The Determinants of Australian Household Debt: A Macro- level Study*

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ABSTRACT

Household debt in Australia has grown at an astonishing rate since the 1990s. This paper employs a cointegrated Vector Autoregression (VAR) model to explore the determinants of Australian household debt. The results show that GDP is the most important determinant, followed by the housing prices and the number of new dwellings. Meanwhile, interest rates, unemployment rate and inflation are found to have a negative effect on Australian household debt; of these, interest rates are the most significant. Based on these results, it is judicious to rein in household debt in the economic booms through reforms to the financial system, standardizing lending market, monitoring and intervening in assets market, and using the monetary policy timely, comprehensively, and carefully.

Key Words: Australian household debt, cointegrated VAR modelling, housing market, housing prices, interest rates

1 Introduction

The rapid increase in household debt in the last twenty years has been an international phenomenon, also occurring in Australia. As Table 1 shows, the accumulated household debt level increased from A$187 billion in 1990 to A$905 billion in 2005. Although the gearing ratio (total liability as percentage of total assets) in 2005 was only 18.6% due to a rapid increase in total assets, the debt-income ratio jumped from 70.6% in 1990 to 162.8% in 2005. To put this into perspective, the average Australian household would have to work more than one and a half years just to pay off their debt.

Table 1:   Household liabilities, GDP and disposable income, A$ billion

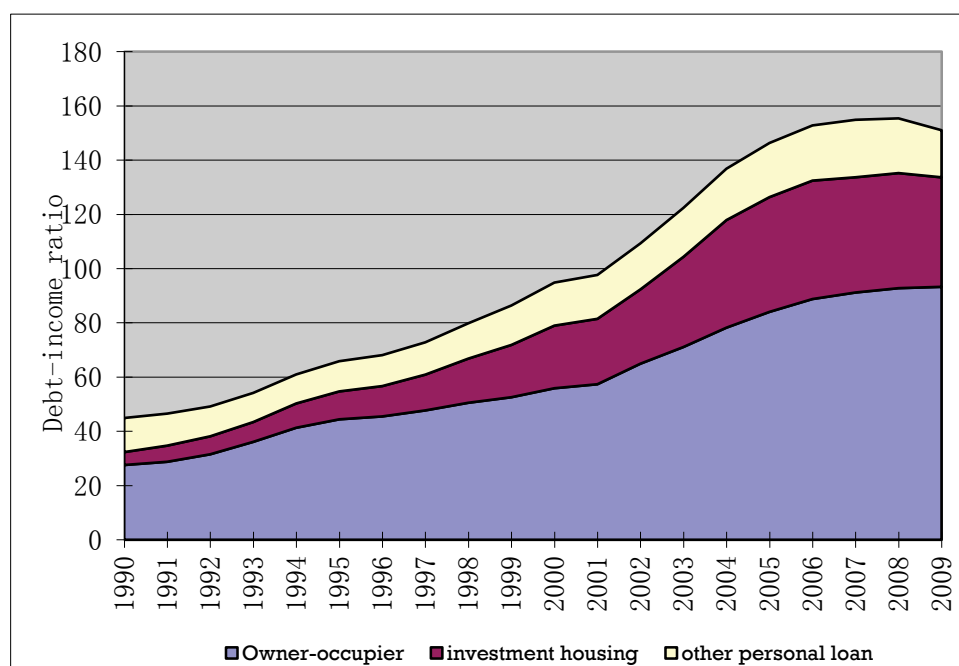| Year	Total Liabilities	Total assets	Disposable income	Liabilities as % of total assets	Liabilities as % of disposable income
Jun-90	187	1495	265	12.5	70.6
Jun-95	267	1926	324	13.9	82.4
Jun-00	473	2919	413	16.2	114.5
Jun-01	515	3180	451	16.2	114.2
Jun-02	596	3554	471	16.8	126.5
Jun-03	685	3932	486	17.4	140.9
Jun-04	800	4505	518	17.8	154.4
Jun-05	905	4875	556	18.6	162.8

Source: RBA (2009) Bulletin Table B20 and ABS (2008), cat, no. 5204.0

The accelerated growth of Australian household debt has generated serious concerns. In 2003, *The Economist* (2003, p. 70) remarked:

> The profligacy of American and British households is legendary, but Australians have been even more reckless, pushing their borrowing to around 125 per cent of disposable income. …there are now concerns that unsustainable rates of borrowing will sooner or later end in tears.

On the other hand, based on the low gearing ratio, others are more optimistic and the ANZ bank (2005) claimed that the financial position of Australian households was within a serviceable range. However, this perspective may be over-optimistic because a low gearing ratio does not protect Australian households against large amounts of housing mortgage debt.

Figure 1: **Composition of Australian household debt**

Sources: Based on data from RBA (2009)[1]

Figure 1 decomposes Australian household debt into three categories: owner-occupied housing debt, investment housing debt, and other personal debt. What is immediately noticeable is that owner-occupier housing accounts for more than half of total household debt in the period under consideration. The other distinguishing feature is that debt associated with investment housing increases dramatically during the period, from less than 5% of disposable income in 1990 to more than 40% in 2008. This increase in investment housing debt is largely driven by rising housing prices since late 1990s; on the other hand, investment housing is also significant in inflating housing prices. This debt breakdown explains the high debt-income ratio and the low gearing ratio in the Australian household sector. Large amounts of debt leads to a high debt-income ratio, but the high percentage of mortgage debt secured on housing assets reduces the gearing ratio. Since housing assets, as the dominant assets in Australian household balance sheet, have been highly inflated in recent years, a decline in housing price will significantly decrease the household assets value and thus the gearing ratio. Consequently, the low gearing ratio does not guarantee that Australian household debt is of low risk.

