HOUSING WEALTH, STOCK MARKET WEALTH AND CONSUMPTION: A PANEL ANALYSIS FOR AUSTRALIA

Nikola Dvornak and Marion Kohler

Research Discussion Paper
2003-07

July 2003

Economic Research Department
Reserve Bank of Australia

We wish to thank Ellis Connolly, Anthony Richards and seminar participants at the Reserve Bank of Australia and at the Australian National University, Canberra for helpful comments and discussions. Mary Cavar and Johann LaBrooy provided much appreciated help with the data. All remaining errors are ours. The views expressed are those of the authors and do not necessarily reflect the views of the Reserve Bank of Australia.

Abstract

This paper addresses the question of how changes in stock market wealth and housing wealth affect consumption expenditure in Australia. We approach the problem using a panel of Australian states, for which we construct data on housing and stock market wealth.

We estimate the link between consumption and the components of wealth using panel-data estimation techniques, including fixed-effects instrumental variable and panel DOLS estimators. Unlike previous studies, we find that both housing wealth and stock market wealth have a significant effect on Australian consumption. We estimate that a permanent increase in households' stock market wealth of *one dollar* increases annual consumption by 6 to 9 cents in the long run while a permanent increase in housing wealth of one dollar is estimated to increase long-run annual consumption by around 3 cents. However, given that households' housing assets are more than three times as large as stock market assets, our estimates imply that a *one per cent* increase in housing wealth has an effect on aggregate consumption that is at least as large as that of a one per cent increase in stock market wealth.

JEL Classification Numbers: E21, E44, R31
Keywords: consumption, housing wealth, stock market wealth, panel data

Table of Contents

HOUSING WEALTH, STOCK MARKET WEALTH AND CONSUMPTION: A PANEL ANALYSIS FOR AUSTRALIA

Nikola Dvornak and Marion Kohler

1. Introduction

The dramatic changes in stock values and in house values over the last decade have renewed policy and academic interest in the effects of household wealth on consumption expenditure. It is sometimes argued that the effect of changes in housing wealth is larger than the effect of changes in stock market wealth.[1] The reasoning is two-fold: firstly, more people own houses than shares and secondly, financial innovation has made it easier to access capital gains from housing wealth. However, there are other factors that work in the opposite direction and so an assessment requires quantitative estimates of the effect of changes in each type of wealth on consumption.

Studies that estimate the effect on consumption of changes in housing wealth and stock market wealth often find that one of the coefficients is insignificant. For example, Tan and Voss (2003) use Australian data and find a strong long-run effect of stock market wealth but an insignificant housing wealth effect. In addition, Case, Quigley and Shiller (2001) report a number of US studies that use aggregate level or household level data and have had difficulty in finding a significant housing wealth effect. They suggest that this may be the result of multicollinearity of the two wealth variables, which might be overcome using state-level data. Using a panel of US states they find that the housing wealth effect is significant and larger than the stock market wealth effect.

In this paper we follow Case *et al* (2001) and use a state-level panel to estimate the effect of changes in wealth components on household consumption in Australia. However, we use a richer specification, which controls for changes in household debt. We also employ a wider range of econometric techniques in order to analyse the robustness of results, including instrumental variables to control for endogeneity, as well as a dynamic OLS estimator for panels, and mean group

1 See, for instance, *The Economist*, Jan 11th 2003, ‘Living in never-never land’, p. 68.

estimators based on a Seemingly Unrelated Regression (SUR) model for the state-specific wealth effects.

The next section discusses briefly the results from previous studies on consumption and wealth, followed by Section 3 which outlines some theoretical considerations for our chosen specification. Section 4 explains how the data set was constructed before we present the estimation results and a number of robustness tests. The robustness of the results through time is analysed in Section 5 followed by the conclusions in Section 6.

2. Related Literature

The effect of wealth on consumption has been studied extensively in the empirical literature on consumption functions. In this section we provide a brief overview of the findings of these studies.[2]

Few studies have examined the relationship between consumption and *total* wealth for Australia. Tan and Voss (2003) have estimated the marginal propensity to consume (MPC) out of total wealth at 0.04 or, in other words, that long-run annual consumption increases by 4 cents in response to a one dollar increase in wealth. Bertaut (2002) puts this number marginally higher at 0.05. In an earlier study, McKibbin and Richards (1988) found an MPC of 0.02, but they point out that this may be understated due to the poor quality of wealth data for their estimation period. This compares with estimated MPCs from total wealth of around 0.03 to 0.07 for the US. Estimates for Canada are in the region of 0.05 to 0.08, while for the UK the estimates range from 0.02 to 0.04.[3]

---

[2] The effects of wealth on consumption are typically measured as either marginal propensities to consume (MPC) or elasticities. For ease of comparison, we have provided all results in the form of MPCs. MPCs measure by how many *dollars* consumption increases if wealth increases by one dollar. Elasticities measure by how many *per cent* consumption increases if wealth increases by one per cent. Elasticities can be converted into MPCs by multiplying with the ratio of consumption to wealth.

[3] Bertaut (2002) and Girouard and Blondal (2001) investigate the US, Canada and the UK in cross-country studies. See also IMF (2000) and Boone, Giorno and Richardson (1998) for the US; Boone, Girouard and Wanner (2001) and Macklem (1994) for Canada; and Boone *et al* (2001) for the UK.

Many studies have concentrated on the effect of *stock market wealth* on consumption. For Australia, Tan and Voss (2003) estimate an MPC in the range of 0.04 to 0.16. The corresponding effect for the US is estimated to range from 0.03 to 0.075, and for Canada from 0.045 to 0.08. For the UK it ranges from 0.04 to 0.045, whereas for the other G7 countries it is estimated to be less than 0.02. The strong effect for the US compared with many European countries is often justified by the less concentrated distribution of stock ownership across households, and the larger share of stock ownership relative to households' other financial assets.[4]

Fewer studies have estimated the effect of *housing wealth* on consumption. Estimates of the housing wealth effect range from 0.03 to 0.05 for the US and from 0.02 to 0.08 for the UK.[5] When estimated jointly with the stock market effect, the housing wealth effect is often found to be insignificant. Case *et al* (2001) report a number of US studies, which – using aggregate- or household-level data – have had difficulty in finding a significant housing wealth effect. For Australia, Tan and Voss (2003) find an insignificant long-run effect of housing wealth while the stock market effect is significant. As discussed by Case *et al* (2001) this result may be due to multicollinearity, which our study addresses by using a panel of Australian states. We find a significant long-run effect of both stock market and housing wealth on consumption, consistent with Kent and Lowe (1998) who argue that house prices have been an important determinant of consumption in Australia.

