

Reserve Bank of Australia

RESEARCH
DISCUSSION
PAPER

Household Saving and Asset Valuations in Selected Industrialised Countries

Paul Hiebert

RDP 2006-07

HOUSEHOLD SAVING AND ASSET VALUATIONS IN SELECTED INDUSTRIALISED COUNTRIES

Paul Hiebert

Research Discussion Paper
2006-07

August 2006

Reserve Bank of Australia

This work was initiated while the author was visiting the Reserve Bank of Australia (RBA) from the European Central Bank (ECB). The views expressed in this paper are those of the author and do not necessarily reflect those of the RBA or the ECB. I would like to thank staff at the RBA and ECB for useful comments and assistance, with a special thanks to Marion Kohler and Christopher Kent for very useful discussions and guidance. I would also like to thank Claudio Borio and Philippe Hainaut for providing data compiled by the BIS, along with Sue Black and Ana Lima for their useful assistance in constructing relevant databases. Any remaining errors are, of course, my sole responsibility.

Author: paul.hiebert@ecb.int

Economic Publications: ecpubs@rba.gov.au

Abstract

Over the past decade, a fairly synchronised and steady decline in household saving rates has been witnessed in some OECD countries but not in others. In these English-speaking countries, which share many similar institutional and cultural features, declines in household or personal saving appear to have been correlated with large capital gains and rapid financial innovation. An empirical investigation based on quarterly macroeconomic data indicates that gains in the valuation of asset holdings have indeed been important as a substitute for traditional household saving (that is, personal saving as defined in the national accounts) in these countries over the last decades, and in some cases that this effect has been intensifying through time. Existing studies analysing private saving have tended to either focus on individual countries, finding the importance of wealth effects in certain cases, or a panel of OECD countries in which other common factors tend to dominate the wealth effect. In the latter case, it is possible that the lack of a significant wealth effect could be attributable to heterogeneity across countries.

JEL Classification Numbers: C22, E21
Keywords: household saving, wealth valuation, error-correction

Table of Contents

1. Introduction 1

2. Household Saving in Standard Theoretical Models 5

3. Empirical Assessment 10
   - 3.1 Data and Model Specification 11
   - 3.2 Individual Analysis of Countries 12
   - 3.3 A Panel of English-speaking Industrialised Countries 17

4. Conclusion 19

Appendix A: Data 20

Appendix B: Measurement Issues Related to the National Accounts Measure of Saving 21

Appendix C: The Relationship of Household Saving to Wealth Building 24

References 26

HOUSEHOLD SAVING AND ASSET VALUATIONS IN SELECTED INDUSTRIALISED COUNTRIES

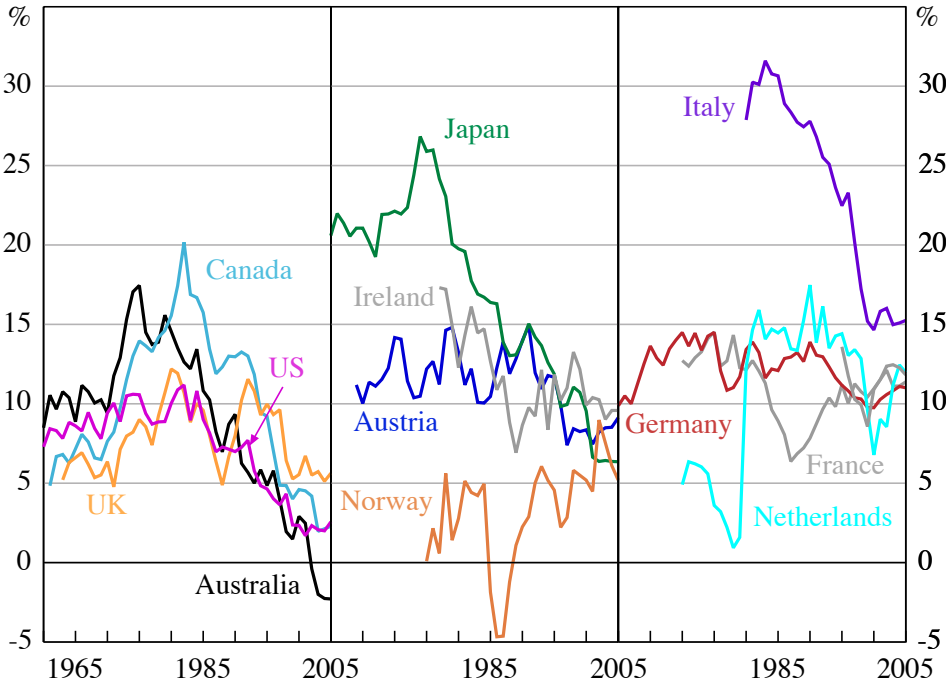
Paul Hiebert

1. Introduction

Over the past decade, a fairly synchronised and steady decline in household saving rates has been witnessed in some OECD countries but not in others. A casual inspection reveals that this trend has been most pronounced for four English-speaking industrialised countries – that is, Australia, Canada, the United Kingdom and the United States (Figure 1).

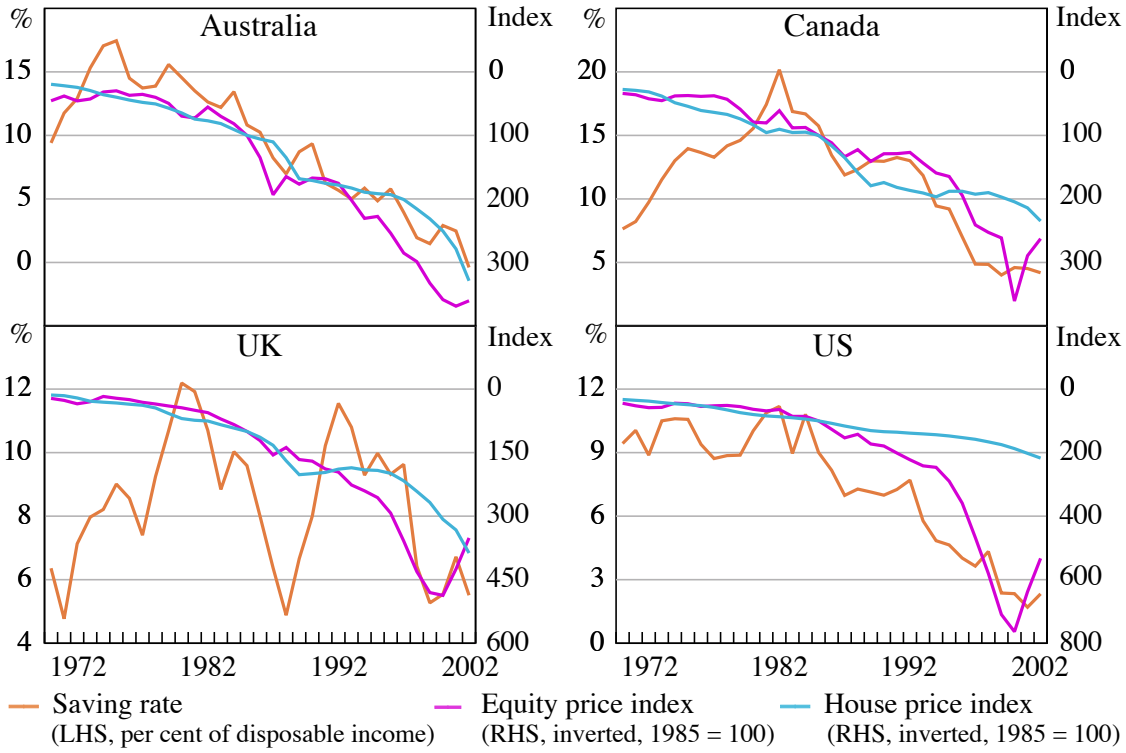
Figure 1: Evolution of Household Saving Rates in Selected OECD Countries

Per cent of disposable income



In this set of countries, the fall in saving since the early 1980s has occurred in conjunction with a trend rise in wealth and improved access to capital gains in both financial and residential housing markets (Figure 2). It appears that gains in wealth have increasingly been used as a substitute for traditional personal saving, that is, saving as measured in the national accounts.