Thanks to the global financial crisis, the growth of Australian household debt now is slowing down and appears less worrying. In order to avoid an event similar to the US sub-prime crisis, however, it is pertinent to identify the factors that affect Australian household debt.

The remainder of the paper is organised as follows. The next section reviews previous studies on household debt. Section 3 discusses the construction of the dataset. Section 4

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[1] The household debt in this graph excludes debt owed by unincorporated enterprises, so the debt-income ratios are lower than those shown in Table 1.

is aimed at testing and estimating the empirical model. Section 5 interprets and discusses the main findings from the empirical model. Section 6 summarises the main conclusions and provides some policy suggestions.

2 Previous Studies

The rapid rise of household debt is a relatively new phenomenon and thus it is rare to find studies on household debt before 1990s. The booming household debt in the 1990s triggered enormous interest in the phenomenon and a substantial amount of literature has since been published. As the purpose of this paper is to explore the determinants of Australian household debt, only papers concerning factors affecting household debt are reviewed.

A number of empirical studies on the effects of household debt have been presented for countries other than Australia. In South Africa, Aron and Muellbauer (2000) utilise the adjusted SARB (South African Reserve Bank) data to estimate the impact of financial liberalisation on household consumption and household debt and conclude that the financial liberalisation and fluctuation in asset values have important implications for consumer spending and increasing household debt in South Africa. In the US, Barnes and Young (2003) employ a calibrated partial equilibrium overlapping generation (OLG) model to explain household debt in terms of a consumption-income and housing-finance motivations. They find that the substantial rise of household debt in the 1990s can be explained by real interest rate, income growth expectations, demographic changes, and the removal of credit constraint. Tudela and Young's study (2005) also uses the OLG model to analyse the household debt in UK and claims that the changes in interest rates, house prices, preferences, and retirement income affect household debt. Jacobsen (2004) employs a flexible dynamic model and the Norwegian quarterly data from 1994 Q1 to 2004 Q1 to estimate the effects of various factors on household debt and claims that many factors influence the household debt such as the housing stock, interest rates, the number of house sales, the wage income, the housing prices, the unemployment rate, and the number of students. Martins and Villanueva (2003) construct a data set combining household survey data and administrative record of debt to estimate the responsiveness of long-term household debt to the interest rate change in Portugal and they find that the elasticity of the probability of mortgage borrowing to a change in the interest rate is large and negative. Magri (2002) analyses the determinants of Italian households' participation in the debt market by using the data from Bank of Italy's Survey of Household Income and Wealth, and suggests that the age, income, living area, and the enforcement cost of banks, have important effects on household debt. Kearns (2003) employs household-level data to explore why households fell into mortgage arrears during the 1990s in Ireland. His study suggests that a modest rise of interest rates would result in a substantial repayment burdens for significant number of newly mortgaged households and concludes that the continuing strong growth of mortgage lending, caused by relaxed lending criteria and households accepting higher repayment burdens, may lead to a higher rate of mortgage arrears among households. Thaicharoen et al. (2004) claim that low interest rates, demographics, and declining borrowing constraints, have contributed to debt in Thai

households and that the current debt levels in Thailand do not pose a threat to financial stability and the macro-economy.

Other studies have integrated data from multiple countries. Debelle (2004) analysed the possible determinants and the macroeconomic implications of rising household debt. According to him, the rise of household debt reflects the response of households to lower interest rates and an easing of liquidity constraints. The increased household debt itself is not likely to be the source of negative shocks to the economy, however he suggests it will amplify shocks from other sources. Crook (2003) compared studies of the effects of household debt across a number of countries. He found that the debt holding by age follows the life cycle pattern in all countries observed, there are considerable variations in the determinants of desired levels of debt and that there is intra- and inter-national variation in the marginal effects of household debt.

In Australia, prompted by rising household debt, some institutions have included household debt information in their surveys or initiated surveys on this topic. The Australian Bureau of Statistics (ABS) has conducted a few wave surveys on Household Expenditure (HES) and Melbourne University started the Household, Income and Labour Dynamics in Australia (HILDA) Survey (funded by the federal government) in 2001 and has already completed 6 waves. The Reserve Bank of Australia (RBA) finished a survey in 2006 on Household Behaviour around Housing Equity. A number of studies at the household sector level have been based on these surveys: Bray (2001) studies financial stress in Australia using the 1998-99 HES survey; La Cava and Simon (2003), by employing a logit model and using the data from the HES and HILDA surveys, study the factors that affect the financial constraints of Australian households. Schwartz et al. (2006) use bivariate and logit models to analyse the data obtained by surveys on Household Behaviour around Housing Equity. These studies provide information at the micro level.

At the macro level, the RBA and other institutes have published a number of papers and speeches on household debt. Stevens (1997) emphasizes the positive effect of low inflation on household borrowings. The RBA (1999) attributes the quick growth of personal credit to innovations in products offered by banks, the increasing household preference toward the use of credit cards, and the continuing economic expansion with low inflation and low interest rates. The RBA (2003) illustrates the composition and distribution of household debt and suggests that low interest rates, low inflation rate, and financial deregulations may have led to the rise in household debt. A number of studies support this view. For example, the Australian Consumers' Association (2003) believes that financial deregulation, retailing credit, and the new financial products and channels account for the rising household debt. The Treasury (2005) suggests that the increase in household debt partly reflects increased house prices due to sustained low inflation and interest rates, and partly reflects the improved product choice and reductions in borrowing costs from the deregulation of the financial sector in the 1980s and 1990s. The ANZ Bank (2005) claims that the rising household debt level is attributable to the sustained boom in house prices, and that the sustainability of household credit depends on the growth of household disposable income and employment.