3. Theoretical Considerations and Model Specification

Although the focus of this paper is empirical, we want to ensure that our chosen specification is consistent with standard consumption theories. In the next subsection we briefly discuss an empirical model based on the Life-Cycle/Permanent Income Hypothesis (LC-PIH) of consumption, which links

---

4 For the US see Boone *et al* (1998), Starr-McCluer (1998) and Brayton and Tinsley (1996). For Canada, the UK and the other G7 countries see Bertaut (2002), Boone *et al* (2001), Boone *et al* (1998), Pichette (2000) and Deutsche Bundesbank (2003).

5 See for example Boone *et al* (2001) and Girouard and Blondal (2001). For Canada Boone *et al* (2001) report a coefficient on housing wealth in excess of 0.1. This seems very high but this may be partly due to their specification, which implies that their coefficients are semi-elasticities rather than MPCs.

consumption to income and wealth. We then introduce the specification chosen for Section 4.

3.1 Theoretical Considerations

Our model is based on a standard textbook LC-PIH model as described in Blanchard and Fisher (1989). A representative consumer chooses the path of consumption C_t to maximise (expected) utility u_t over her life time, where θ is the rate of time preference (Equation (1)). In each period, the budget constraint implies that assets at the end of the period A_{t+1} equal savings (defined as labour income Y_t plus assets at the beginning A_t minus consumption), which earn interest at the rate r_t (Equation (2)).

$$\max E_t \left[\sum_{t=0}^{T} (1+\theta)^{-t} u(C_t) \right] \tag{1}$$

$$\text{s.t.} \quad A_{t+1} = (1+r_t)(A_t + Y_t - C_t) \tag{2}$$

The first-order condition implies the following optimal consumption path:[6]

$$C_t = \frac{r}{1+r} A_t + \frac{r}{1+r} \sum_{k=0}^{T=\infty} (1+r)^{-k} E_t Y_{t+k} \tag{3}$$

Equation (3) expresses consumption at time t as a function of the assets in that time period (non-human wealth) and the sum of the current and discounted expected future income stream (human wealth). Note that in this model the marginal propensity to consume out of wealth is $\frac{r}{1+r}$. If for instance the long-run risk-free real interest rate was between 3 and 5 per cent, the MPC would be between 0.03 and 0.05. Of course, this result depends on the assumptions imposed to arrive at Equation (3), such as an infinite planning horizon and a constant, risk-free interest

6 This requires a number of assumptions, such as a quadratic utility function, the assumption that the interest rate r_t is constant and equal to the rate of time preference θ, the holding of the life-time budget constraint, an infinite horizon for optimisation and a no-Ponzi game condition, which rules out bequest motives for holding assets.

rate on assets. Assuming instead that the consumer has a remaining life span of 30 years rather than infinity (and if we rule out bequest motives), the MPC would increase to between 0.05 and 0.06, other things being equal.

If we further assume that income follows a stochastic AR(1) process with a coefficient η, we can express current consumption as a function of current assets and current income (Equation (4)), where β and γ are functions of r and η.

$$C_t = \beta A_t + \gamma Y_t \tag{4}$$

The consumption function in Equation (4) makes no distinction between the different assets an individual might hold. For simplicity, let us consider only two types of assets: stock market assets S_t (a financial asset) and housing wealth H_t (a non-financial asset). The consumption function then takes the form:

$$C_t = \beta_1 S_t + \beta_2 H_t + \gamma Y_t \tag{5}$$

From theory, one might expect the marginal propensity to consume out of stock market wealth β_1 to be similar to that of housing wealth β_2. However, a number of reasons have been put forward for why the responsiveness of consumers to different types of wealth could be different: differences in liquidity, other utility associated with owning an asset (housing services, bequest motives), distribution across income groups, expected permanency of changes, mismeasurement of wealth and 'psychological factors'.[7]

First, the two classes of assets may have differences in liquidity.[8] For instance, housing is often considered a 'lumpy' asset – it may be difficult to liquidate only a part of it, and transaction costs of 'trading up' or 'trading down' tend to be high. In contrast, it might be easier to change stock market wealth by buying or selling a small number of shares. This implies that the coefficient on housing wealth should be lower than that on stock market wealth. However, financial innovation, such as the availability of home equity loans, is likely to have increased

7 For a more detailed discussion see Case *et al* (2001).

8 For a more detailed analysis of the impact of asset liquidity on consumption, see Pissarides (1978).

the liquidity of housing assets as can be seen by the increase in housing equity withdrawal in recent years (see Muellbauer and Lattimore (1999) and Reserve Bank of Australia (2003)).

Second, housing represents both an asset and a consumption item. When house prices increase, wealth may increase, but so too does the cost of housing services (see Poterba (2000)). Increases in the value of owner-occupied housing do not increase the ability of a household to consume more of other goods and services unless that household is willing to realise that increased value, say by 'trading down' into a smaller and less expensive house. Many households do not appear to be willing to do this, including those who intend to leave their houses as bequests.[9] This factor makes it less likely that increased wealth in housing is consumed, resulting in a lower MPC from housing wealth.

Third, there may be distributional factors at work. Housing wealth tends to be held by consumers in all income classes. Stock market wealth, on the other hand, is in many countries concentrated in the high-income groups which are often thought to have a lower propensity to consume out of both income and wealth. In this case, changes in housing wealth might have a larger impact on consumption than changes in stock market wealth. This reason is often cited for why the stock market effect in European countries is often smaller than in the US, as US share ownership is spread more widely across the income distribution (see IMF (2000)).

Fourth, consumers may view increases in wealth for some asset classes as more likely to be permanent, while others are more likely to be viewed as temporary or uncertain. This difference in perception of the permanency of price changes could be related to past experiences of sudden price reversals in asset markets, such as stock markets or housing markets. If an increase (or decrease) is seen as permanent, it is more likely to increase (or decrease) long-run consumption.

Fifth, consumers may not find it easy to accurately measure wealth. This may be especially so for houses which are less homogenous and less frequently traded than shares. On the other hand, the argument has also been put forward that many

9 A related argument is based on the notion that for every household that sells a house there is a household that buys it. Therefore, in aggregate, the increase in consumption (through the seller) could be offset – at least partially – by a decrease in consumption by the buyer. For a model that formalises this argument, see Bajari, Benkard and Krainer (2003).

consumers may not be aware of the exact value of their indirect share holdings, such as pension funds or superannuation funds, until they are close to retirement age.

Finally, consumers may attach certain psychological factors to certain assets. For instance, house ownership may also be an end in itself, as it provides a visible sign of status. Or as argued by Shefrin and Thaler (1988), consumers may use ‘mental accounts’ and earmark certain assets as more appropriate to use for current expenditure while others are reserved for long-term savings.

It is ultimately an empirical question which of these effects dominate, and thus whether the effect of housing wealth on consumption is different from that of stock market wealth. Before we discuss the empirical results of our attempt to estimate these effects, however, we have to clarify a number of specification issues.

3.2 Model Specification

Our chosen model specification is based on Equation (5), but it is augmented by a variable O_t measuring other wealth which captures the effect of financial assets not included in the stock market wealth variable (such as currency holdings, term deposits and non-equity superannuation holdings).

