3$.

$$c_t = \alpha + \beta_y y_t + \beta_h h_t + \beta_f f_t + \sum_{j=-3}^{3} \gamma_j \Delta y_{t-j} + \sum_{j=-3}^{3} \delta_j \Delta h_{t-j} + \sum_{j=-3}^{3} \theta_j \Delta f_{t-j} + \varepsilon_t \quad (2)$$

[8] Throughout the Analytical Note, lower-case letters denote variables that are expressed in natural logarithms.

[9] In theory, human wealth is defined as the expected discounted value of future labour income. Since this variable is unobservable, Lettau and Ludvigson (2001) suggest approximating it using labour income (y) as this captures the non-stationary component of human wealth when modelling income as the dividend paid on the stock of human wealth.

[10] An Engle-Granger test for cointegration was implemented using the Augmented Dicky-Fuller (ADF) test on the residuals from a static OLS regression of consumption on income, housing wealth and net financial wealth. The null hypothesis of a unit root in these residuals was rejected at the 10% level, at the lag order selected by the Akaike and Schwarz information criteria.

There is potential for parameter instability in the DOLS model given economic reforms and financial market liberalisation that have occurred over the past three decades.[11] For example, financial innovation and credit liberalisation has made it easier to withdraw equity from housing wealth over time to bring forward consumption, in effect making property wealth more liquid. The preferences for holding a particular form of wealth may also change due to adverse shocks in the equity and property markets or tax changes, which could alter expectations of future investment returns. Therefore, tests for structural breaks are applied, although such breaks and their effect on the estimated parameters can be difficult to identify accurately and are not necessarily one-off, but instead may occur more slowly through time.

The dataset used for the estimation consists of the following variables, deflated by the CPI (excluding GST rate changes), for the period 1982Q2 to 2016Q2:[12]

- Housing wealth: housing and land value, including rental properties (RBNZ)
- Financial wealth[13] *net* of total household liabilities (RBNZ)
- Household consumption expenditure (Statistics New Zealand)
- Household disposable income excluding property income (RBNZ and Statistics New Zealand)

This analysis uses aggregate consumption rather than decomposing consumption into durables and nondurables components. This enables the analysis to focus on the effect of housing wealth on aggregate demand. Property income is excluded from household disposable income as changes in property income are also correlated with fluctuations in housing wealth. The variables are also expressed in per capita terms to control for population growth over the sample.

Following De Veirman and Dunstan (2008), household liabilities are deducted from financial wealth, as opposed to housing wealth. The results that follow in the remainder of the note are largely unchanged when housing wealth is instead defined net of mortgage liabilities, and financial wealth is specified net of non-housing liabilities.

[11] De Veirman and Duntan (2008) find evidence of instability in the cointegrating relationship in the mid-eighties with a structural break at the time of the 1987 stock market crash. Dvornak and Kohler (2003) and Tan and Voss (2003) find considerable parameter instability through time for Australia.
[12] Where history is unavailable, observations are backcasted using the dataset compiled in De Veirman and Dunstan (2008).
[13] Unincorporated equity in housing is deducted from financial wealth as it is already captured in the measure for housing wealth.

4 Results

The elasticities found in the DOLS regressions are reported in table 1, while the derived marginal propensities to consume (MPC) are reported in table 2. In the full sample (1982 to 2016), a 1 percent increase in real per capita housing wealth and net financial wealth is associated with a 0.22 percent increase in real per capita consumption on average, while the income elasticity is 0.35 percent.

Table 1: Dynamic OLS results

Dependent variable:	Household consumption		
Sample:	Full sample	1982Q2 – 2004Q4	2005Q1– 2016Q2
Income	0.35***	0.50***	0.50***
	(0.0786)	(0.0913)	(0.0114)
Housing wealth	0.22***	0.24***	0.15***
	(0.0255)	(0.0238)	(0.0211)
Net financial wealth	0.22***	0.13**	0.05***
	(0.0392)	(0.0600)	(0.0124)
GST Dummy	0.01*	0.02***	0.00
	(0.0072)	(0.0068)	(0.0012)
Observations:	130	87	43
R-squared:	0.9912	0.9875	0.9976
Coefficient test (p-value)	0.9534	0.0651*	0.0000***

*10% significance, **5% significance, ***1 % significance, ( ) = standard error
Notes: The GST dummy is a 1/-1 dummy variable for GST rate changes in 1986Q4, 1989Q3, 2010Q4. The coefficients for the explanatory variables from $t-3$ to $t+3$, and constant are not reported. HAC (Newey-West) standard errors are used. The coefficient test reports the p-value of the null hypothesis that the coefficient on housing wealth and financial wealth are equal.