All of these studies on Australian household debt are instructive; however they provide only financial analyses on Australian household debt. To provide a more comprehensive picture of Australian household debt, this study identifies the determinants of Australian household debt by employing empirical models, using data from household accounts, microeconomic data from surveys and macroeconomic data.

3. Dataset

The household debt level is jointly determined by supply and demand, that is, – the households' decision to take on debt and the availability of funding. However, both sides are ultimately determined by macroeconomic variables, thus the determinants of household debt must lie in these macroeconomic factors. Through analysing factors affecting borrowing and/or lending, we can obtain potential determinants of household debt.

In regards to demand, the households' desire to borrow is subject to the level of household disposable income and the purposes of borrowing. Household disposable income is derived through household gross income plus social transfer, and less income tax payable and other outlays. Since income tax rates in Australia have undergone minimal change in recent decades and the social transfer and other outlays are small relative to household gross income, we focus on household gross income. Household gross income includes the wage income and gross mixed income, domestic and overseas investment income. At the macro level, these factors can be approximated by GDP.

The purposes of household borrowing include smoothing consumption and investing. The level of consumption is closely related to changes in the demographic profile of the Australian population and the price level (CPI), and may be also related to the macros affecting consumer confidence such as unemployment rate and GDP. The investment decisions are typically related to interest rates. Moreover, from the decomposition of Australian household debt, we learnt that housing is the main investment vehicle for Australian households. In considering the large amount of housing debt, housing prices and the number of new houses entering the market are important factors.

In regards to supply, the availability of funding and the ease of obtaining finance are largely indicated by interest rates. However, to reduce credit risk, lenders may take into account factors such as household income level and other macroeconomic variables, including the unemployment rate, the inflation rate and GDP. Among these factors, household income level can be approximated by GDP and the inflation rate is a monotonic transformation of CPI. Including all possible variables affecting Australian household debt yields the following information set:

X= (DEBT, NDWELL, HPI, R, U, GDP, POP, CPI)
where

- DEBT – Accumulated household debt
- NDWELL – Number of new dwellings approved
- HPI – Housing price index

- R –Interest rate
- U – Unemployment rate
- GDP – Gross domestic product
- POP – Population
- CPI – Consumer price index

The inflation rate and CPI are closely related to each other; to reduce multicollinearity, we only include CPI in the model.

Arguably, real per capita data or logarithmic value are preferable because they can reduce heteroscedasticity in the model. However, this study uses nominal values for a number of reasons. First, the White test demonstrates that the heteroscedasticity problem in the model is not serious when nominal values are used. Second, when the logarithmic value is used, the max-eigen value tests reject the cointegration hypothesis. Third, the measurement errors are often problems in macro time series; transformation of nominal value to real and/or per capita value (divided by CPI or POP) may magnify these errors. Finally, some international studies show that Demographic characteristics and inflation have significant influence on household debt, thus a nominal value is needed to test if it holds true for Australia.

The time series data for the variables in the information set are from the Australian Bureau of Statistics (ABS), the Reserve Bank of Australia (RBA) and other institutions. The majority of data were obtained from ABS, including population, unemployment rates, housing prices, GDP, and the CPI. The data for new dwellings commencements came from the Housing Industry Association (HIA, 2006). Data for household debt and official interest rates were provided by RBA. Due to different sources and different measurement of data, some data sequences needed to be adjusted before use. Specifically, the data set in this study is described as follows:

- **Household debt (DEBT):** Seasonally adjusted quarterly data, measured in billion A$, at the end of quarter.

- **GDP:** Seasonally adjusted quarterly data, measured in billion A$.

- **Consumer price index (CPI):** Base year 1989/1990=100.

- **Housing price index(HPI):** CPI on housing 1989/90=100.

- **Interest rate (R):** Official interest rate, quarterly averaged monthly data.

- **Unemployment rate (U):** Quarterly averaged monthly data.

- **Population (POP):** Measured in thousand persons, ABS estimated quarterly data. Since the data is available only from June of 1989 onwards, the annual population in 1988 provided by ABS is adopted as the data in June of 1988 and the data from September 1988 to March 1989 is calculated assuming the population growth rate is stable in this period.

- **Number of New dwelling approvals (NDWELL):** Measured in thousand dwellings, including all kinds of housing such as units and houses.

4. The Empirical model

Since macroeconomic variables are notorious for non-stationarity, cointegrated VAR analysis is used to study the relationship between Australian household debt and other macroeconomic factors.

Methodology

The likelihood estimation of a cointegrated VAR model for time series data integrated of order one I(1) was developed by Johansen (1988) and Johansen and Juselius (1990). An unrestricted VAR(k) model of an I(1) time series of p-dimension, X_t, can be expressed as follows:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \varepsilon_t, \ t = 1,...,T$$

To conduct an I(1) cointegration analysis of the above unrestricted VAR(k) model, it is necessary to check if the cointegrating vector exists. To satisfy this, the rank of matrix Π must be less than full rank but greater than zero. Mathematically,

$$0 < rank(\Pi) < r \quad \text{or} \quad \Pi = \alpha\beta'$$

where $\alpha, \beta \in R^{p \times r}$, α are referred to the adjustment vectors and β as the cointegration vectors.