Theory might suggest that all the wealth variables should be measured as *net* wealth. Housing wealth is therefore measured net of housing debt, which accounts for between 60 and 80 per cent of household debt in Australia over the sample period. Stock market wealth is measured using the asset variable only. This reflects the lack of information on how much (if any) of households’ personal debt is used to finance the purchase of stock market wealth. Finally, other wealth is defined to comprise all financial assets not captured in the stock market variable, net of households’ personal debt.[10] All variables are expressed in real per capita terms

[10] We have also estimated a model which includes the debt terms separately. While our main results of a significant stock market and housing wealth effect survive, the stock market effect falls considerably and the housing wealth effect rises somewhat. However, several results of these specifications, such as a positive coefficient on housing debt, point towards econometric problems when estimating a large number of coefficients with highly correlated variables and a short sample size.

and the equation is estimated in levels.[11]

$$C_t = \alpha + \gamma Y_t + \beta_1 S_t + \beta_2 H_t + \beta_3 O_t + \varepsilon_t \tag{6}$$

At this point, we should stress that our focus in estimating Equation (6) is not to test a particular form of a consumption function, or to test the LC-PIH hypothesis. To do so one would ideally like to include a richer specification of dynamics which would no doubt substantially enhance its short-run forecasting performance. Our objective is instead to isolate and measure the effects of stock market wealth and housing wealth on consumption over a longer time horizon. Our interest lies therefore in the parameters β_1 and β_2 which measure the effect of stock market and housing wealth on consumption. Accordingly we treat income and other net wealth as control variables.

Another specification issue is whether to use total consumption or non-durable consumption in our model. Much of the earlier consumption literature (e.g., Blinder and Deaton (1985)) focuses on non-durable consumption. A justification for this is that these studies test the behavioural relationships based on the utility derived from the flow of consumption. Since the *flow* of services from durable goods is difficult to measure, durables are usually omitted.

In contrast, our focus is to measure the effect of changes in housing and stock market wealth on the aggregate economy. To this end we focus on consumption *expenditure*, which includes expenditure on durable goods, and we are less interested in consumers' utility from the flow of consumption. We therefore use total consumption.[12]

---

[11] The empirical literature is divided on whether consumption functions should be estimated in levels or logarithms; see the discussion in Lettau, Ludvigson and Barczi (2001) and Deutsche Bundesbank (2003). We follow the previous literature for Australia (e.g., McKibbin and Richards (1988), Debelle and Preston (1995), and Tan and Voss (2003)) and estimate Equation (3) in levels. In our model, the coefficients do not change substantially when estimated in logs and transformed into MPCs.

[12] This is also the approach chosen by Case *et al* (2001). Using total consumption also allows us to avoid a number of problematic issues. Firstly, if one is using non-durable consumption then for consistency one must include durables in wealth, which they (arguably) are not. Secondly, one must decide on some (necessarily ad hoc) depreciation rate to depreciate durable goods wealth. For a discussion and further justification see Rudd and Whelan (2002).

4. Estimation

Studies that try to jointly estimate the effect of changes in housing wealth and stock market wealth often find that one of the coefficients is insignificant. More often than not this is the coefficient on housing wealth. But why is the housing wealth effect so elusive? One possible reason is that there is a high degree of correlation between aggregate housing wealth and stock market wealth, making it difficult to disentangle the two effects. This multicollinearity can cause one of the variables to appear insignificant.

In a recent study for the US, Case *et al* (2001) suggest that this multicollinearity between the two wealth variables could be mitigated using state-level data. Since each state's housing market is geographically distinct, each will be affected by regional shocks, in addition to national macroeconomic shocks. Thus the profile of housing wealth over time should differ from state to state. In contrast, stock markets are highly integrated across states so we would expect similar trends in the valuation of equity market portfolios across states.[13]

This variation in the state-level profiles of housing wealth should dampen the multicollinearity found in the aggregate level data. In addition, using a panel will increase our sample size relative to aggregate estimates. Thus state-level panel data should give us more accurate estimates of the housing and stock market wealth effects, allowing us to establish their size and significance and to test for a difference in magnitudes.

Before we proceed to discuss the estimation strategy and estimation results, we describe briefly how the state-level data set was constructed.

4.1 Data Summary

The data used in the estimation consist of a panel of observations on five economic variables. These variables are consumption, income, stock market wealth, net dwelling wealth and net other financial wealth. The cross-section spans five Australian states: New South Wales (NSW), Victoria (VIC), Queensland (QLD), South Australia (SA) and Western Australia (WA).[14] We also have a similar

---

[13] However, there may be differences across states in the share of equity holdings in total wealth so one may still get extra information from state-level data.

[14] Tasmania, ACT and the Northern Territory are excluded due to data limitations.

data set for the nationwide aggregate. All series are quarterly observations from 1984:Q4 to 2001:Q4. For some of the state-level series the quarterly profile had to be inferred for the earlier part of the sample using aggregate data. A detailed description can be found in Appendix A.

For consumption we use data on ‘household consumption expenditure’ which are available from the Australian Bureau of Statistics (ABS) on a quarterly frequency at the state level and an aggregate (nationwide) level.

The measure of labour income was constructed using earnings data adjusted for transfers and taxes, similarly to Tan and Voss (2003). The earnings data are calculated using a measure for the wage bill, scaled to account for self-employed persons. All these data are available on a state level.

Stock market wealth and other financial wealth is based on the ABS Financial Accounts from 1988:Q4 onwards. Foster (1997) provides data on household financial wealth prior to this. We use two measures of stock market wealth. The first includes both direct equity holdings and equity held through superannuation funds – the remaining financial assets are included in ‘other financial wealth’. As it is not clear how closely households monitor equity wealth held indirectly through superannuation funds, we use a second measure of stock market wealth that includes direct equity holdings only. For this version, equity superannuation wealth is included in ‘other financial wealth’. To obtain state-level data the aggregate level stocks are distributed among the states using financial flows data for the respective components from the 1994 Household Expenditure Survey (HES). We thus assume that the distribution of stock market wealth across states is constant through time.[15]

Dwelling wealth was constructed using median dwelling prices and the number of dwellings. We construct data on the number of dwellings for each state using the census and housing completions data. For dwelling prices we use the quarterly median dwelling price series from the Commonwealth Bank of Australia/Housing

[15] Of course, this assumption would be a problem if stock owners in different states held equity portfolios which are substantially different in terms of their price movements. We have currently no data to test this assumption on a broad enough level.

Institute of Australia (CBA/HIA), which is available on an aggregate and a disaggregate level.[16]

Data on household debt are based on the quarterly series on aggregate housing debt and personal debt from the RBA. To obtain state-level series these data were distributed among the states using loan repayment flows for both categories of debt from the 1994 HES.

All variables are in per capita and in real terms, deflated by the relevant state consumption deflator.