Figure 2: Household Saving Rates and Real Asset Price Dynamics



To date, the empirical literature on saving has been based on either individual country data (at the macro or micro level) or cross-country panel data. At the country level, most studies have examined developments in the US, where several studies suggest that capital gains – both on equity holdings and on residential real estate – are playing an increasingly important role in the accumulation of household wealth and the fall in household saving. Using aggregate data, Faulkner-MacDonagh (2003) analyses saving ratios relative to wealth in a cointegration framework for the US, and finds that accounting for all sources of wealth (equity, housing, non-equity financial), the US personal saving rate was not far below an implied equilibrium level. At the microdata level, Juster *et al* (2004) analyse household-level panel data for the US and find that capital gains on corporate equities were the key driver of the decline in the personal saving rate in the US between 1984 and 1994. Likewise, Maki and Palumbo (2001), using microdata, find that the direct wealth effect on household spending can explain much of the decline in the US aggregate household saving rate observed in the 1990s; and that the groups of households that benefited the most from the substantial increases in equity wealth in these years – namely those

with high incomes or those who had attained higher education – were also the groups that substantially decreased their rates of saving.[1]

Moving to a multi-country setting, several studies have analysed the macroeconomic determinants of saving in a panel setting. Loayza, Schmidt-Hebbel and Servén (2000) employ dynamic panel data methods with fixed effects estimators for a large panel of countries. They find that there are a variety of factors responsible for underlying trends in saving (though no direct measures of developments in household wealth are included). In particular, using annual data, they find: evidence of inertia in private saving (possibly attributable to lagged effects of the explanatory variables on saving); that the population age structure affects saving through life-cycle channels; and that saving is affected by financial liberalisation, inflation and fiscal policy. A more homogenous group, namely developed economies, is examined in several OECD studies employing panel data techniques which better account for panel heterogeneity, such as de Serres and Pelgrin (2003) and de Mello, Kongsrud and Price (2004).[2] These studies find strong evidence of offsetting movements in private and public saving (or dissaving), lending some support for Ricardian Equivalence. Wealth effects are found to have a common impact on private saving for this group of countries with rising wealth usually associated with lower saving. Sarantis and Stewart (2001) also examine the determinants of private saving in OECD countries, but use panel cointegration tests which allow for both panel and dynamic heterogeneity, although they assume a unique cointegrating vector for the entire panel. They find considerable heterogeneity in the determinants of private saving across OECD countries, ranging from factors such as demographics and credit constraints to public saving. However, they do not include any direct measures of wealth valuation.

While several other studies have analysed issues related to household consumption and wealth effects, relatively few have specifically examined the analogous

---

1 While a microdata approach may capture effects not present in aggregate data, it can be problematic insofar as findings for a specific cross-section may not be directly applicable to trends at the macro level. That said, a micro approach can provide some complementary information, including household saving behaviour by income category.

2 The methodologies employed account for panel heterogeneity by allowing the short-run coefficients to vary across countries while imposing the same long-run restrictions.

relationship with household saving.[3] Indeed, analysing household saving is a very complex issue, given both a raft of measurement issues – with household saving as measured in the national accounts being an imperfect measure of life-cycle saving – and a rather complex process through which saving decisions are made.[4] Notwithstanding these issues, a focus on household saving rather than household consumption allows for another perspective on household behaviour, possibly providing some additional insight given that the share of income saved is a metric that many people use to describe their consumption patterns (see Shiller 2004).

This study aims to bridge the gap between existing studies of private saving which have either examined single economies or tended to examine a rather heterogeneous group of countries. It assesses the effect on household saving (as measured in the national accounts) of wealth valuation changes by analysing a subset of countries with similar institutional and cultural features – namely the English-speaking countries identified above – within a common model. The analysis is centered on single-equation error-correction models for each country, with additional estimation for a panel of these countries. The results suggest that there is a significant offset to the decline in saving provided by valuation gains for wealth for these English-speaking countries, that this offset appears to have varied by asset type, and that this offset has become more important through time for some countries.

The rest of the paper is organised as follows. Section 2 discusses some theoretical considerations to justify the basic approach adopted in the empirical analysis. Section 3 details the modelling approach and presents the results. Some concluding remarks are made in Section 4. Several appendices contain background information: Appendix A presents data sources; Appendix B covers statistical measurement issues related to the national accounts measurement of saving; and Appendix C contains background conceptual issues in mapping the national accounts notion of household saving to the accumulation of household wealth.

---

[3] There is a sizeable literature on wealth effects and household consumption. For example, Bertaut (2002) and Barrell and Davis (2004) employ dynamic cross-country analyses on the basis of single-equation error-correction models, and show a bigger wealth effect on consumption in Australia, Canada, the UK and the US than in other countries, such as those in continental Europe.

[4] Moreover, in the US, periodic revisions have resulted in sizeable changes to historical data on personal saving (see Nakamura and Stark 2005).

2. Household Saving in Standard Theoretical Models

The determinants of household saving are complex and are likely to vary both through time and across countries. The theoretical literature identifies several motives for saving, and four, in particular, dominate (see Browning and Lusardi 1996 and Callen and Thimann 1997):

1. *life-cycle saving* to provide resources for retirement;
2. *consumption smoothing* in the face of (relatively temporary and unexpected) fluctuations in income;
3. *precautionary (buffer-stock) saving* to finance unexpected losses in income; and
4. *liquidity constraints*, which are relevant in the case of large lifetime expenditures (including house purchases, education, etc).

In developing a theoretical framework to help tie these concepts together and underpin the econometric analysis of the determinants of saving, a useful starting point is to consider models of the Life Cycle/Permanent Income Hypothesis (LC/PIH) of consumption. These link consumption and saving to income and wealth according to motives 1 and 2 above.[5] In the standard LC/PIH model, outlined in Blanchard and Fisher (1989) and consistent with the presentation of Dvornak and Kohler (2003), a representative consumer chooses consumption in each period so as to maximise expected lifetime utility:

$$\max E_t \left[\sum_{t=0}^{T} \beta^t u(C_t) \right]$$

subject to a series of period-flow budget constraints:

$$A_{t+1} = (1 + r_t)(A_t + Y_t - C_t)$$

[5] Motives 3 and 4 above are not dealt with in the standard LC/PIH model, but are relevant to the discussion of credit constraints below.

where C_t represents consumption at time t, Y_t income, A_t non-human wealth holdings, r_t the interest rate and β the discount rate.