Stability tests indicate there may be a structural break in the mid-2000s for the DOLS model.[14] Hence, the second and third columns in table 1 report the re-estimated parameters using a split sample before and after 2005Q1.[15] This break point coincides with the peak in estimated housing equity withdrawal (shown in figure 2) and household dissaving. The results that follow do not appear to be sensitive to the

[14] A Quant-Andrews breakpoint test shows that the maximum Chow-F statistic occurs in 2005Q4, which is statistically significant at the 1 percent level. A Bai-Perron sequential break test also finds a break in 2005Q4, while a unit root structural break test of the error correction term conditioned on the DOLS results indicates a break in 2004Q4.
[15] Coefficient estimates in the full sample are not necessarily a convex combination of coefficients across sub-samples. Further information on this can be provided from the author on request.

exact date of the break between 2004 and 2007. A statistical test of the null that the coefficients on housing and financial wealth are equal is rejected in both sub-samples.

The estimated coefficients reported in the second column of table 1 for the period 1982 to 2005 correspond to the period examined by De Veirman and Dunstan (2008). The response of consumption to income (0.50 percent) and housing wealth (0.24 percent) are similar to those in De Veirman and Dunstan (2008), although the magnitude on net financial wealth is now found to be much larger with the improved balance sheet data.[16]

The sub-sample estimates in the third column of table 1 indicate that the consumption response to changes in wealth has fallen in the sample after 2005. The coefficients on housing and financial wealth over 2005 to 2016 are lower than those of the period 1982 to 2005 by 0.09 and 0.08 percentage points respectively.

As noted in section two, households in New Zealand have been holding an increasing share of their wealth in housing. To account for the change in wealth shares for each form of asset over time, the implied dollar-for-dollar MPCs are presented in table 2. The MPCs are calculated by multiplying the elasticities in table 1 by the average ratio of consumption to the relevant form of wealth over the respective sample. This is useful to understand the potential impacts of dollar value changes in household wealth, particularly their housing wealth (i.e. changes in house prices).

Table 2: Dynamic OLS results — implied MPCs (cents)

Sample:	Full sample	1982Q2–2004Q4	2005Q1–2016Q2	De Veirman and Dunstan (2008)
Housing wealth	6.1	7.7	2.7	7.2
Net financial wealth	13.6	7.4	3.7	2.4

Table 2 shows that between 2005 and 2016, a one dollar rise in housing wealth corresponds to a 2.7 cent increase in household consumption, which is 5.0 cents lower than the pre-2005 period, when it was 7.7 cents. The MPC with respect to financial wealth declined to a lesser extent (3.7 cents) in the sample after 2005. Over the full sample, a one dollar rise in housing wealth corresponds to a 6.1 cent increase in household consumption, which is lower than the MPC of financial wealth (13.6 cents).

Table 2 also reports the estimated MPCs from De Veirman and Dunstan (2008) who instead found the MPC of housing wealth to be significantly higher than financial

[16] De Veirman and Dunstan (2008) found that a 1 percent increase in housing wealth and financial wealth was associated with a 0.20 percent and 0.02 percent increase in real per capita consumption respectively. The long-run income elasticity was estimated to be 0.51 percent.

wealth between 1982 and 2006. The new MPC estimates are in line with an Australian study by Dvornak and Kohler (2003) who find a larger stock market wealth effect relative to housing wealth. Dvornak and Kohler (2003) report an MPC of 6 to 9 cents for stock market wealth, and a housing wealth MPC of 3 cents in the dollar. In contrast, for US data, Carroll et al., (2011) estimate a long-run MPC for housing wealth of around 9 cents, which is larger than the financial wealth effect of around 4 cents.

As a robustness check, the DOLS model is re-estimated by defining housing wealth net of mortgage debt and financial wealth net of non-mortgage debt (table A1, appendix). Table A2 of the appendix also shows that the implied MPCs from wealth decline by a similar magnitude to the baseline wealth specification in the sample after 2005.

5 Alternative approach

The baseline cointegration model relies on the assumption that there is a stable long-run relationship, but there are reasons to suspect why this may not hold between 1982 and 2016. Changes in productivity growth, neutral interest rates, demographics, and financial market innovation, amongst others, could affect the relationship between consumption, wealth and income. In particular, the rising share of housing wealth in the portfolio of households since the early 2000s would translate to instability if it represented an increase in the steady-state share of housing in total wealth.