4.2 Estimation Strategy

Our data panel is quite different from the typical panel in micro-econometrics in that the number of time periods is quite large. Moreover, our variables are non-stationary and cointegrated.[17] For this type of panel, Pesaran and Smith (1995) discuss a number of estimators that yield consistent estimates of the *average* effect across groups. These 'average' effects are more informative for monetary policy which is concerned with setting policy at an aggregate level, rather than at the state level.

First, the fixed-effects estimator is proposed. We estimate a standard fixed-effects model, but also an Instrumental Variables (IV) version which takes account of the endogeneity of the right-hand side variables.

A more sophisticated estimator is the panel dynamic OLS (panel DOLS) estimator. This is the panel equivalent of Stock and Watson's (1993) widely used dynamic OLS (DOLS) estimator. The DOLS estimator is a single equation technique that has better small sample properties than OLS and is able to deal with regressor endogeneity by the inclusion of lead and lagged differences of the explanatory variables. Many studies which estimate aggregate consumption functions favour

---

16 Alternative house price series, such as the median dwelling price series by the Real Estate Institute of Australia or the Residex Repeat Sales index, have a lower geographical coverage. In any case, we found that the difference in estimation results due to the choice of house price index is negligible.

17 We confirmed the non-stationarity using unit root tests on the individual series and panel unit root tests. Cointegration tests suggested that the variables are cointegrated. Of course, this is not surprising as consumption functions are the classic example for cointegration analysis.

the DOLS estimator.[18] Our panel DOLS estimator is equivalent to that developed in a recent study by Mark and Sul (2002). The estimator used is of a form that allows for fixed effects in the cointegrating regression, thus making it conceptually equivalent to the standard fixed-effects panel estimator.

Second, the mean group estimator is employed. This involves running separate regressions for each group, and averaging the coefficients across groups. We estimate the separate regressions for each group using a Seemingly Unrelated Regressions (SUR) estimator in its standard form (a Zellner GLS estimator) and in an IV version. We then average the coefficient to obtain the mean group estimator proposed by Pesaran and Smith (1995).[19]

Third, we estimate the consumption function using aggregate data. As this is not the focus of our paper we estimate the aggregate primarily to provide a benchmark (with the same specification) against which to compare our findings at the state level.

Pesaran and Smith (1995) point out that all these estimators provide consistent estimates of the average effect. However, due to the small cross-section dimension of our panel, some differences are to be expected.

4.3 The Fixed-effects Estimator

We present the results of the fixed-effects estimation in Table 1. The fixed-effects estimator is an OLS estimator that imposes common slopes, but allows for state-specific intercepts. In addition to the standard fixed-effects estimates the results of an Instrumental Variable (IV) estimator are reported, which corrects for the inconsistency of OLS arising from the endogeneity of income.[20]

As our model is estimated in levels, all the coefficients are interpreted as long-run MPCs. They tell us by how many dollars consumption increases if the

---

18 For example, Ludvigson and Steindel (1999) for the US and Tan and Voss (2003) for Australia.

19 The mean group estimator can either be an unweighted average or a weighted average of the coefficients. The weighted average version uses the estimated variance-covariance matrix for the weights. Both estimators are consistent.

20 We use lags of income and contemporaneous values of the other independent variables as instruments.

Table 1: Results for the Fixed-effects Estimator
Marginal propensities to consume

Variable	Description	All equity			Direct equity only		
		OLS	IV	Panel DOLS	OLS	IV	Panel DOLS
Y_t	Disposable income	0.450*	0.565*	0.583*	0.456*	0.569*	0.623*
		(0.042)	(0.055)	(0.083)	(0.040)	(0.051)	(0.077)
$S_t^{DE,IE}$	Stock market wealth	**0.024***	**0.021***	**0.023***			
	(all equity holdings)	(0.001)	(0.002)	(0.003)			
S_t^{DE}	Stock market wealth				**0.019***	**0.015***	**0.025***
	(direct equity only)				(0.003)	(0.003)	(0.006)
H_t	Net housing wealth	**0.008***	**0.007***	**0.008***	**0.008***	**0.007***	**0.008***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
O_t^{NE}	Net other financial wealth	0.025*	0.023*	0.017*			
	(excludes all equity)	(0.002)	(0.002)	(0.003)			
$O_t^{IE,NE}$	Net other financial wealth				0.026*	0.024*	0.020*
	(excludes direct equity)				(0.001)	(0.001)	(0.002)
No of obs		345	335	325	345	335	325
No of groups		5	5	5	5	5	5
R^2 within		0.96			0.96		
R^2 overall		0.81			0.81		
F-test (fixed effects = 0)		134	103		136	106	

Notes: All variables are in real per capita terms and in levels. Standard errors are in parentheses and * denotes significance at the 5 per cent level. For the IV estimations we use the first and second lags of income and contemporaneous values of the other independent variables as instruments.

independent variable increases permanently by one dollar. Note that, since our data are quarterly, the MPCs have to be multiplied by 4 in order to obtain the change in *annual* consumption.

For the IV fixed-effects estimate we find an MPC for income of 0.57, a stock market wealth effect of 0.021 and a housing wealth effect of 0.007. If we exclude indirect stock market holdings the stock market wealth effect falls to 0.015, although – taking the standard errors into account – the difference is not significant. The coefficient on ‘other wealth’ is significant and it is in the range of the stock market wealth effect, which is consistent with the view that its components, other financial wealth and personal debt, have a significant effect on long-run consumption. All coefficients are statistically significant at the 1 per cent level regardless of whether we use the OLS or the IV estimator. The use of the IV estimator does affect the coefficient on income substantially but the wealth effects are only slightly changed.[21] One noteworthy result is that the housing wealth effect is lower than the stock market wealth effect. For the standard fixed-effects estimators (OLS and IV) we can comfortably reject that the stock market and housing effect are equal at the 1 per cent level of significance.

The panel DOLS estimator, which takes account of both dynamics and endogeneity, finds a long-run stock market wealth effect of 0.023 and a housing wealth effect of 0.008, with both estimates statistically significant. The housing wealth effect is in the range of that estimated by the OLS and IV methodologies. However, the stock market effect is somewhat higher than that from the IV estimator. This is also true for the version with direct equity only, which has a rather high MPC at 0.025 but also a standard error which is twice the size of that obtained with the other estimators. Again, the long-run stock market wealth effect is significantly larger than that of housing wealth.

4.4 The Mean Group Estimator

The results of the SUR estimation are presented in Table 2 and Table 3. Although the SUR yields a consumption function for each state, we are primarily interested in the mean group estimator in Table 2. We report results from both the standard estimation using the Zellner GLS estimator as well as an IV version of this estimator.