On the basis of this simple framework, it follows that the optimal consumption path implied by the first-order condition of the above problem will look something like:[6]

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

That is, consumption is a function of current assets (non-human wealth) and permanent (or lifetime) income, which is the sum of current and discounted expected future labour income (human wealth). In what follows, savings are defined according to the concept relevant to the national accounts, namely, the difference between income and consumption. The more persistent is an unexpected change in income, the larger will be the effect on consumption (and the smaller will be the effect on saving). The opposite is true for more temporary changes in income.

In order to make the problem tractable for the purposes of empirical analysis, current income can be assumed to follow a stochastic $AR(1)$ process, thereby allowing consumption to be expressed as a function of current assets and current income. Furthermore, wealth can be split into two broad sub-components: financial (W^{fin}) and non-financial (W^{nonfin}), which can be thought of as largely consisting of housing wealth. This yields the following expression for consumption on the basis of Equation (1) above:

$$C_t = \phi_1 Y_t + \phi_2 W^{fin} + \phi_3 W^{nonfin} \tag{2}$$

Given that real saving is equal to real (disposable) income less real consumption, a corresponding expression for saving (S_t) is therefore:

$$S_t \equiv Y_t - C_t = (1-\phi_1)Y_t - \phi_2 W^{fin} - \phi_3 W^{nonfin} \tag{3}$$

---

6 This requires a number of assumptions such as a constant interest rate equal to the rate of time preference (1–β) and a well-behaved utility function (see Dvornak and Kohler 2003).

In the above expression, $(1-\phi_1)$ represents the marginal propensity to save out of current disposable income while the ϕ_2 and ϕ_3 coefficients reflect the marginal propensity to offset saving due to valuation gains in wealth (that serve to reduce the need to save out of current income). This is consistent with the notion in the literature that capital gains would be expected to have a negative effect on saving (see Ludwig and Sløk 2004).[7]

A split between financial and non-financial wealth may be warranted for a number of reasons. First, under the *behavioural life-cycle hypothesis*, households may earmark certain assets for current expenditure while others are reserved for long-term savings.[8] Second, and related to the first point, the effect on consumption and saving depends on whether the shocks to wealth are perceived to be transitory or permanent, and this may differ across asset classes. Third, as housing is both a household asset and a consumption item, the wealth effect from this channel is debatable. On the one hand, while an increase in the price of housing benefits existing homeowners, it is accompanied by an offsetting increase in the implicit rental cost of housing and therefore simply represents a transfer of wealth within the household sector between current homeowners and renters or future homeowners. On the other hand, housing can also be used as collateral for borrowing for liquidity-constrained households and thus may help to explain the common finding of a positive effect of rising housing wealth on consumption – see Debelle (2004).

While the above specification gives a basic set of determinants of household saving, other factors may also exert an influence. In particular, liquidity constraints may influence saving decisions, leading some households to build up precautionary savings and others to limit consumption according to current,

---

7 Wealth effects could be expected through *realised* capital gains (such as equity withdrawal for housing or dividend payments) that enhance households' ability to spend. These effects, however, may be complemented or even eclipsed by the influence of *unrealised* capital gains. Such effects – working, for example, through retirement savings accounts – may capture the potentially strong influence of expectations regarding the future evolution of wealth, and hence influence the consumption and saving behaviour of households.

8 On top of 'mental accounting', differences in liquidity between asset types and varying bequest motives would also point in favour of separating the consumption/saving effects of financial and non-financial wealth – see Altissimo *et al* (2005).

rather than permanent, income. In practice, households may face limits on their ability to borrow against future income. For instance, marketable assets are normally required as collateral to borrow large amounts of money, credit limits commonly apply, and interest rates tend to be higher on unsecured loans. Hence, developments that lead to a relaxation of credit constraints can have a persistent (though transitory) impact on aggregate savings. In particular, a relaxation of borrowing constraints will tend to reduce aggregate savings, with the reduction building through time as an increasing proportion of the population takes on higher debt levels. This occurs as new generations come of age and take on debt (to a greater extent than previous generations at the same stage of life) while older generations, with some degree of savings and limited future labour income available to service debt, have little or no incentive to respond to an easing in credit constraints. On this basis, a term capturing the effects of financial innovation is warranted in empirical analysis of the determinants of household saving.

The direction of the impact on savings of reduction of liquidity constraints, and financial innovation more generally, is somewhat ambiguous. While financial deregulation over the past decades has made it generally easier for households to borrow through time,[9] financial system developments may have also provided opportunities for, and returns to, financial saving (Callen and Thimann 1997, Boone, Girouard and Wanner 2001 and de Mello *et al* 2004).

There are several other broad factors which may affect aggregate household saving but are excluded from the empirical analysis. First are measures of demographic change. Rising old-age dependency ratios might be expected to have reduced saving through life-cycle effects. The Congressional Budget Office (2003) also notes the trend in recent times to postpone parenthood to later years, which increases child-rearing expenses in peak earning years when saving would otherwise be high. These dampening influences on saving are likely to be

---

9 A list of significant financial innovations over the past decades can be found in Kohn (2005), where he notes

> the ability of new technologies in financial markets to reduce transactions costs, to allow the creation of new instruments that enable risk and return to be divided and priced to better meet the needs of borrowers and lenders, to permit previously illiquid obligations to be securitized and traded, and to make obsolete previous divisions among types of financial intermediaries and across the geographical regions in which they operate.

important, but in practice, including them is not straightforward. For example, it is not clear whether contemporaneous values of dependency are more relevant than forecasts of the dependency ratio. Also, when aggregating household-level saving, the influence of demographics on saving may cease to hold given interactions between the generations. In particular, bequests to younger cohorts may reduce aggregate saving even though older cohorts may not dissave, as indicated in de Mello *et al* (2004).

A second variable excluded from the empirical specification is the interest rate. Interest rates are usually of weak explanatory power and have an ambiguous impact on saving depending largely on the extent of credit constraints and on the relative magnitude of income and substitution effects – see Callen and Thimann (1997) and de Mello *et al* (2004). Interest rates have an indirect effect on saving through income and wealth effects. Interest rates could also be considered as capturing changes in the discount rate or general beliefs about future economic developments, as found by Parker (1999).[10] Changes to nominal interest rates also capture shifts in inflation over time. A reduction in steady-state inflation would be expected to reduce saving to the extent that it represents a reduction in 'macroeconomic volatility' and therefore a motive for high precautionary saving (Loayza *et al* 2000).[11]

A third variable excluded from the empirical specification involves institutional and tax factors. Such factors are likely to have an important impact on saving decisions, though these are difficult to capture quantitatively. Differences in tax and transfer system design across countries and through time within countries are likely to be important in explaining different saving behaviour of private

---

[10] The presence of *hyperbolic discounting* could lead to variation in consumers' rates of time preference over time and to dynamically inconsistent spending behaviour. This possibility could help to explain how low-income households can, on the basis of optimal decision-making, end up in a saving trap with little or no wealth accumulation – see Dynan, Skinner and Zeldes (2004) for a discussion.

[11] One further possible reason for a positive relationship is based on a statistical distortion that high consumer price inflation induces in the measure of the personal saving rate – see Connolly and Kohler (2004) and Shiller (2004). There is an upward bias in measured household saving during times of high inflation, such as the 1970s and 1980s, when creditors' real return on interest-bearing assets, which have a fixed nominal principal, is significantly lower than nominal interest rates would suggest (and households tend to be net holders of these assets).

households (see, for instance, Callen and Thimann 1997). In this sense, the use of unobserved fixed effects in panel regressions may be warranted to capture such effects insofar as they are invariant with respect to time and/or cross-sections.