If the requirement is satisfied, the unrestricted model is simplified as follows:

$$\Delta X_t = \alpha(\beta' X_{t-1}) + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \varepsilon_t, \ t = 1,...,T$$

Since some variables may be weakly exogenous (such that they have insignificant adjustment coefficients), X_t is decomposed into two groups – endogenous variables Y_t and weakly exogenous variables Z_t such that:

$$X_t = (Y_t, Z_t), \ Y_t \in R^m, \ Z_t \in R^{p-m} \ and \ m \geq r$$

The conditional model for Y_t is

$$\Delta Y_t = \omega \Delta Z_t + (\alpha_y - \omega\alpha_z)(\beta' X_{t-1}) + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t, \ t = 1,...,T$$

If $\alpha_z = 0$, the conditional model simplifies to:

$$\Delta Y_t = \omega \Delta Z_t + \alpha_y(\beta' X_{t-1}) + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t, \ t = 1,...,T$$

Model estimation and testing

Since most macroeconomic time series data are non-stationary, unit root tests are performed. Before formal testing procedures are undertaken, the time series data are plotted to allow for visual inspection (see Appendix 1). Most time series show apparent trends (except NDWELL). Both Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are performed and the results are listed in Appendix 2. With the exception of DEBT and POP, the PP and ADF tests suggest first order integration for all variables at 5% level of significance. For DEBT and POP, the ADF test rejects the null hypothesis of non-stationarity of the first-differenced DEBT and POP at 10% level of significance, but PP test rejects the hypothesis at very high negative t-value. Taking into consideration the critique that the ADF test has low power in low tail tests (Enders, 1995), we accept the results of ADF test at 10% level.

Since we are working with non-stationary data, the co-integration test has to be performed. Both Trace and Max-eigenvalue tests are used. In implementing the tests, a deterministic linear trend and intercept are included in the cointegration equation. The trace test suggests three cointegration equations while the max-eigenvalue test suggests only one cointegration equation (see Table 2).

Table 2   The results of cointegration tests

No. of CE(s)	Trace Statistic	0.05 Critical Value	Adjusted Critical Value	No. of CE(s)	Max-Eigen Statistic	0.05 Critical Value	Adjusted Critical Value
None *a	266.8892	187.4701	244.0648	**None *a**	92.4223	56.70519	73.82374
At most 1 *	174.4669	150.5585	196.0101	**At most 1**	49.80271	50.59985	65.87528
At most 2 *	124.6642	117.7082	153.2428	**At most 2**	38.45159	44.4972	57.93032
At most 3	86.21263	88.8038	115.6125	**At most 3**	28.46353	38.33101	49.90264
At most 4	57.7491	63.8761	83.15945	**At most 4**	24.71639	32.11832	41.81442
At most 5	33.03271	42.91525	55.8708	**At most 5**	18.03523	25.82321	33.6189
At most 6	14.99748	25.87211	33.68256	**At most 6**	8.873858	19.38704	25.23973
At most 7	6.123623	12.51798	16.29699	**At most 7**	6.123623	12.51798	16.29699

Notes

* Denotes rejection of the hypothesis at the 0.05 level according to the standard critical value
a Denotes rejection of the hypothesis at the 0.05 level according to the adjusted critical value
2 lags are chosen to minimize SIC.

However, the likelihood ratio (LR) tests of Johansen's procedure are derived from asymptotic properties and the statistical inference may not be applicable to a finite sample. Many econometricians are concerned about the problem of finite sample size in Johansen's LR tests for cointegration. Reinsel and Ahn (1988) suggest that a scaling factor, which is a simple function of T, n, and k (T is the sample size, n is the number of variables in the model and k is the number of lags), may be used to obtain finite-sample critical values from their asymptotic counterparts. Reimers (1992) claims that in finite samples the Johansen test statistics too often over-rejects the null hypothesis of non-cointegration when it is true, and suggests the application of the Reinsel-Ahn method to adjust

Johansen's test statistics by a factor of (T-nk)/T. Cheung and Lai (1993) use the surface analysis in Monte Carlo experiments to estimate the finite-sample critical values for both trace and max-eigen value tests, and find that the finite sample bias of Johansen's tests is a positive function of T/(T-nk). Following this finding, they claim "since both n and k are of positive values, T/(T-nk) is always greater than one for any finite T value, indicating that the tests are biased toward finding cointegration too often when asymptotic critical values are used. Furthermore, the finite-sample bias toward over-rejection of the no cointegration hypothesis magnifies with increasing values of n and k" (Cheung and Lai, 1993, p. 319).

In the case of this study, the sample size is 72 (T=69 after adjustment); a handful of possible variables is included in the unrestricted model (n=8); and the SIC indicates the proper lags for cointegration test is 2 (k=2). As a result, the finite-sample bias in the cointegration test tends to be large. Following the suggestion of previous studies, T/(T-nk) is used to scale up the standard critical value. The adjusted critical values are shown in the columns next to the stardand critical value in table 2. According to the adjusted critical values, both tests suggest one cointegration relationship at 0.05 level.

Next, the vector error correction model (VECM) is estimated. A constant and a deterministic trend are included in the cointegration equation. Two lags are chosen to minimize Schwartz information criterion (SIC). The estimated cointegration relationship and adjustment coefficients are as follows:

Table 3:   The results of VECM estimation and testing of the unrestricted model

Cointegration Vector	DEBT	GDP	NDWELL	HPI	R	U	CPI	POP	Trend
Coefficients	1.000	-12.791	-9.346	-42.109	206.728	159.517	11.924	-0.240	62.099
S.E.		(4.072)	(3.689)	(11.393)	(52.667)	(34.393)	(19.416)	(1.042)	(51.557)
t-Value		[-3.141]*	[-2.534]*	[-3.696]*	[3.925]*	[4.638]*	[0.614]	[-0.231]	[1.204]
Adjustment Coefficients	-0.040	-0.0014	-0.0025	0.003	-0.0002	0.0003	0.0013	0.006	
S.E.	(0.005)	(0.0014)	(0.0035)	(0.0015)	(0.0004)	(0.0003)	(0.0008)	(0.014)	
t-Value	[-8.645]*	[-1.0006]	[-0.734]	[1.805]*	[-0.467]	[1.025]	[1.643]*	[0.442]	
LR Test of cointegration restrictions POP is both insignificant and weakly exogenous (null hypothesis): Chi-square (2)=0.065468, p=0.967796									

Table 3 shows that most of the variables in the cointegration vector are significant except for POP and CPI. For CPI, the adjustment coefficient is significant at 10% level, so the tendency is to keep it in the cointegration vector. For POP, both the coefficient in cointegration vector and the adjustment coefficient are insignificant, which implies POP is an insignificant and weakly exogenous variable. The result of a formal restricted cointegration test confirm these findings: the last panel of Table 3 shows that the LR test is unable to reject the imposed restriction at 0.05 level.