Looking at the IV mean group estimator, the housing market wealth effect of 0.009 is similar to those of the fixed-effects estimators of 0.007 and 0.008. The mean group estimator puts the stock market wealth effect at 0.027 which is higher than any of the fixed-effects estimators, and with more than 10 cents in the dollar annual MPC also rather implausibly high. Using directly held equity only, the MPC is

[21] The MPC of income is rather low. More generally, other studies have found this coefficient to be unstable. In our case, changes in the time period, the inclusion of dynamics and the inclusion of other variables, such as ‘net other wealth’, affect its size considerably. Other research has suggested that the assumption of a constant real interest rate matters for this coefficient. Due to data limitations and as this coefficient is not the focus of our study, we have not modelled this aspect further.

Table 2: Results for the Mean Group Estimator
Marginal propensities to consume

	All equity		Direct equity only	
	Zellner GLS	IV	Zellner GLS	IV
Y_t	0.265*	0.376*	0.295*	0.429*
	(0.036)	(0.057)	(0.033)	(0.048)
$S_t^{DE,IE}$	**0.030***	**0.027***		
	(0.001)	(0.002)		
S_t^{DE}			**0.022***	**0.019***
			(0.003)	(0.003)
H_t	**0.008***	**0.009***	**0.006***	**0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
O_t^{NE}	0.028*	0.023*		
	(0.002)	(0.002)		
$O_t^{IE,NE}$			0.032*	0.028*
			(0.002)	(0.002)

Notes: All variables are in real per capita terms and in levels. Constants are not reported. Standard errors are in parentheses and * denotes significance at the 5 per cent level. The mean group estimator reported here is the version which uses an unweighted average of the estimates for each state. The standard error of the mean group estimator is calculated assuming the estimates for each state are independent.

lower at 0.019. This is somewhat higher than the corresponding coefficient for the fixed-effects estimators. The income effect of 0.4 is lower than those estimated in the fixed-effects models which range from 0.5 to 0.6.

Table 3 reports the details of estimates for the individual states. The stock market wealth effects and the housing wealth effects are positive and – with one exception – significant. Some variation in both the housing wealth effect and the stock market wealth effect is probably not surprising. As there are substantial differences in both types of wealth across states and as housing markets are strongly influenced by regional developments, we gain some extra information that – using state-level data – allows us to disentangle the housing wealth effect from the stock market wealth effect. On the other hand, we may also have more noise in the state-level data leading to variation in the estimates across states. The variation documented in Table 3 is large enough to raise some concerns over the validity of the homogenous slope restriction of the fixed-effects model. We would certainly caution against focusing on the results of the model for any individual state.

Table 3: Results for the Seemingly Unrelated Regressions Estimator
Marginal propensities to consume

	NSW	VIC	QLD	SA	WA	Mean group estimator
	Zellner GLS estimator – all equity					
Y_t	0.319*	0.296*	0.264*	0.317*	0.129	0.265*
	(0.057)	(0.053)	(0.101)	(0.087)	(0.096)	(0.036)
$S_t^{DE,IE}$	**0.039***	**0.039***	**0.025***	**0.024***	**0.024***	**0.030***
	(0.003)	(0.002)	(0.004)	(0.002)	(0.004)	(0.001)
H_t	**0.003***	**0.004***	**0.012***	**0.005**	**0.018***	**0.008***
	(0.001)	(0.001)	(0.002)	(0.003)	(0.003)	(0.001)
O_t^{NE}	0.034*	0.029*	0.037*	0.023*	0.018*	0.028*
	(0.004)	(0.003)	(0.004)	(0.003)	(0.007)	(0.002)
No of obs	69	69	69	69	69	
R^2	0.98	0.99	0.97	0.97	0.96	
	IV estimator – all equity					
	NSW	VIC	QLD	SA	WA	Mean group estimator
Y_t	0.385*	0.350*	0.558*	0.519*	0.067	0.376*
	(0.066)	(0.081)	(0.184)	(0.132)	(0.134)	(0.057)
$S_t^{DE,IE}$	**0.034***	**0.038***	**0.015***	**0.022***	**0.024***	**0.027***
	(0.003)	(0.002)	(0.006)	(0.002)	(0.005)	(0.002)
H_t	**0.005***	**0.004***	**0.011***	**0.004**	**0.021***	**0.009***
	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.001)
O_t^{NE}	0.026*	0.026*	0.031*	0.019*	0.011	0.023*
	(0.005)	(0.003)	(0.004)	(0.004)	(0.007)	(0.002)
No of obs	67	67	67	67	67	

Notes: All variables are in real per capita terms and in levels. Constants are not reported. Standard errors are in parentheses and * denotes significance at the 5 per cent level. The mean group estimator reported here uses an unweighted average of the estimates for each state. The standard error of the mean group estimator is calculated assuming the estimates for each state are independent.

Encouragingly, the mean group estimator is in line with the fixed-effects estimators, indicating that this variation washes out when we look at the average effect on the macroeconomy as a whole. Thus we can be reasonably confident about our estimates of the wealth effects at the 'average' (i.e. national) level, even if the range of estimates for the particular states seems implausibly wide.

When we compare our results with the long-run wealth effects estimated by other studies a number of differences arise. Converted into annual MPCs, we find that stock market wealth increases consumption by about 6 to 9 cents in the dollar. In comparison, Bertaut (2002) finds a long-run effect of stock market wealth of 5 cents in the dollar while the estimates by Tan and Voss (2003) range from 4 cents in the dollar to 16 cents in the dollar.[22] Our estimate is broadly consistent with the – admittedly wide – range of estimates provided by other studies. It lies above the *total* wealth effect of 0.04 estimated by Tan and Voss (2003) for Australia. However, this should not be entirely unexpected, as our housing MPC is lower than 0.04. Since housing wealth accounts for a large share of Australian households' assets, this lower MPC is being balanced by an accordingly higher MPC on stock market wealth. The stock market effect lies also at the higher end of those estimated for other countries, but the lower end of our range is well within the range found for other countries.

Our long-run housing wealth effect translates into an annual MPC of around 3 cents in the dollar. This lies at the upper end of the range reported by Tan and Voss (2003), who find an insignificant effect of housing wealth on consumption of between minus 4 cents and plus 4 cents in the dollar. Similar to Case *et al* (2001), using state-level data we have found both a significant housing market and stock market wealth effect for Australia. But, unlike their study, which finds that the housing effect in the US is larger than the stock market effect, we have confirmed the result from previous studies for Australia which found that the stock market wealth effect is larger than the housing wealth effect.

---

22 The specification by Tan and Voss (2003) differs in a number of dimensions from ours. They estimate the effect on non-durable consumption only whereas we use total consumption. As a result, they include durable consumption in their wealth measure. Finally, they estimate their model over a slightly different sample period from ours.

4.5 Estimation Using Aggregate Data

Our estimation strategy is based on state-level data. This raises the question what do we gain from using state-level data rather than aggregate-level data? As we have chosen a different specification from that of previous studies, a direct comparison may be difficult. We therefore estimate an aggregate consumption function using our model, allowing us to compare our state-level results with an aggregate benchmark.[23] The results for our model using aggregate data are presented in Table 4. Again, the model is estimated in levels and in real per capita terms.