3. Empirical Assessment

This section contains an empirical assessment of Australia, Canada, the UK and the US, where a casual inspection suggests that the co-movement of asset price valuation and private saving has been particularly striking. Indeed, a common pattern appears to be prevalent in these countries, with some similarities in terms of cultural, demographic and institutional characteristics in addition to economic/financial structure and cycles.[12] These countries have had relatively similar experiences over time with regard to asset price developments, propensities to incur debt and access to credit. Moreover, it is likely that households in these countries have relatively similar attitudes *vis-à-vis* homeownership versus renting along with many similarities in pension schemes.[13]

The empirical results are presented in two parts. First, the results from a single-equation error-correction model (ECM) using quarterly data are presented for these four countries. Supplementing this estimation is an empirical investigation as to whether such relationships have been stable. Second, a panel of these four countries is considered. Appendix A contains further detail regarding the data employed, including sources. Appendix B analyses several possible corrections in the standard statistical measurement of saving. Appendix C provides a discussion of the conceptual link between household saving and wealth.

---

[12] Other English-speaking industrialised countries with potentially similar features, such as Ireland and New Zealand, could not be included in the analysis given an incomplete quarterly dataset.

[13] This would include voluntary personal pension plans in the US and Canada, compulsory superannuation in Australia and a mix between voluntary and mandatory occupational personal pension plans in the UK.

3.1 Data and Model Specification

An error-correction framework is estimated using the Dynamic Ordinary Least Squares (DOLS) procedure of Stock and Watson (1993), which mitigates the effects of regressor endogeneity on the distribution of the least squares estimator via the inclusion of leads and lags of the first difference of the right-hand-side variables.

The starting point for estimation is Equation (3), augmented with a variable to account for financial change over the sample period as discussed in Section 2. Measures capturing financial deregulation and/or proxies for financial deepening could be, among other things, credit-to-GDP ratios, ratios of monetary aggregates to GDP or interest rate spreads. The ratio of household debt to disposable income is chosen as the proxy for financial liberalisation, given that it should capture effects of financial innovation through their impact on expanding household borrowing.

The specification is as follows, with all variables in logs:[14]

$$s_t = \phi_0 + \phi_1 y_t + \phi_2 p^{eq}{}_t + \phi_3 p^{h}{}_t + \phi_4 f_t + DOLSterms_t + \varepsilon_t \tag{4}$$

where: s_t is the level of the real personal saving at time t; y_t is the level of real disposable income;[15] $p^{eq}{}_t$ is an index for real equity prices; $p^{h}{}_t$ is an index for real residential housing prices; f_t is the financial liberalisation measure; and

$$DOLSterms_t \equiv \sum_{i=-k}^{k} \gamma_i \Delta y_{t+i} + \sum_{i=-k}^{k} \upsilon_i \Delta p^{eq}{}_{t+i} + \sum_{i=-k}^{k} \lambda_i \Delta p^{h}{}_{t+i} + \sum_{i=-k}^{k} \theta_i \Delta f_{t+i} \tag{5}$$

---

[14] A log-linear specification is chosen over a per-capita alternative on two main grounds. First, the interpretation of parameter estimates from a log-linear specification is straightforward, while defining an appropriate per-capita specification is complicated by differing units of national accounts data versus asset price indices. Second, the quarterly data contain only positive values of saving over the sample period, allowing for the use of logarithms.

[15] Disposable income is the variable chosen in this study, rather than wages, given better data availability. Also, income other than wages and salaries (for example, interest and dividend income) contribute to saving.

The associated short-term specification of the ECM is:

$$\Delta s_t = \alpha_1 ECM_{t-1} + \alpha_2 \Delta y_t + \alpha_3 \Delta {p_t}^{eq} + \alpha_3 \Delta {p_t}^{h} + \zeta_t \qquad (6)$$

where ECM_{t-1} is the lag of the residual from the long-run equilibrium levels Equation (4) estimated above.

Data are quarterly, and the common estimation period starts in 1970 for all countries except Australia, for which data on household debt are only available from 1977 onward.

As outlined in Appendix A, household saving, income and debt data are taken from national sources, while BIS data are used for real price indices for equities and residential housing, proxying for changes in the real value of household wealth. Price indices rather than the real value of wealth are included, reflecting limitations in obtaining a complete set of comparable quarterly data across the countries.[16] All variables are deflated using the price deflator for personal consumption from the national accounts.

3.2 Individual Analysis of Countries

On the basis of Augmented Dickey-Fuller (ADF) tests and taking into consideration possible structural breaks, all variables entering the specification (in levels) are found to be difference stationary, and so are modelled as I(1) stochastic processes within a single cointegrating relation for each country.

From the ECM estimations, reported in Table 1, the following observations can be made:

- the long-run *income effect* from the cointegration equation indicates that income enters the specification significantly and with the expected positive sign; the estimated long-run elasticity of saving with respect to disposable

[16] Even so, these price series appear to correlate highly with the available household wealth data. An examination of household net financial wealth and non-financial assets (as reported by the *OECD Economic Outlook* for Canada, the UK and the US; and the RBA for Australia) against the equity and house price index of the BIS, respectively, indicates a correlation of over 0.9 between each pair of series over the 1993–2002 period.

Table 1: ECM Estimates for Industrialised Countries

	US 1970:Q3–2002:Q4			Australia 1977:Q2–2002:Q1		
	Coefficient estimate	SE	p-value	Coefficient estimate	SE	p-value
Estimation in log-levels						
Disposable income (y)	1.023	0.272	0.00	1.079	0.564	0.06
Equity price index (p^{eq})	–0.596	0.080	0.00	–0.236	0.164	0.15
House price index (p^{h})	–1.214	0.483	0.01	–0.813	0.407	0.05
Debt-income ratio (f)	–0.240	0.521	0.65	–1.336	0.239	0.00
Estimation in log differences						
ECM(–1)	–0.224	0.084	0.01	–0.422	0.171	0.02
Δy	8.464	1.122	0.00	12.852	1.592	0.00
Δp^{eq}	–0.339	0.194	0.08	–0.134	0.362	0.71
Δp^{h}	–3.955	1.282	0.00	–2.266	1.178	0.06
	Canada 1970:Q3–2002:Q4			**UK 1970:Q3–2002:Q4**		
	Coefficient estimate	SE	p-value	Coefficient estimate	SE	p-value
Estimation in log-levels						
Disposable income (y)	1.674	0.123	0.000	2.027	0.214	0.00
Equity price index (p^{eq})	–0.869	0.089	0.000	–0.559	0.087	0.00
House price index (p^{h})	1.029	0.207	0.000	–0.985	0.205	0.00
Debt-income ratio (f)	–1.886	0.173	0.000	1.514	0.238	0.03
Estimation in log differences						
ECM(–1)	–0.224	0.068	0.001	–0.154	0.065	0.02
Δy	5.374	0.565	0.000	9.549	0.750	0.00
Δp^{eq}	–0.173	0.113	0.127	–0.165	0.142	0.25
Δp^{h}	–0.377	0.280	0.181	–1.625	0.399	0.00