Since POP is both insignificant and weakly exogenous, we could exclude it from the model in order to reduce multicollinearity – population is very likely to be correlated with other variables, especially GDP. However, according to Harris (2003), estimation conditioned on weakly exogenous variables can improve normality and thus the properties of the model,

so it is preferable to condition the estimation on this weakly exogenous variable. This study adopts this practice: We exclude POP from cointegration vector but let it be a conditional factor in VECM estimation. The cointegration tests for the conditional model show one cointegration relationship (again, using the adjusted critical value). Using the VECM to estimate the revised model, the following results (displaying only the cointegration equation, adjustment coefficients and diagnostic tests) are obtained:

Table 4: The results of VECM estimation and testing of the conditional model

Variables	DEBT	GDP	NDWELL	HPI	R	U	CPI	C	Trend	
Coefficient	1.000	-11.063	-5.260	-20.844	72.740	41.081	23.063	-85.996	-2.927	
S.E.		(1.438)	(1.204)	(3.635)	(17.018)	(10.845)	(6.043)		(16.011)	
t-Value		[-7.693]*	[-4.368]*	[-5.734]*	[4.274]*	[3.788]*	[3.816]*		[-0.183]	
Adjustment coefficient	-0.077	0.001	0.012	0.0025	-0.005	0.002	-0.0015			
S.E.	(0.020)	(0.005)	(0.012)	(0.005)	(0.0012)	(0.001)	(0.003)			
t-Value	[-3.895]*	[0.177]	[0.941]	[0.479]	[-4.120]*	[2.409]*	[-0.542]			
Diagnostic tests:										
R-squared: 0.821256 Adj. R-squared: 0.794444 Schwarz (for ECM): 6.124948 Schwarz (for VECM): 19.94743										
VEC Residual Serial Correlation LM Tests 8th order			LM-Stat= 57.9230						p= 0.1792	
Jarque-Bera Residual test for normality:			J.B.(2)= 2.9966 (ECM equation for DEBT) J.B.(14)= 23.0431 (VECM system)						p= 0.2235 p=0.0596	
White heteroscedasticity test:			Chi-squared(504)= 542.6976						p= 0.1132	

1-lag is chosen to minimize SIC.

The first panel of Table 4 shows the estimated cointegration vector. The estimated results show that all variables have significant influence on household debt in the long run, but the deterministic trend is insignificant. Comparing with the first panel of Table 3, we find that standard errors become much smaller and the estimated coefficients become more realistic. As a result, the t-values increase considerably, especially for GDP. This confirms the collinearity problem caused by POP in unrestricted model and justifies the decision to drop it from cointegration vector.

The second panel shows the adjustment coefficients from the VECM estimation results. The adjustment coefficient for DEBT has the correct sign (negative) and is significant, which means that the error correction is quite effective.

The estimation passes all diagnostic tests shown in the last panel of Table 4. The ECM equation for DEBT has a reasonably high R-squared (0.82) and adjusted R-squared (0.79), indicating the equation explains the behaviour of change in household debt in the short run well. The LM tests up to 8th lag could not find autocorrelation at conventional level. The Jarque-Bera test confirms the normal distribution of residuals for displayed ECM with a p-value of 0.2235; even for the VECM system, the J.B. test could not reject the null of

normality at conventional level. The White test shows no serious heteroscedasticity problem in the mode.5. Analysis of estimation results

According to the first panel of Table 4 (the sign on coefficients in the table should be read opposite, since the dependent variable DEBT is on the same side of other variables in the cointegration vector), factors negatively affecting household debt are interest rate, unemployment rate and CPI while those acting positively include GDP, the number of new dwelling approvals, and housing prices. In addition, Table 3 shows that the effect of population is very insignificant, which is quite counter-intuitive. We discuss these 3 factors in turn.

Factors affecting household debt negatively

First, the model shows that the interest rate has dramatically negative effect on household debt. The interval estimates show that if the interest rate increases by one percent, the level of household debt would decrease by $55.72-89.76 billion over time. The direct reason for this is that the interest rate hike will increase the borrowing cost, which will deter households from borrowing or at least reduce the amount of money they are inclined to borrow. Moreover, for households who have already incurred debt, it will increase repayment burden if the debt is based on a variable interest rate (which is the case for most Australian housing loans). If the repayment burden is unbearable, some households are required to sell their property to pay off their debt. As a result, household debt will decrease. The increase in interest rates also indirectly affects household debt by discouraging investment. The reduction in investment will slow down the whole economy. The scaling back of the economy may reduce households' income, increase the unemployment rate and thus reduce household borrowing. If households' newly incurred debt is less than the amount of their scheduled repayments, the household debt level will also decrease.

Second, another important factor affecting household debt negatively is the rate of unemployment. This is due to the negative effect of unemployment on household income. Generally speaking, a high unemployment rate means there is less income for all households and thus a greater desire for loans to finance consumption. From this point of view, it will lead to a rise in household debt. However, lower income due to unemployment casts doubt on future income, which has two implications. One is that households without regular employment will be discouraged from borrowing because of concerns about the ability to repay loans; the other is that unemployment increases the possibility of financial constraints. These two factors actually limit household demand for financing and depress the growth of household debt. Moreover, a rising unemployment rate indicates a deteriorated economic situation, in which investors are very cautious to lend. Consequently, household debt will shrink. The estimation results show that the negative effect dominates.