Carroll et al. (2011) provides an alternative approach for measuring the relative dollar-for-dollar MPC impact between housing and financial wealth that is more robust to long-run instability. This approach exploits the gradual response of consumption to permanent shocks in order to measure the speed and strength of the wealth effect.

As in Carroll et al. (2011), a two stage least squares regression is adopted to account for measurement error in consumption growth. In the first stage, consumption growth (Δc_t) is estimated against lagged changes in housing wealth, net financial wealth, and a vector of lagged control variables (Z_{t-1}), which include the effective mortgage rate and change in household disposable labour income (equation 3). All variables are specified in real per capita terms. The consumption growth momentum coefficient (χ) is then estimated in the second stage regression (equation 4). A value of χ that is positive and less than one implies a slow consumption growth adjustment.

The implied long-run MPC or 'eventual MPC' for future consumption is calculated by dividing the immediate MPC of housing and financial wealth (a_1 and a_2) by $(1-\chi)$. The eventual MPC reflects medium-run dynamics in consumption, in contrast with the DOLS estimates in the cointegration approach, which reflects some average characteristics over the whole sample.

$$\Delta c_t = a_0 + a_1\left(\frac{\Delta H_{t-1}}{C_{t-2}}\right) + a_2\left(\frac{\Delta NF_{t-1}}{C_{t-2}}\right) + a_3 Z_{t-1} + u_{1,t-1} \quad (3)$$

$$\Delta c_{t+1} = b_0 + \chi \Delta \widehat{c_t} + u_{2,t} \quad (4)$$

The estimates of the alternative approach are reported in table 3. Estimates between 1982 and 1990 have been excluded as consumption growth was highly volatile over this earlier period making it problematic to pin down the speed of adjustment (χ), and thus the implied MPCs were difficult to interpret. Over the full sample between 1990Q1 and 2016Q2, a $1 increase in housing wealth in the previous quarter translates into a 0.5 cent increase in consumption in the current quarter. A $1 increase in housing wealth corresponds to an eventual MPC of 1.7 cents once consumption has fully adjusted. The estimate for net financial wealth is insignificant.

Structural break tests indicate a break in 2003Q2 and therefore the model is re-estimated with two split samples presented in the second and third column or table 3. Table 3 shows that between 1990 and 2003, the immediate MPC on housing wealth was 2.1 cents compared with just 0.5 cents in the sample after 2003. The immediate MPC for net financial wealth was again not statistically significant across the split samples.

The eventual MPC for housing wealth was also high in the sample up to 2003 (5.3 cents) compared with 0.6 cents between 2003 and 2016. Although, the eventual MPC from housing wealth for the period 2003 to 2016 is difficult to interpret as the speed of adjustment (χ) was not statistically significant, potentially due to the short sub-sample size. If it is assumed that consumption growth momentum over the full sample (0.70) provides a reasonable proxy for the period 2003 to 2016, then the eventual MPC from housing wealth would be equivalent to 1.6 cents in this sub-sample.

The estimated eventual MPC for housing wealth is lower than the MPC from the DOLS model in table 2, and studies for Australia (Dvornak and Kohler, 2003) and the US (Carroll et al., 2011). However, the results from the alternative model reinforce the results from the baseline DOLS model in the sense that the propensity to consume out of housing wealth is lower in the period since the early to mid-2000s.

The changing pattern in the response of consumption to wealth may reflect a number of factors, although identifying the exact drivers is out of the scope of this Analytical Note. Intuitively, one possible explanation is that the downturn in the housing market during the GFC has led to a reassessment of expected future capital gains, thereby weakening the housing collateral effect. Another possibility is that it may reflect a

general desire by highly indebted households to pay down debt due to heightened precautionary motives, along with low interest rates, following the crisis. The latter may indicate a prolonged but temporary period of deleveraging and higher saving, thereby contributing to restrained consumption growth relative to gains in household wealth.[17]

Table 3: Results of the alternative approach[18]

Sample:	Full sample	1990Q1–2003Q1	2003Q2–2016Q2
Consumption growth momentum (χ)	0.70253**	0.605773*	0.173072
	(0.2734)	(0.2493)	(0.4589)
Housing wealth (a_1)	0.005168***	0.020852***	0.004688*
	(0.0017)	(0.0050)	(0.0026)
Net financial wealth (a_2)	-0.001312	-0.001305	-0.002501
	(0.0039)	(0.0059)	(0.0045)
Income growth	0.099048	0.265196***	-0.049752
	(0.0791)	(0.0692)	(0.1069)
Real mortgage rate	-0.00067	-0.000517	-0.000959
	(0.0005)	(0.0006)	(0.0009)
GST dummy	-0.005628***		-0.004489**
	(0.0015)		(0.0019)
Eventual MPC (cents)			
Housing wealth ($\frac{a_1}{1-\chi}$)	1.7	5.3	0.6
Net financial wealth ($\frac{a_2}{1-\chi}$)	-0.4	-0.3	-0.3
Observations:	106	53	53
R-squared:	0.1321	0.2786	0.1246