Notes: Dummy variables included in levels equation: US – 2001:Q4, 2002:Q1, 2002:Q4; Australia – 1998:Q2, 1991:Q1, 1999:Q4, 2001:Q2; Canada – 2002:Q2, 2002:Q3, 2002:Q4; UK – 2000:Q1. These are included to mitigate the impact of outliers on the estimation.

income is close to one (except for the UK, where it is higher). Such elasticities are associated with an implied long-run marginal propensity to save out of disposable income[17] in the vicinity of 0.07 for Australia and the US and a somewhat higher 0.17 for Canada and the UK.[18] The dynamic response to income is significant, positive, and sizeable, implying considerable adjustment in saving around its long-run equilibrium level in response to changes in income, consistent perhaps with consumption smoothing;

- an examination of the long-run *wealth effect* indicates that increases in both residential housing prices and equity prices have tended to reduce household saving, except in the case of Canada (where cycles in the housing price index around its trend in the late 1980s and early 1990s may have exerted some influence on the result, mirroring a similar finding in Bertaut 2002). With this one exception, the responsiveness of saving, in absolute value, to *equity* prices is much lower than it is to *house* prices.[19] This may indicate the relative ease of extracting capital gains from housing and/or the wider holding of housing assets among the general population (Barrell and Davis 2004). As for wealth effects in the dynamic equation, saving is more responsive in the short-run to changes in house prices relative to equity prices. This may reflect a slower response of saving to equity price movements given a perception on the part of households that house price movements are more permanent than movements

---

17 These marginal propensities to save are obtained by multiplying the estimated income elasticity of saving by the average share of real household saving in real disposable income over the relevant sample period.

18 For Australia, the numbers are somewhat below the estimates of Connolly and Kohler (2004), who find that the marginal propensity to save out of labour income is around 13 cents in the dollar. For the US, these implied marginal propensities are broadly consistent with the findings of Juster *et al* (2004), who find that an extra dollar of income raises saving by roughly 8 cents. Dynan *et al* (2004) find widely differing marginal propensities to save across households by income level, with estimates ranging from 3 cents per dollar of income for lower quintiles and up to 43 cents for upper quintiles.

19 This finding is consistent with Case, Quigley and Shiller (2001), who show that housing wealth has a larger impact than equity wealth on consumption on the basis of a pooled sample of 14 countries. However, this result is not uncontroversial. It stands in contrast to the finding of Juster *et al* (2004), who use US microdata to show that the effect on saving of capital gains on corporate equities was substantially larger than the effect of capital gains on housing or other assets over the period 1984–1994. See Altissimo *et al* (2005) for a comprehensive review of the literature estimating wealth effects on consumption.

in financial assets (Lettau and Ludvigson 2003),[20] along with ease of access to housing equity in these countries and wider homeownership relative to equity holdings;

- the long-run coefficient estimates on the *debt-to-income ratio* generally suggest a negative impact on saving from financial innovation, or a reduction in saving from an increased ease in borrowing. However, the opposite is true for the UK, suggesting that the development of the financial system may have enhanced opportunities for, and returns to, saving (out of disposable income); and
- the speed of adjustment terms in the dynamic equations indicate that cointegration holds in all cases, and points to a fairly rapid adjustment to long-run equilibrium.

One additional issue which warrants special attention is whether the relationship between saving and its determinants has changed through time.[21]

To assess the issue of instability in the estimates of Equation (4), recursive least squares estimation of the baseline specification was undertaken.[22] This was done excluding the dummy variables and over an expanding window. The starting sample is from 1970:Q3 to 1978:Q1 for all countries except Australia, for which the initial sample is from 1977:Q2 to 1984:Q1.

Results suggest that some parameter instability is present (Figures 3a and 3b). The absolute size of the long-run coefficient on equity prices increases towards the end of the sample period for Canada and the US (likely a result of a widening of equity

---

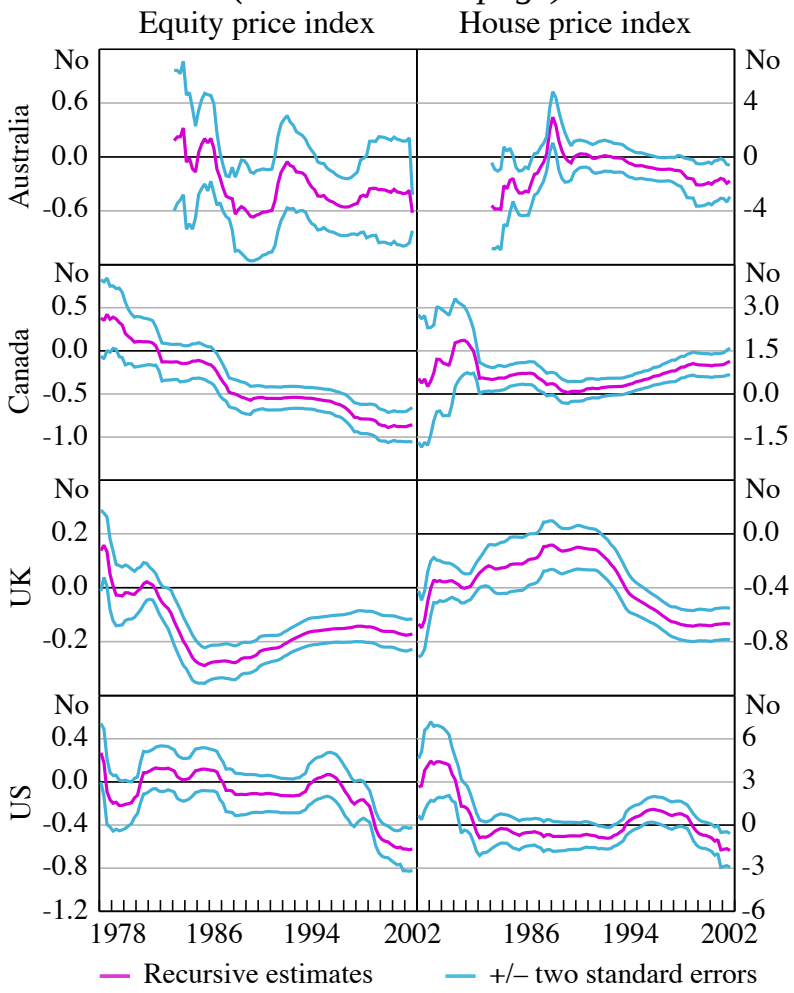
[20] Lettau and Ludvigson find that only a small fraction of the variation in household net worth over the past few decades has been related to variation in aggregate consumer spending, consistent with consumption smoothing – though this result is contested by Rudd and Whelan (2002).

[21] Another issue is that of possible simultaneity, although the assumption that asset values as weakly exogenous appears to be a reasonable approximation of reality given that saving from income that flows into wealth is eclipsed by valuation changes. An estimated restricted vector autoregression similar to that of Lettau and Ludvigson (2003) indicates some possible simultaneity for the US but not for the other countries (results available from author on request).

[22] This test is not without its faults – notably the low power to detect changes – but it has better performance in assessing the importance of structural breaks when compared with the Chow test when the date of the break is unknown (Hamilton 1994).