How do these results compare to the fixed-effects panel? Compared with the state-level results in Table 1, the income effect is higher for the aggregate-level data, ranging from 0.59 to 0.80, which is in line with those found by other studies (e.g., Tan and Voss (2003)). The stock market wealth effect ranges from 0.011 to 0.024 and is close to the panel-data estimate of 0.015 to 0.027. The housing wealth effect, which ranges from –0.004 to 0.002, is substantially smaller than the panel estimates of around 0.008.

One can detect one unifying theme in the results in Table 4: in all models the stock market wealth effect is significant while the housing effect is insignificant. Note that this general theme holds for other aggregate level studies, such as Tan and Voss (2003), as well. This is where the value of state-level data can be seen most clearly. With state-level data we continue to find a significant stock market wealth effect and we find that this effect is at least as large as the housing wealth effect. But with state-level data the housing wealth effect becomes significant, in both the fixed-effects and the mean group estimators. As discussed earlier, this result suggests that the insignificance of the coefficient at the aggregate level is due to multicollinearity, which could be mitigated using state-level information.[24]

---

[23] Time series estimation techniques such as an error correction model (ECM) allow us also to judge how long it takes for the long-run effects of a permanent wealth change to pass through to consumption. Although the results regarding the dynamics are sensitive to different specifications, some preliminary analysis suggests that it takes several years for a permanent change in wealth to fully affect consumption, in line with other studies, such as Tan and Voss (2003), who find a time span of around 16 quarters.

[24] Statistical measures suggest also that the degree of multicollinearity is lower for the state-level data set. For example, the condition index (CI) suggested by Belsley, Kuh and Welsch (1980) measures collinearity within a group of variables (a higher CI suggests more multicollinearity). The CI for the aggregate data set is 9.56, the median CI for the individual states is 8.43 and the CI for the pooled state-level data set is 3.94.

Table 4: Results Using Aggregate Level Data
Marginal propensities to consume

	All equity			Direct equity only		
	IV	ECM	DOLS	IV	ECM	DOLS
Y_t	0.713*	0.803*	0.661*	0.645*	0.696*	0.592*
	(0.074)	(0.146)	(0.061)	(0.061)	(0.125)	(0.052)
$S_t^{DE,IE}$	**0.020***	**0.022***	**0.024***			
	(0.003)	(0.005)	(0.003)			
S_t^{DE}				**0.011***	**0.014**	**0.015***
				(0.004)	(0.008)	(0.004)
H_t	**0.002**	**–0.004**	**0.000**	**0.002**	**–0.002**	**0.001**
	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)
O_t^{NE}	0.030*	0.035*	0.035*			
	(0.004)	(0.006)	(0.003)			
$O_t^{IE,NE}$				0.029*	0.032*	0.033*
				(0.003)	(0.005)	(0.003)
No of obs	69	68	68	69	68	68
R^2 adjusted		0.98	0.99		0.98	0.99
SE regression	45	70	34	41	68	34
DW	1.13	2.12	0.92	1.04	2.20	0.84

Notes: All variables are in real per capita terms and in levels. Only long-run coefficients are reported. Constants are not reported. Standard errors are in parentheses and * denotes significance at the 5 per cent level. For the IV estimations we use the first and second lags of income and contemporaneous values of the other independent variables as instruments.

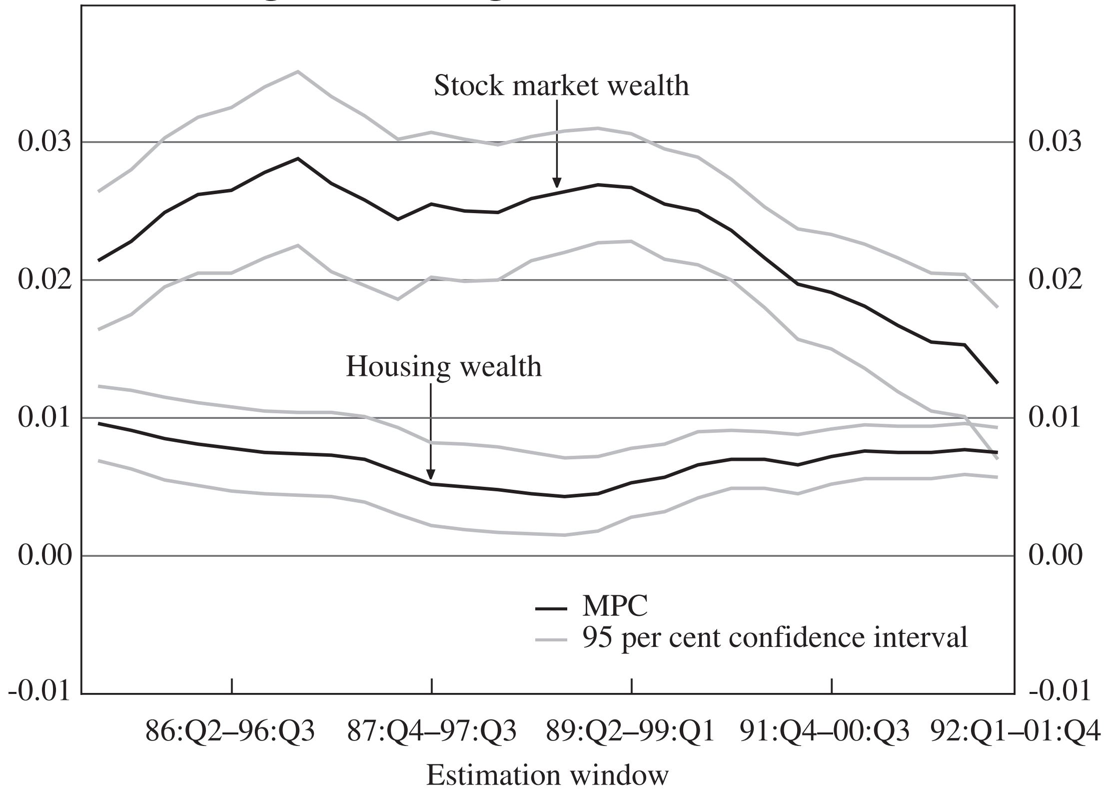
Of course, like any estimation, our results may be sensitive to the specific assumptions made, such as the time period over which we estimate or the model specification chosen. The next section therefore briefly discusses the robustness of the coefficients through time.

5. Robustness of the Results Through Time

Previous studies of consumption functions for Australia have found considerable parameter instability through time (e.g. Debelle and Preston (1995) and Tan and Voss (2003)). One possible reason for this is the process of economic reform in Australia during the last two decades. Financial liberalisation and deregulation can create structural breaks in the underlying relationships that we are estimating and these are not necessarily ‘one-off’ breaks but could occur slowly over time. Naturally, this raises the question of how robust our results are to changes in the time period chosen.