It is noticeable that the estimation results show that the rate of unemployment is less influential than the interest rate. This finding is consistent with previous studies. For example, Debelle (2004, p. 57) argues that the rate of unemployment is less severe than the interest rate because "unemployment generally affects only a relatively small section of

population, and the degree of overlap between those households with a higher risk of unemployment and those with high debt level has historically been low".

Finally, CPI also shows a significant negative effect on household debt. Although the statistical significance of CPI is slightly higher than that of the unemployment rate, arguably its influence on household debt is much smaller than the latter because the point estimate of coefficient for unemployment rate is nearly twice as much as that for CPI.

Inflation (percentage increase in CPI) has different effects on borrowing and lending. In regards to borrowing, inflation will devalue debt, so there is a strong stimulus for households to borrow. However, on the supply side, inflation will erode the principal and discourages lending. The significant negative effect of CPI indicates that the supply side dominates: In the face of high inflation, fewer funds are lent, so household debt would decrease. This finding is consistent with previous research. For example, many studies (RBA, 2003; Debelle, 2004; and Treasury, 2005, for example) suggest that low inflation can be a reason for rising household debt because it may decrease the financial constraints on households (lower inflation leads to lower interest rates and thus less income is needed for the reduced scheduled payment) and encourages lending (lower inflation erodes the principal more slowly).

Contributing factors of household debt

Considering the positive factors, the empirical model shows that GDP has the most substantial influence on household debt while both the housing prices and the number of new dwellings also have a very significant effect.

First, the positive influence of GDP on household debt may arise via two. One is that the magnitude of GDP indicates the size of the economy and thus the capacity of household borrowing and lending. A higher GDP implies higher income for households and more gross-operating surplus for firms. With higher income, households will be less credit-constrained. On the other hand, higher income and profit provide richer founding sources for banks. The other channel may come from household confidence. The growth rate of GDP is a popular indicator of economic development. Robust growth of GDP makes people more confident so that they feel that it is safe to borrow and lend. With increased demand (willingness and ability to borrow) and increased supply (willingness to lend), household debt may grow in line with GDP.

Second, the significant positive effect of the housing price index can be easily understood considering the importance of housing prices in housing assets, and the importance of housing assets in Australian household investment portfolio, as illustrated in Figure 1. Increasing housing prices will scale up housing assets. For new home buyers, this means they have to take substantially more debt in purchasing housing, other things being equal. For those who have already taken housing loans, increased housing assets provide them with a good opportunity to withdraw housing equity, i.e.: to obtain more loans against the increased value of housing. As a result, household debt will increase along with the housing prices.

Last, the number of new dwelling approvals also has significant influence. The effects of new dwellings approvals are two-fold. On the one hand, new dwellings increase the total housing assets in the market. Given the high demand for housing assets and the popularity of the housing mortgage loan in Australia, this implies more housing debt for households. On the other hand, new dwellings entering the market means more housing supply. If housing demand is unchanged, housing prices will drop. Decreased housing prices will reduce the market value of housing assets and thus reduce the amount of housing loans accordingly. The estimated results show that the former effect dominates the latter.

However, the significant effect of the number of new dwelling approvals should be interpreted together with the land-use policy of Australian governments. Australian state governments had very tight control of the use of land in recent decades, so the number of new dwelling approvals has barely changed – it has fluctuated at around 38 thousand per quarter in the period 1988-2006. The small number of new dwelling approvals made its negative influence on housing prices negligible, so the positive effect dominates. It is possible that with governments loosening their control of the use of land, the effect of the number of new dwellings will become insignificant or even negative.

The role of population

The estimation results show that demographics is both insignificant and weakly exogenous. However, some analysts believe that population should have significant positive effect on household debt because the growth of population is likely to increase the number of households with debt and thus the total household debt level.

This reasoning is consistent with some previous studies. For example, both the study on household debt in USA by Tudela and Young (2005) and the study on Thai household debt by Thaicharoen et al. (2004) conclude that population has a significant effect. However, Crook (2003) shows that there are considerable variations in the determinants and in the marginal effects of household debt, both within countries and between countries. The insignificant effect of Australian population may come from the change of population composition in Australia. The increase in population may increase the total household debt if the percentage of households with debt is increased or unchanged. This condition is not valid in Australia because the age composition of the population changed as the Australian population increased, as shown in Table 5.

Table 5: Composition of Australian Population

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total population (Million)	18.072	18.311	18.518	18.711	18.926	19.153	19.413	19.641	19.873	20.092	20.329
Population aged 0–14 years (%)	21.5	21.4	21.2	21.0	20.9	20.7	20.5	20.3	20.0	19.8	19.6
Population aged 15–64 (%)	66.6	66.6	66.7	66.7	66.8	66.9	66.9	67.0	67.2	67.2	67.3
Population aged 65 and over (%)	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.7	12.8	13.0	13.1
Population aged 80 and over (%)	2.6	2.6	2.7	2.8	2.8	2.9	3.1	3.2	3.3	3.4	3.5
Median age of	33.7	34.0	34.4	34.8	35.1	35.4	35.7	36.0	36.2	36.4	36.6

total population										

Source: ABS (2008), Cat. No. 4102.0

Table 5 displays the obviously aging tendency of the Australian population: The median age increases from 33.7 to 36.6 in the period 1995-2005. According to the life cycle hypothesis (LCH) by Modigliani and Brumberg (1954) and Friedman (1957), those who are most likely to have debts are at the relatively early stage of the life-cycle – between 25-35 years of age. Although the actual numbers of the population in this age decile are unavailable, Table 5 suggests that the percentage of households in this decile tends to decrease: The median age of the total population increased beyond 35 years in 1999, which indicates that the percentage of the population aged 25-35 is decreasing. In brief, taking into account both the effect of the increase in population and that of the aging population, the influence of changes to the composition of the population Australian household debt is insignificant.