Figure 3a: Recursive Estimates of the Long-run Equilibrium Coefficients

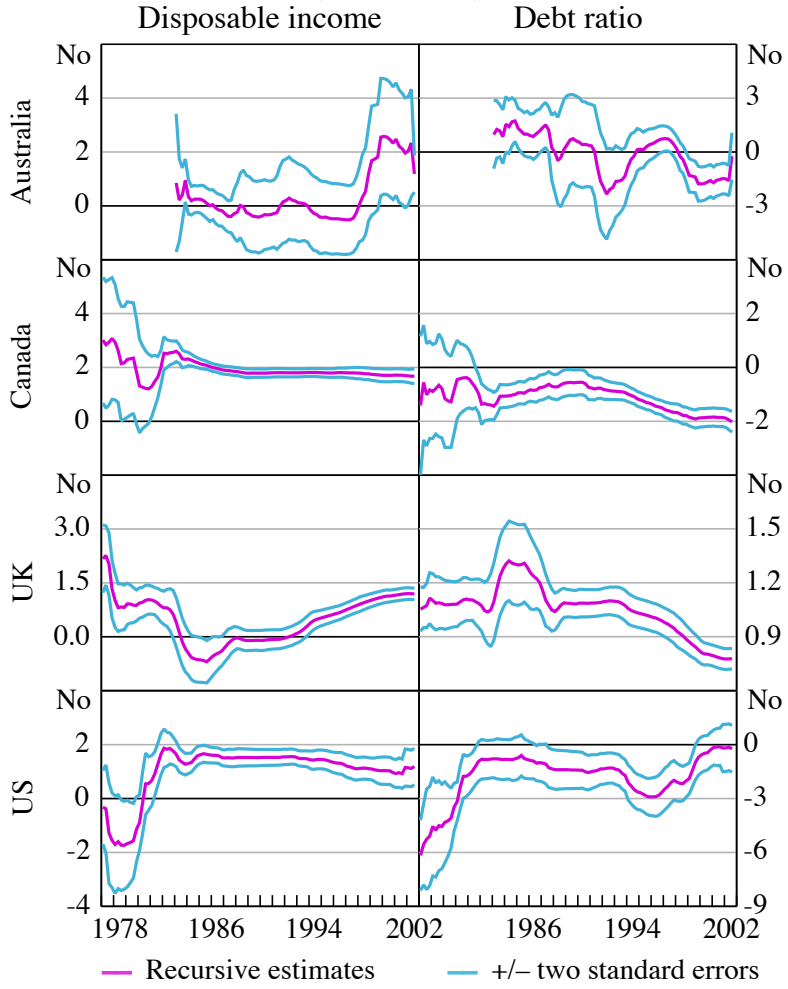
(continued next page)



holdings across households), with a similar pattern for house prices in the case of the UK and the US. Abstracting from instability early in the recursive estimation generated by the initially small sample sizes, only in the case of Canada do the coefficients on equity and house price terms appear to show clear linear trends throughout the expanding estimation window. For the case of the US, recent years have seen an increase in the effect of both equity and house prices on saving. For the UK, it would appear that, for the effect of housing prices on savings, there may have been a structural break in the early 1990s. For the income coefficients, recursive estimation indicates broadly stable parameter estimates for Canada and the US, whilst there is evidence of a break in the late 1990s in Australia and some drift in the case of the UK. Recursive estimation indicates an increase in the absolute value of the debt ratio coefficient in the cases of Australia, Canada and the UK in recent years.

Figure 3b: Recursive Estimates of the Long-run Equilibrium Coefficients

(continued)



3.3 A Panel of English-speaking Industrialised Countries

As a further step, the four countries are grouped into a panel in order to assess common trends. The estimation methodology employed is panel DOLS.[23] The estimation period is 1977:Q1–2002:Q1 in order to obtain a balanced panel. The panel unit root tests of Breitung (2000) indicate that all of the variables can be considered as I(1) stochastic processes in a panel context, while ADF tests for the error terms from the regression in log-levels indicate that the system has a cointegrating relation.

[23] See Mark and Sul (2002) for a recent discussion and application of this methodology.

Table 2: Dependent Variable – Real Saving
Australia, Canada, the UK and the US

	Estimation in log-levels 1977:Q1–2002:Q1		Estimation in log difference 1977:Q2–2002:Q1	
	(1)	(2)	(1)	(2)
Constant	2.367	0.906		
	(0.00)	(0.71)		
ECM(–1)			–0.198	–0.244
			(0.00)	(0.00)
Disposable income	1.073	1.414	9.236	9.140
	(0.00)	(0.00)		(0.00)
Equity price index	–0.783	0.777	–0.350	0.360
	(0.00)	(0.00)	(0.04)	(0.03)
House price index	–0.372	–0.462	–2.124	–2.277
	(0.03)	(0.02)	(0.00)	(0.00)
Debt-income ratio	–0.031	–0.485	0.344	0.280
	(0.36)	(0.00)	(0.00)	(0.02)
Adjusted R^2	0.96	0.96	0.37	0.39

Notes: ECM(–1) indicates lagged error term from level equation. (1) is a regression with common constants; (2) with cross-section fixed effects. P-values are in parentheses.

Results are presented both for the case of common constants and with cross-section fixed effects. On the basis of the estimation reported in Table 2, the following observations can be drawn:

- the estimated long-run cointegration equation indicates that *disposable income* enters the specification significantly and with the expected positive sign. Long-run income elasticities appear to be unitary when including a common constant, and somewhat higher when including cross-section fixed effects. The associated common marginal propensity to consume appears consistent with the average marginal propensity to consume from the country regressions in Section 3.2;

- an examination of the long-run *wealth effects* indicates that the equity price indices appear to have a larger long-term effect on real saving than those for house prices, with the converse true for the short run. This stands in contrast to the individual country results, though this result is likely driven by Canada, where house prices were estimated to vary positively (albeit insignificantly)

with saving; as argued earlier, this latter result may stem from some instability in the Canadian housing price index in the late 1980s. All in all, it would appear that such a homogenous grouping of countries confirms the existence of a significant negative effect of wealth on saving;

- the estimated long-run coefficient on the *debt-to-income ratio* indicates a negative effect of financial innovation on saving; and
- the speed of adjustment term in the dynamic equation would indicate that cointegration holds in all cases, and points to a fairly rapid adjustment to long-run equilibrium in four or five quarters.

4. Conclusion

This paper presents a framework in which asset price movements and household saving out of income could be linked, and an empirical investigation to gauge the importance of asset valuation changes as a substitute for traditional (that is, national accounts) household saving in English-speaking developed countries (Australia, Canada, the UK and the US) over the past 30 years. To this end, a common model is applied to these economies for which declines in saving over this period appear to have been largest, and institutional and cultural factors are likely to be relatively homogenous. Quarterly estimation indicates that in these countries, gains in house prices seem to have substituted for traditional saving more so than gains in equity prices, and that in some cases these effects may have increased through time. Increasing debt ratios have generally been associated with lower saving, consistent with liquidity constraints becoming less important with financial innovation. All in all, it would appear that in these countries over recent years, ‘active’ saving (that is, through traditional means of setting aside a portion of current income) has been increasingly supplanted by ‘passive’ saving (that is, using valuation gains, either realised or unrealised) as a means of accumulating wealth.