We have therefore re-estimated the model over different time periods. Similar to other studies, we find that the income effect rises considerably over the 1990s, irrespective of the estimation method chosen. In comparison, the wealth coefficients, which are our parameters of interest, appear to be more stable through time. Figure 1 presents the results for the wealth MPCs using a rolling window of 10 years and the fixed-effects IV model.

Figure 1: Rolling Fixed-effects Estimates



While there appears to be some variation in the estimated coefficients over time, it is hardly excessive considering that a 10-year window is a rather short sample for this type of regression. For the entire time period, the stock market effect is greater than the housing wealth effect. The confidence intervals indicate that for most of the period this difference is statistically significant. When we use the measure with direct equity holdings only (Figure 1 shows the stock market wealth effect for all equity holdings), the two MPCs are not significantly different from each other over most of the time period. Both wealth effects are significantly different from zero at the 10 per cent level of significance for every window. Thus, whatever structural changes have occurred over the estimation period, they apparently do not alter the finding that both stock market wealth and housing wealth affect consumption.

It should also be noted that the coefficient on stock market wealth has changed somewhat over time, perhaps reflecting – at least in part – ongoing changes in the structure of the financial markets. Similarly, the increase in the housing wealth coefficient towards the end of the sample period might be consistent with the observed increase in housing equity withdrawal over the recent years. These changes, although they appear to be occurring gradually, caution also that the past may not always be an indication of the future, especially during periods of rapid financial innovation.

6. Conclusions

In this paper we have followed Case *et al* (2001) and used a state-level panel to estimate the effect of changes in different components of wealth on household consumption expenditure in Australia.

In contrast to previous studies using economy-wide data, we find using state-level data that both housing wealth and stock market wealth are significant long-run determinants of consumption. The marginal propensity to consume out of stock market wealth is estimated to be larger than that with respect to housing wealth, and statistically significantly so in most cases. Using state-level data may thus have provided some further insight.

For our preferred model, a one-dollar permanent increase in stock market wealth is estimated to increase annual consumption by 6 to 9 cents in the long run and a similar increase in housing wealth is estimated to increase consumption by around 3 cents. Since households' housing assets are more than three times as large as stock market assets, our estimates imply that a one per cent increase in housing wealth has an effect on aggregate consumption that is at least as large as that of a one per cent increase in stock market wealth.

Finally, it is worth noting that these estimates refer to the *long-run* effect of a *permanent* change in wealth, which is likely to take years, rather than quarters to fully pass through to consumption.

Appendix A: Data

The data set used in this paper consists of a panel of observations on seven variables. These variables are consumption, labour income, stock market wealth, dwelling wealth, other financial wealth and households housing debt and personal debt. The cross-section spans five Australian states: New South Wales (NSW), Victoria (VIC), Queensland (QLD), South Australia (SA) and Western Australia (WA).[25] We also have a similar data set for the nationwide aggregate. All series are quarterly observations from 1984:Q4 to 2001:Q4.

Consumption

Description: Household consumption expenditure at current prices in A$ millions, seasonally adjusted, from 1984:Q4 to 2001:Q4. Available both by state and nationwide.

Source: ABS Cat No 5206.0

Income

Description: Household after tax labour income at current prices in A$ millions from 1984:Q4 to 2001:Q4.

Sources: ABS Cat No 6302.0; ABS Cat No 6203.0; ABS Cat No 5206.0

Construction: We construct state-level and national labour income following Tan and Voss (2003). State i's after-tax labour income Y_i is defined as:

$$Y_i = \text{Wages}_i + \text{Transfers}_i - \gamma_i \text{Tax}_i \tag{A1}$$

Wages$_i$ are defined as wages$_i = (365\frac{7}{4} \cdot \text{awe}_i \cdot \text{employment}_i \cdot \text{scale}_i)$ where awe$_i$ are average weekly earnings, employment$_i$ is the number of wage and salary earners, scale$_i$ is a scaling factor that adjusts for self-employed workers (calculated as the ratio of hours worked by employed persons to hours worked by wage and

[25] Tasmania, ACT and the Northern Territory are excluded due to data limitations.

salary earners)). Multiplication by $365\frac{7}{4}$ converts average weekly earnings to a quarterly frequency. The data were obtained from ABS Cat No 6302.0 and ABS Cat No 6203.0 and are available quarterly from 1984:Q4.

Transfers_i are calculated as *total secondary income* less *social contributions for workers compensation* for each state. Both series are available annually from 1989/90 onward in ABS Cat No 5206.0. We used aggregate-level data from the same source to backcast these series to 1984 and to infer a quarterly profile for them.

γ_i is the share of labour income in total household income, calculated as Wages_i divided by *total primary income*$_i$. *Total primary income*$_i$ is available annually from 1989/90 onward in ABS Cat No 5206.0. We used aggregate-level data from the same source to backcast this series to 1984 and to infer a quarterly profile.

Tax_i is calculated as the sum of *income tax payable* and *other current taxes on income, wealth, etc* for each state. Both series are available annually from 1989/90 onward in ABS Cat No 5206.0. We used aggregate-level data from the same source to backcast these series to 1984 and to infer a quarterly profile for them.

Stock market wealth

Description: Household gross financial wealth invested in assets whose value varies directly with the stock market, in A$ millions, from 1984:Q4 to 2001:Q4.

Sources: ABS Financial Accounts Cat No 5232.0; RBA Occasional Paper No 8.

Construction: The above sources provide data on a number of sub-components of financial wealth. We group these into the following categories: currency and deposits, direct equity holdings, equity superannuation, non-equity superannuation, and other.

We use quarterly data from 1988:Q4 onward from ABS Cat No 5232.0 and annual data from RBA Occasional Paper No 8 before then. The quarterly profile before 1988:Q4 was inferred using the S&P/ASX 200 index of share prices for direct equity holdings and using a linear trend for the other categories of financial wealth.[26]

We used information on financial flows from the 1993/94 Household Expenditure Survey (HES) to distribute these aggregate financial wealth stocks across the five states.[27] *Investment income* was used for direct equity holdings and other, *superannuation income* was used for both superannuation wealth categories, and *financial account interest income* was used for currency and deposits. The process is described by the following equation where W_c^i is the proportion of the total wealth in asset category c attributable to state i:

$$W_c^i = \frac{\sum_{n=1}^{N^i} (w_c^i)_n \cdot \frac{H^i}{N^i}}{\sum_{i \in I} \sum_{n=1}^{N^i} (w_c^i)_n \cdot \frac{H^i}{N^i}} \tag{A2}$$

where $(w_c^i)_n$ is income flow from assets in category c to household n in state i, N^i is the number of households from state i surveyed[28] and H^i is the total number of households in state i.

We used two classifications of stock market wealth in our estimation. The first consists of the sum of direct equity holdings and equity superannuation. The second consists of direct equity holdings only.