6. Concluding Remarks

The empirical results presented in this paper reveal that rapidly rising Australian household debt is the result of a favourable macroeconomic environment and the booming housing market. The robust economic development in Australia (growing GDP with a low interest rate; low unemployment and a low inflation rate) causes optimistic expectations. When households are sufficiently optimistic to borrow and investors are confident to lend, household debt surges. The housing market also played a significant role in the rapid growth of Australian household debt. Australian households are in favour of housing investment. The high demand for housing pushes up house prices and the expectation of rising housing prices in turn encourages investment demand for housing. A booming housing market leads to a high level of housing mortgage debt. Moreover, the estimation results reject the hypothesis that demographic characteristics play a significant role in rising household debt.

Based on the findings of this paper, we can provide the following policy suggestions for managing household debt.

First, it is necessary to rein in rising household debt. Robust economic growth tends to push up household debt levels. The high level of household debt may not represent high risk in good economic times; however, history tells us that economic growth is associated with large fluctuations. If households have accumulated a substantial level of debt during the economic boom, this necessitates high repayments for a considerable period of time (this is especially true for housing debt). When economic recession arrives, households are likely to encounter wage cuts, reduced working hours or even unemployment. The reduced income and high debt repayment burden leaves households with no choice but to cut consumption sharply. A sharp decrease in consumption will lead to downward spin of the economy. If household debt level is so high that some households cannot maintain scheduled repayments, a credit crisis is inevitable. The harmfulness of uncontrolled household debt growth is evident from the economic situation in many countries including

Japan, the Netherlands and the UK. The global financial crisis originating from the US is also a spectacular demonstration of the effect of uncontrolled household debt. Given the large negative effect of uncontrolled debt levels, reining in household debt levels in economic booms should be an important task for the government.
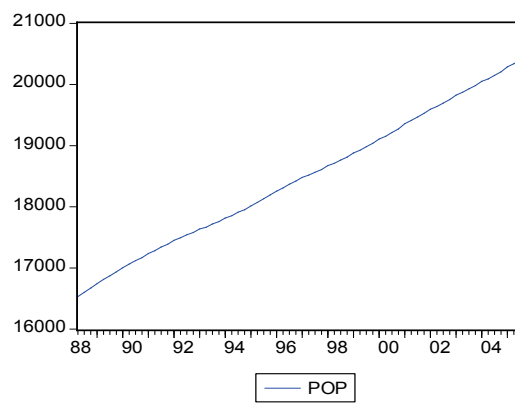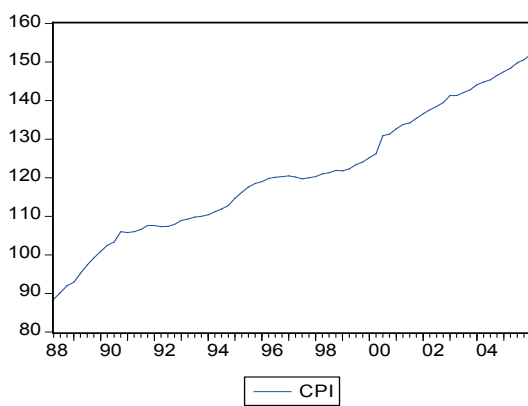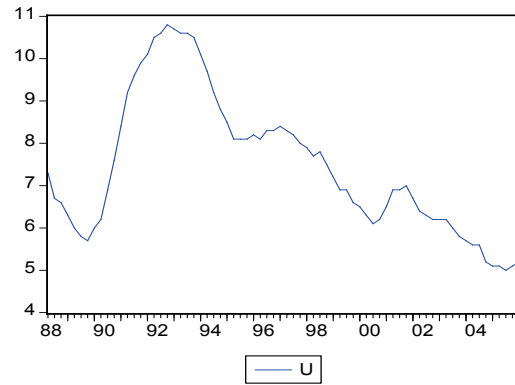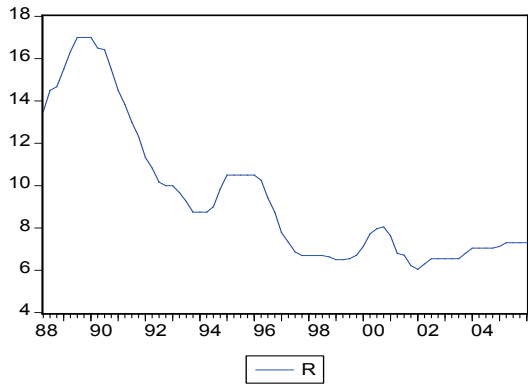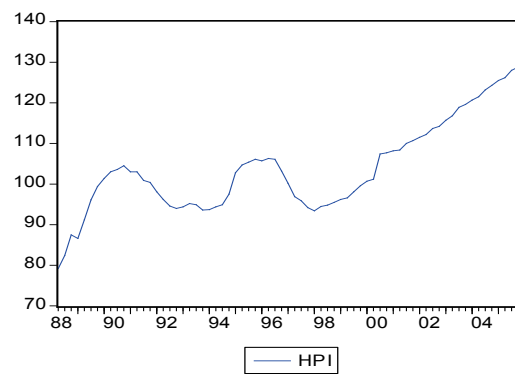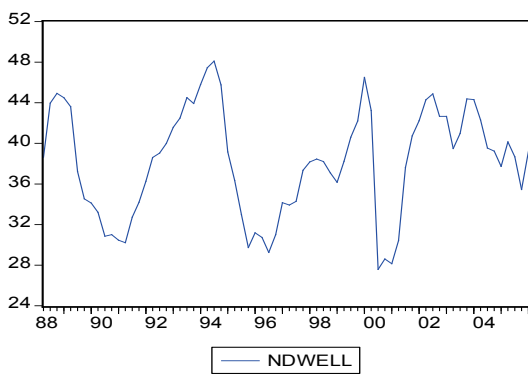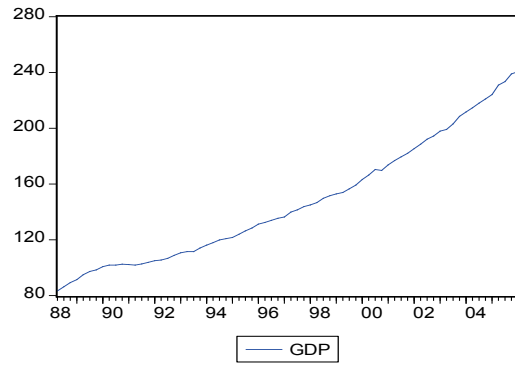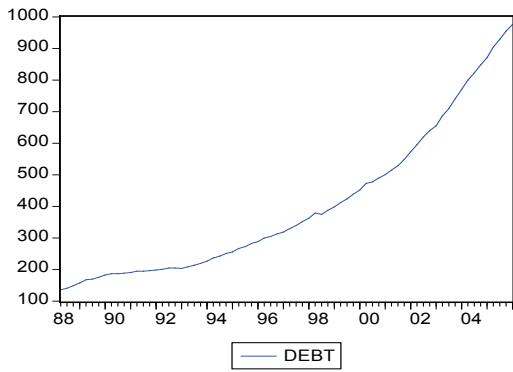
Second, it is important to reform the financial system and standardize the lending market. An abundance of credit supply in recent decades, indicated by low interest rates, is an important factor contributing to rising household debt. However, channelling credit supply into the household debt market largely relies on financial institutions. Financial institutions, as middlemen, have the tendency to expand business and to shift risk. Under the current over-deregulated financial system, they have successfully achieved both tasks. For example, when a mortgage is set up, the credit risk is first shifted to borrowers through collateralization, and then further shifted to investors through the financial products like collateralized debt obligations (CDOs): Housing mortgage debt was bundled and sold to final investors as AAA ranking assets. As the risk is shifted out, financial institutions can expand housing mortgage business without worries. The risk-free position of financial institutions promotes unprofessional practice in lending market, e.g.: unconforming loans. Regulating and standardizing the practice of financing and mortgage could limit the irresponsible behaviours of institutions.