Appendix A: Data

Personal/household saving, household disposable income, household debt

Definition: national accounts definition

Units: national currencies

Sources: *OECD Economic Outlook* No 75 (June 2004); national data (Australia – Australian Bureau of Statistics (ABS); Canada – Statistics Canada; UK – Office for National Statistics; US – Bureau of Economic Analysis (BEA); Federal Reserve Board)

Equity price index

Definition: see Borio and Lowe (2002)

Units: index, 1985 = 100

Sources: Bank for International Settlements (BIS) (see Borio and Lowe 2004)

Residential house price index

Definition: see Borio and Lowe (2002)

Units: index, 1985 = 100

Sources: BIS (see Borio and Lowe 2004)

Personal consumption deflator

Definition: national accounts definition

Units: index, 2000 = 100

Sources: *OECD Economic Outlook* No 75 (June 2004); national data (Australia – ABS; Canada – Statistics Canada; UK – Office for National Statistics; US – BEA)

Appendix B: Measurement Issues Related to the National Accounts Measure of Saving

Household saving as defined in the national accounts is a residual concept, and can be defined as follows:[24]

personal income – personal taxes – personal outlays

where:

- *personal income* is the sum of compensation of employees, supplements to wages and salaries, proprietors' income with inventory valuation adjustment and capital consumption adjustment, rental income of persons with capital consumption adjustment, personal income receipts on assets, and personal current transfer receipts, less contributions for government social insurance;
- *personal taxes* include taxes paid by persons on income, including realised net capital gains, and on personal property; and
- *personal outlays* are the sum of personal consumption expenditures, personal interest payments, and personal current transfer payments.

Because household saving as measured in the national accounts is a residual item, its computation is in effect a compounding of any measurement errors in aggregates such as consumption, income and taxes. As discussed in this paper, household saving as measured in the national accounts is clearly an imperfect measure of life-cycle saving and the flows into the stock of household wealth.[25] Moreover, when moving into cross-country comparisons, several basic comparability issues arise:

---

[24] This definition is from the Bureau of Economic Analysis in the US; see <http://www.bea.gov/bea/glossary/glossary_p.htm>.

[25] For an overview of some conceptual differences between household saving as measured in the national accounts and economic concepts of saving, see Gale and Sabelhaus (1999).

1. coverage of the saving rate measure, that is, whether it includes purely households or a broader definition of personal saving rates which also includes non-profit institutions serving households plus unincorporated enterprises. Most countries report the personal saving rate, which may mask different marginal propensities to consume across sectors, including effects on saving arising from changing trends in incorporation;[26]

2. pension scheme design, with an important difference between defined benefit and defined contribution schemes. Though the former are treated as if their assets were directly owned by the employee beneficiaries, households generally retain stronger ownership of the latter given that they actively manage these (see Reinsdorf 2004 for such an argument for the US 401(k) savings of households);

3. taxation issues may influence household saving ratios. For example, while unrealised capital gains are not included in personal income as measured in the national accounts, taxes paid on them are recorded.[27] Relevant capital gains could include, for instance, realised and unrealised capital gains on housing, financial assets, owned businesses, and other components of wealth. See point 5 below for another taxation issue;

4. the distinction between current and capital outlays in the national accounts is subject to debate. Though consumer durable goods are normally considered as consumption, they could alternatively be considered as investment, which would raise gross savings; net savings would be offset by depreciation of fixed capital. The same argument could also apply when examining outlays toward

---

[26] Indeed, such trend changes in incorporation may have been evident in the last decades in industrialised countries given factors such as a shrinking agricultural sector, a rise in the number of self employed, and a trend for small businesses to become incorporated for tax reasons – see, for instance, Connolly and Kohler (2004). One prominent example is the incorporation of Goldman Sachs in the late 1990s, see Gale and Sabelhaus (1999). Taken in conjunction with a likely differing marginal propensity to consume out of notional profits and labour income, this could induce some movement in personal saving as measured in the national accounts. In particular, if small businesses' average propensity to save out of their retained profits is generally higher than households' average propensity to save out of their other income, this change is likely to have reduced the average saving rate out of total household income.

[27] This could imply a shift of income (and consequently saving) from the household to the public sector when substantial gains occur, such as in the 1990s, see de Serres and Pelgrin (2003).

human capital, such as those on education, which are treated as consumption (de Mello *et al* 2004);

5. the extent to which household consumption of public services is financed by collective taxation may exert an influence on disposable income, thereby affecting the saving ratio (see Harvey 2004);

6. another taxation issue which may influence household saving ratios is the split of taxes between income taxes and taxes on production;

7. the design of defined benefit pension plans across countries may influence private saving. As noted in Harvey (2004), the most recent version of the System of National Accounts (SNA 93) introduced a special treatment of contributions to, and benefits from, funded pension schemes. Contributions to private pension or life insurance schemes and the income earned by these schemes are both included in household saving, whereas any excess of private contributions to public social security schemes over the benefits received for them is not regarded as household saving. As indicated in Cotis, Coppel and de Mello (2004), transactions between households and government social security systems are considered as current, while those with private schemes are treated as capital transactions; and

8. inflation affects saving through the adjustment of nominal debt service payments, whereby higher inflation raises nominal interest payments and receipts while eroding the real value of debt and transferring wealth from creditors to debtors (de Mello *et al* 2004 and Edey and Gower 2000).

It is beyond the scope of this paper to provide detailed estimates of the size of these estimates for the four countries of interest, and this is left for future research. The interested reader is referred to Reinsdorf (2004), who adjusts the US saving ratio for factors (1) through (4) above, and Harvey (2004), who makes adjustments only for (5) through (7), also for the US. Also Catte and Boissinot (forthcoming) examine the comparability of savings rates across OECD countries and make some efforts to construct a harmonised definition of savings across countries.

Appendix C: The Relationship of Household Saving to Wealth Building

As noted in Appendix B, the household saving rate as measured in the national accounts is computed as a residual item, representing the difference between all sources of after-tax income and consumption. While this definition of household saving may indicate flows into household wealth – and therefore the soundness of household balance sheets – it does not take into account the sale of, or changes in, the market valuation of existing household assets (also referred to as 'holding gains'), which can be considerable. In this respect, the convention of Juster *et al* (2004) can be adopted, whereby saving can be broken down into an 'active' component (the national accounts notion of the saving ratio) and a 'passive' one (capital gains on existing assets). Indeed, over the second half of the 1990s, personal savings declined to record lows as wealth grew to record highs in several countries. This fact can be attributed to the effects of valuation changes in wealth, which rose to record highs in the late 1990s.[28]

The relationship between household saving and the change in household wealth can be summed up rather succinctly. Following on the presentation of Perozek and Reinsdorf (2002), the wealth accumulation identity can be written as follows:

$$W_t = (1 + i_t + \frac{\Delta P_t}{P_{t-1}})W_{t-1} + Y_t - T_t - C_t \qquad \text{(C1)}$$

where W_t is wealth at time t; i_t represents nominal interest, dividend and rental rates of return; $\frac{\Delta P_t}{P_{t-1}}$ is the percentage change in the price of assets from time $t-1$ to time t; Y_t is income from sources other than wealth holdings; T_t is *net* tax paid; and C_t is consumption expenditure on goods and services.