*10% significance, **5% significance, ***1% significance ( ) = standard error
Notes: The model includes a constant which is not reported. The GST dummy is a 1/-1 dummy variable for GST rate changes for 1986Q4, 1989Q3, 2010Q4. HAC (Newey-West) standard errors are used. The speed of adjustment in consumption growth (χ) is estimated in the second stage of the OLS regression according to equation 4.

[17] See Bascand (2016) for a summary of household saving behaviour in New Zealand since the crisis.
[18] As with the DOLS approach, the results under this alternative approach do not significantly change if housing wealth is defined net of mortgage debt and financial wealth is defined net of non-mortgage debt.

6 Conclusion

Housing wealth has increased rapidly in recent years but relative to the 1990s and 2000s, the response of per capita household spending has been weaker than expected. This Analytical Note estimates a long-run cointegrating relation between household consumption, housing wealth, net financial wealth and income to examine this recent dynamic.

The cointegration model suggests that both the consumption elasticity of housing wealth and the propensity to consume out of housing wealth is lower in the post-2005 period. The elasticity and MPC of net financial wealth is also lower in the sample after 2005, but to a lesser extent. The findings for housing wealth are largely robust to an alternative method proposed by Carroll et al. (2011) which accounts for potential long-run instability in the assumed cointegrating relationship.

A key contribution of the analysis is that it incorporates improved household balance sheet and national accounts data, and an up-to-date sample incorporating observations since the GFC. The approach recognises the importance of household balance sheet data in accounting for evolving credit and wealth relationships when assessing the trend in household spending.

Future analysis could involve examining the consumption-wealth dynamic using cross-sectional data at the household level to isolate certain characteristics regarding demographics, wealth, income, and debt levels. Disentangling the underlying drivers may shed light as to whether or not the response of consumption to wealth will revert to the relationships observed in previous cycles.

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Appendix

I. Housing equity withdrawal – measurement methodology

The methodology is represented by equation A1 following Smith (2006), where housing equity withdrawal (HEW) is defined as the change in mortgage lending (ΔNL) plus capital grants (CG) minus housing investment. Capital grants include KiwiSaver first home withdrawals and Home Start grants since their introduction in 2011.

Housing investment includes residential investment in dwellings (HI), transfers of dwellings to the household sector and costs associated with transfers between households (TC), and net transfers of land to the household sector (NT).

$$HEW = \Delta NL + CG - (HI + NT + TC) \quad \text{(A1)}$$

Estimated residential investment and residential insurance pay-outs relating to the Canterbury rebuild have been excluded in the calculation, as the related fluctuations in equity may not be reflected in changes in household behaviour.

Table A1: DOLS model with alternative wealth definition

Dependent variable:	Household consumption		
Sample:	Full sample	1982Q2 – 2004Q4	2005Q1– 2016Q2
Income	0.33***	0.49***	0.44***
	(0.0867)	(0.0906)	(0.0306)
Net Housing wealth	0.07***	0.18***	0.12***
	(0.0224)	(0.0349)	(0.0143)
Net financial wealth	0.34***	0.20***	0.13***
	(0.0536)	(0.0517)	(0.0388)
GST Dummy	0.01*	0.02***	0.00
	(0.0081)	(0.0071)	(0.0012)
Observations:	130	87	43
R-squared:	0.99	0.987	0.9976
Coefficient test (p-value)	0.0001	0.7888	0.7333

*10% significance, **5% significance, ***1 % significance, ( ) = standard error
Notes: The GST dummy is a 1/-1 dummy variable for GST rate changes in 1986Q4, 1989Q3, 2010Q4. The coefficients for the explanatory variables from t − 3 to t + 3, and constant are not reported. HAC (Newey-West) standard errors are used. The coefficient test reports the p-value of the null hypothesis that the coefficient on housing wealth and financial wealth are equal.

Table A2: DOLS results with alternative wealth definition — implied MPCs (cents)

Sample:	Full sample	1982Q2–2004Q4	2005Q1–2016Q2
Net Housing wealth	2.6	7.4	2.9
Net financial wealth	13.1	8.0	4.6