Third, the results of this study suggest monitoring assets markets closely and intervening when necessary. Mass production in the modern economy leads to cheap prices for most consumption goods, so inflation tends to be low. The cheap prices of consumption goods mean less profitability in production, so savings fail to be channelled into production. Instead, they become portfolio investments. This portfolio investment goes to asset markets and pushes up assets prices. An assets boom generates large amounts of speculation-induced household debt. Given the popularity of portfolio investment in recent decades, it is very desirable to create an assets price index as an indicator of the economic environment. In the case of Australia, housing assets are the favourite and housing debt becomes the main source of Australian household debt, so the fluctuation of the housing market will affect Australian household debt greatly. The government should monitor housing prices closely and can intervene in the housing market through influencing the number of new dwelling approvals or through taxes or subsidies on the purchase of housing.

Fourth, the official interest rate is an effective tool in controlling household debt. However, it should be used in a timely, comprehensive, and careful manner. The cointegration analyses shows significant negative effects of the official interest rate on household debt, so it can be a very useful tool; but the timing of changing the official interest rate is very important. When an increase in household debt starts picking up speed, an increase in interest rates may help to slow down the accumulation of household debt. However, when household debt reaches a very high level, an increase in the interest rate may increase households' repayment burden substantially and induce a credit crisis. The interest rate tool also should be used comprehensively. Nowadays, most countries adopt the 'targeting-inflation' interest rate policy. However, the modern economy is very complex and the inflation rate alone may not indicate the development of the economy properly; hence other indicators, such as assets prices and the unemployment rate, should also be taken

into account in deciding the proper official interest rate. Moreover, the effect of interest rate change on the economy is profound, affecting macroeconomic variables such as investment and consumption. Consequently, care should be taken when implementing changes so as to avoid large economic shocks.

Appendix 1 Graphs of time series

Appendix 2 The results of unit root tests*

Variable	Level of test	t-statistics (ADF test)	Conclusion of ADF test (5% level)	t-statistics (Phillips - Perron test)	Conclusion of Phillips-Perron test
DEBT	Level	4.24	unit root	3.51	unit root
	First difference	-3.32	No unit root (10%)	-6.06	No unit root
GDP	Level	1.45	unit root	1.49	unit root
	First difference	-8.02	No unit root	-8.02	No unit root
NDWELL	Level	-1.72	unit root	-1.95	unit root
	First difference	-4.82	No unit root	-4.78	No unit root
HPI	Level	-1.72	unit root	-1.95	unit root
	First difference	-4.82	No unit root	-4.78	No unit root
R	Level	-2.32	unit root	-1.67	unit root
	First difference	-3.99	No unit root	-3.96	No unit root
U	Level	-3.81	unit root	-1.75	unit root
	First difference	-2.47	No unit root	-3.85	No unit root
CPI	Level	-1.70	unit root	-2.24	unit root
	First difference	-6.37	No unit root	-6.65	No unit root
POP	Level	-0.59	unit root	-0.65	unit root
	First difference	-3.11	No unit root (10%)	-8.53	unit root

* lags are automatically selected by E-view software to minimize Schwarz criterion

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