---

26 As we focus on long-run estimates, the precise quarterly profile should be less important. However, we also checked robustness by shortening the sample.

27 The 1998 HES was also available. We preferred the 1994 HES because it is closer to the midpoint of our sample period. Using the 1998 HES affects the point estimates but does not change the overall result of our study.

28 For superannuation we augmented this such that N^i is the number of people in state i who reported earning superannuation income rather than the total number of people from state i in the survey. This is to account for the fact that most people with superannuation wealth do not receive superannuation income until they retire.

Other financial wealth

Description: Household gross financial wealth not captured by the stock market wealth measure, in A$ millions, from 1984:Q4 to 2001:Q4.

Sources: ABS Financial Accounts Cat No 5232.0; RBA.

Construction: We use two classifications of other financial wealth each of which corresponds to one of the above measures of stock market wealth. The first consists of the sum of non-equity superannuation, currency and deposits, and other. The second consists of the sum of equity superannuation, non-equity superannuation, deposits and currency and other.

Debt

Description: Total household debt in A$ millions, from 1984:Q4 to 2001:Q4.

Source: ABS Cat No 5232.0.40.001; RBA.

Construction: The aggregate debt series was distributed amongst the states using data on housing loan repayments and personal loan repayments from the 1994/95 HES. The methodology is equivalent to that used to distribute aggregate stock market wealth amongst the states.

Housing wealth

Description: Household gross non-financial wealth invested in dwellings, in A$ millions, from 1984:Q4 to 2001:Q4.

Sources: ABS Census of Population and Housing; ABS Cat No 8752.0; ABS Cat No 3101.0; CBA/HIA dwelling price data.

Construction: The stock of dwellings by state is available from the census, for census years. This is converted into a quarterly series by linking the data for the census years using quarterly dwelling completions data from ABS Cat No 8752.0. Finally it is disaggregated into capital city dwellings and non-capital city dwellings using data on the number of households by capital city from ABS Cat No 3101.0.

The median price of established dwellings in cities and in non-metropolitan areas is available from the CBA/HIA. By multiplying this price measure by the corresponding quantity measure we are able to obtain capital city and non-capital city housing wealth measures for each of the five states. Summing the capital city and non-capital city housing wealth measures yields a total housing wealth measure for each state.

References

Bajari P, CL Benkard and J Krainer (2003), 'House prices and consumer welfare', NBER Working Paper No 9783.

Belsley DA, E Kuh and RE Welsch (1980), *Regression diagnostics*, Wiley, New York.

Bertaut CC (2002), 'Equity prices, household wealth, and consumption growth in foreign industrial countries: wealth effects in the 1990s', Board of Governors of the Federal Reserve System International Finance Discussion Paper No 724.

Blanchard OJ and S Fisher (1989), *Lectures on macroeconomics*, MIT Press, Cambridge, Massachusetts.

Blinder A and A Deaton (1985), 'The time series consumption function revisited', *Brookings Papers on Economic Activity*, 2, pp 465–511.

Boone L, C Giorno and P Richardson (1998), 'Stock market fluctuations and consumption behaviour: some recent evidence', OECD Economics Department Working Paper No 208.

Boone L, N Girouard and I Wanner (2001), 'Financial market liberalisation, wealth and consumption', OECD Economics Department Working Paper No 308.

Brayton F and P Tinsley (1996), 'A guide to FRB/US: a macroeconomic model of the United States', Federal Reserve System Finance and Economics Discussion Series No 1996-42.

Case KE, JM Quigley and RJ Shiller (2001), 'Comparing wealth effects: the stock market versus the housing market', NBER Working Paper No 8606.

Debelle G and B Preston (1995), 'Consumption, investment and international linkages', Reserve Bank of Australia Research Discussion Paper No 9512.

Deutsche Bundesbank (2003), 'Macroeconomic aspects of share price developments', *Monthly Report*, 55(3), pp 27–39.

Foster RA (1997), 'Australian economic statistics 1949–50 to 1994–95', Reserve Bank of Australia Occasional Paper No 8, revised.

Girouard N and S Blondal (2001), 'House prices and economic activity', OECD Economics Department Working Paper No 279.

IMF (2000), 'Asset prices and the business cycle', *World Economic Outlook*, pp 77–112.

Kent C and P Lowe (1998), 'Property-price cycles and monetary policy', in *The Role of Asset Prices in the Formulation of Monetary Policy*, BIS Papers No 5, Basel, pp 239–263.

Lettau M, S Ludvigson and N Barczi (2001), 'A primer on the economics and time series econometrics of wealth effects: a comment', Federal Reserve Bank of New York Staff Report No 131.

Ludvigson S and C Steindel (1999), 'How important is the stock market effect on consumption?', *FRBNY Economic Policy Review*, 5(2), pp 29–51.

Macklem RT (1994), 'Wealth, disposable income and consumption: some evidence for Canada', Bank of Canada Technical Report No 71.

Mark NC and D Sul (2002), 'Cointegration vector estimation by panel DOLS and long-run money demand', NBER Technical Working Paper No T0287.

McKibbin WJ and AJ Richards (1988), 'Consumption and permanent income: The Australian case', Reserve Bank of Australia Research Discussion Paper No 8808.

Muellbauer J and R Lattimore (1999), 'The consumption function: a theoretical and empirical overview', in MH Pesaran and MR Wickens (eds), *Handbook of Applied Econometrics*, Vol I, Blackwell Handbooks in Economics, pp 221–311.

Pesaran MH and R Smith (1995), 'Estimating long-run relationships from dynamic heterogeneous panels', *Journal of Econometrics*, 68, pp 79–113.

Pichette L (2000), 'Les effets réels du cours des actions sur la consommation', Banque du Canada Document de travail No 2000-21.

Pissarides CA (1978), 'Liquidity considerations in the theory of consumption', *Quarterly Journal of Economics*, 92(2), pp 279–296.

Poterba JM (2000), 'Stock market wealth and consumption', *Journal of Economic Perspectives*, 14(2), pp 99–118.

Reserve Bank of Australia (2003), 'Housing equity withdrawal', Reserve Bank of Australia *Bulletin*, February, pp 50–54.

Rudd J and K Whelan (2002), 'A note on the cointegration of consumption, income, and wealth', Federal Reserve System Finance and Economics Discussion Series No 2002/53.

Shefrin HM and RH Thaler (1988), 'The behavioral life-cycle hypothesis', *Economic Inquiry*, 26(4), pp 609–643.

Starr-McCluer M (1998), 'Stock market wealth and consumer spending', Federal Reserve System Finance and Economics Discussion Series No 1998/20.

Stock JH and MW Watson (1993), 'A simple estimator of cointegrating vectors in higher order integrated systems', *Econometrica*, 61(4), pp 783–820.

Tan A and G Voss (2003), 'Consumption and wealth in Australia', *The Economic Record*, 79(244), pp 39–56.