In words, wealth in any given period can be expressed as last period's wealth (adjusted for income accruing from pre-existing wealth in addition to valuation changes) plus income net of taxes and consumption. This can be rewritten more intuitively as:

---

[28] More recently, survey findings of Kennickell (2006) for the United States indicate that holding gains on assets explain a very large fraction of the change in net worth in the flow of funds accounts, with holding gains accounting for about 92 per cent of the change in the net worth of the household sector in the fourth quarter of 2004.

$$\Delta W_t = \underbrace{(\frac{\Delta P_t}{P_{t-1}} W_{t-1})}_{\textit{capital gains}} + \underbrace{(i_t W_{t-1} + Y_t - T_t - C_t)}_{\textit{saving}} \quad \text{(C2)}$$

with the first right-hand term representing capital gains on assets and the second right-hand term representing the national accounts concept of saving. In this sense, the national accounts definition of saving accounts for the 'active' component – that is, the difference between income exclusive of capital gains and consumption – but ignores the 'passive' component.

References

Altissimo F, E Georgiou, T Sastre, MT Valderrama, G Sterne, M Stocker, M Weth, K Whelan and A Willman (2005), 'Wealth and Asset Price Effects on Economic Activity', European Central Bank Occasional Paper No 29.

Barrell R and EP Davis (2004), 'Consumption, Financial and Real Wealth in the G-5', National Institute of Social and Economic Research Discussion Paper No 232.

Bertaut C (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 O and S Fisher (1989), *Lectures on Macroeconomics*, MIT Press, Cambridge.

Boone L, N Girouard and I Wanner (2001), 'Financial Market Liberalisation, Wealth and Consumption', OECD Economics Department Working Paper No 308.

Borio C and P Lowe (2002), 'Asset Prices, Financial and Monetary Stability: Exploring the Nexus', BIS Working Paper No 114.

Borio C and P Lowe (2004), 'Securing Sustainable Price Stability: Should Credit Come Back from the Wilderness?', BIS Working Paper No 157.

Breitung J (2000), 'The Local Power of Some Unit Root Tests for Panel Data', in B Baltagi (ed), *Advances in Econometrics, Volume 15: Nonstationary Panels, Panel Cointegration, and Dynamic Panels*, JAI Press, Amsterdam, pp 161–178.

Browning M and A Lusardi (1996), 'Household Saving: Micro Theories and Micro Facts', *Journal of Economic Literature*, 34(4), pp 1797–1855.

Callen T and C Thimann (1997), 'Empirical Determinants of Household Saving: Evidence from OECD Countries', IMF Working Paper No 97/181.

Case K, J Quigley and R Shiller (2001), 'Comparing Wealth Effects: The Stock Market Versus the Housing Market', Cowles Foundation Discussion Paper No 1335.

Catte P and J Boissinot (forthcoming), 'Comparing Saving Rates across OECD Countries', OECD Economics Department Working Paper.

Congressional Budget Office (2003), *Baby Boomers' Retirement Prospects: An Overview*, Congress of the United States, Washington DC.

Connolly E and M Kohler (2004), 'The Impact of Superannuation on Household Saving', Reserve Bank of Australia Research Discussion Paper No 2004-01.

Cotis JP, J Coppel and L de Mello (2004), 'Is the US Prone to "Over-consumption"?', paper presented at the Federal Reserve Bank of Boston Economic Conference, Chatham, 14–16 June.

de Mello L, PM Kongsrud and R Price (2004), 'Saving Behaviour and the Effectiveness of Fiscal Policy', OECD Economics Department Working Paper No 397.

de Serres A and F Pelgrin (2003), 'The Decline in Private Saving Rates in the 1990s in OECD Countries: How Much Can Be Explained by Non-wealth Determinants?', *OECD Economic Studies*, 36(1), pp 117–153.

Debelle G (2004), 'Macroeconomic Implications of Rising Household Debt', BIS Working Paper No 153.

Dvornak N and M Kohler (2003), 'Housing Wealth, Stock Market Wealth and Consumption: A Panel Analysis for Australia', Reserve Bank of Australia Research Discussion Paper No 2003-07.

Dynan KE, J Skinner and SP Zeldes (2004), 'Do the Rich Save More?', *Journal of Political Economy*, 112(2), pp 397–444.

Edey M and L Gower (2000), 'National Saving: Trends and Policy', in D Gruen and S Shrestha (eds), *The Australian Economy in the 1990s*, Proceedings of a Conference, Reserve Bank of Australia, Sydney, pp 277–311.

Faulkner-MacDonagh C (2003), 'US Household Savings: Long-Run Determinants and Short-Term Risks', IMF Staff Country Report No 3/245, pp 5–13.

Gale WG and J Sabelhaus (1999), 'Perspectives on the Household Saving Rate', *Brookings Papers on Economic Activity*, 1, pp 181–214.

Hamilton JD (1994), *Time Series Analysis*, Princeton University Press, Princeton.

Harvey R (2004), 'Comparison of Household Saving Ratios: Euro Area/United States/Japan', OECD Statistics Brief No 8.

Juster F, J Lupton, J Smith and F Stafford (2004), 'The Decline in Household Saving and the Wealth Effect', Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series No 2004-32.

Kennickell A (2006), 'Currents and Undercurrents: Changes in the Distribution of Wealth, 1989–2004', Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series No 2006-13.

Kohn DL (2005), 'Panel discussion "Financial Markets, Financial Fragility, and Central Banking"', Remarks at a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, 27 August.

Lettau M and S Ludvigson (2003), 'Understanding Trend and Cycle in Asset Values: Reevaluating the Wealth Effect on Consumption', NBER Working Paper No 9848.

Loayza N, K Schmidt-Hebbel and L Servén (2000), 'What Drives Private Saving across the World?', *Review of Economics and Statistics*, 82(2), pp 165–181.

Ludwig A and T Sløk (2004), 'The Relationship between Stock Prices, House Prices and Consumption in OECD Countries', *Topics in Macroeconomics*, 4(1), pp 1114–1140.

Maki D and M Palumbo (2001), 'Disentangling the Wealth Effect: A Cohort Analysis of Household Saving in the 1990s', Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series No 2001-21.

Mark NC and D Sul (2002), 'Cointegration Vector Estimation by Panel DOLS and Long-run Money Demand', NBER Technical Working Paper No 287.

Nakamura LI and T Stark (2005), 'Benchmark Revisions and the US Personal Saving Rate', Federal Reserve Bank of Philadelphia Working Paper No 05-6.

Parker J (1999), 'Spendthrift in America? On Two Decades of Decline in the US Saving Rate', NBER Working Paper No 7238.

Perozek M and M Reinsdorf (2002), 'Alternative Measures of Personal Saving', *Bureau of Economic Analysis Survey of Current Business*, 82(4), pp 13–24.

Reinsdorf M (2004), 'Alternative Measures of Personal Saving', *Bureau of Economic Analysis Survey of Current Business*, 84(9), pp 17–27.

Rudd J and K Whelan (2002), 'A Note on the Cointegration of Consumption, Income, and Wealth', Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series No 2002-53.

Sarantis N and C Stewart (2001), 'Saving Behaviour in OECD Countries: Evidence from Panel Cointegration Tests', *Manchester School Supplement*, 69, pp 22–41.

Shiller R (2004), 'Household Reaction to Changes in Housing Wealth', Cowles Foundation Discussion Paper No 1459.

Stock JH and MW Watson (1993), 'A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems', *Econometrica*, 61(4), pp 783–820.