THE EFFECTIVENESS OF FISCAL POLICY IN AUSTRALIA SELECTED ISSUES

Blair Comley[*]*, Stephen Anthony*[*] *and Ben Ferguson*[*]

1. Introduction

Australian fiscal policy is based on a medium-term framework designed to ensure budget balance over the cycle. This medium-term framework ensures that the Government balance sheet remains in good order. The formulation of the fiscal strategy, with an 'over the cycle' emphasis, also allows the use of fiscal policy as a demand management tool.

The fact that the strategy allows the use of discretionary fiscal policy raises the question of the desirability and effectiveness of discretionary fiscal policy. Australia is a relatively small, open, financially developed economy with a floating exchange rate. Standard economic theory suggests that monetary policy is a relatively more potent demand management tool for such economies. For example, it predicts that fiscal expansion will produce higher interest rates that will reduce investment expenditure. However, it also predicts that the instantaneous inflow of capital will to some extent circumvent any change in interest rates, and produce an appreciation of the currency and a smaller contribution of net exports to growth. In contrast, expansionary monetary policy leads to lower interest rates, capital outflow and a depreciated currency, which increases the net export contribution to growth. Symmetrically, with the first policy case, the capital outflow will mitigate the actual change in domestic interest rates.

From a policy maker's perspective it is important to have some understanding of the effectiveness of fiscal policy to inform the desirability and magnitude of any fiscal package. The paper does not attempt to ascertain the total effectiveness of fiscal policy. This paper focuses on two

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factors — private sector saving offsets and interest rate effects — that may reduce the effectiveness of fiscal policy as an aggregate demand management tool in Australia.

The paper is organised as follows. Section II considers evidence of private sector saving offsets in Australia. Section III considers the potential link between fiscal policy and interest margins. Section IV considers the policy implications of the paper's findings.

2. Fiscal Policy and Savings Offsets in Australia

The following is a stylised description of the conventional view of the effects of a fiscal expansion where, for example, the government reduces taxes, with no planned reduction in current or future expenditures.

In the short run the effect of the government reducing taxes is to stimulate consumption which increases aggregate demand and in turn aggregate supply. This boost to consumption is partly offset in the short run by a range of crowding out effects — notably by higher interest rates reducing the level of investment and/or an appreciation of the exchange rate reducing net exports. In the long run the higher interest rate reduces capital accumulation and adversely affects growth. Notwithstanding these offsets and the long run effect on growth, fiscal policy does stimulate activity in the short-term. As such fiscal policy can be an effective tool for demand management.

However, another strand of literature that deals with Ricardian equivalence challenges this conventional wisdom (see Barro (1974)). Ricardian equivalence, suggests that fiscal policy will not alter consumption, savings or growth.

Ricardian equivalence is based on the insight that lower taxes and a budget deficit today require, in the absence of any change in government spending, higher taxes in the future. If individuals are sufficiently forward-looking they will understand that their total expected tax burden is unchanged. As a result they will not increase consumption, but save the entire tax cut to meet their expected future tax liability. The decrease in government saving will thus be offset by an increase in private saving.

Perfect (or full) Ricardian equivalence relies on a very strict set of assumptions including: individuals' consumption choices fit a life cycle

model of consumption; they are forward looking; and effectively 'infinitely lived' through a bequest motive inspired by each generation's concern about the welfare of the next generation.[1]

The full set of assumptions required for full Ricardian equivalence appears not to accord with reality. However, the key issue for the effectiveness of fiscal policy is not necessarily whether all these assumptions hold, but rather whether there is some offsetting savings behaviour that may reduce the demand impact of fiscal policy. Furthermore, there are a range of other possible reasons that may illicit savings offsets at the appropriate level. For example, individuals may smooth their consumption or suffer from consumption inertia. This is essentially an empirical question. Our investigation of this empirical question is motivated by consideration of all these potential savings offsets.

International evidence suggests that an increase in public saving tends to lower private saving with an offset coefficient of around one half (Masson, Bayoumi and Samiei (1995); Callen and Thimann (1997); and Loyoza, Schmidt-Hebbel and Serven (2000)).

In contrast to these international studies, previous work with Australian data (Edey and Britten Jones (1990); Blundell-Wignall and Stevens (1992); and Lee (1999)) has found little evidence of Ricardian effects.

However, there may be a range of issues with previous Australian studies which may have affected their findings. We now briefly discuss some issues related to these studies.

Blundell-Wignall and Stevens (1992) regressed the change in the private savings ratio on the change in the public savings ratio using annual data from 1964 to 1991, and found no significant offset. We find similar results when this approach is replicated with annual data from 1974-75 to 1999-2000.[2] However, when we have included other potential explanatory variables that may affect private savings (unemployment; income; inflation; and, real interest rate) we find a significant saving offset of around a half.[3] This suggests that the previous study's regression analysis

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1 For a full set of assumptions underpinning Ricardian equivalence see Elmendorf and Mankiw (1998).

2 Annual data for this study was constructed from quarterly series listed in Appendix 1.

3 Full results of this model can be found in Appendix 5.

may have been misspecified due to the omission of other explanatory variables.

Lee (1999), using quarterly data from 1980:1 to 1999:1, found no significant offset between household savings and changes in aggregate general government savings. However, while the evidence for savings offsets is weak at the household level, it is more appropriate to consider a broader measure of saving such as total private sector savings. Private sector savings include the savings of private corporations in addition to household savings.

This distinction is of little consequence if household and private savings are highly correlated, however, there is evidence to suggest this is not the case.[4] Chart 1 indicates that the household savings ratio in Australia is not a good proxy for overall private savings behaviour. The correlation coefficient between the private savings ratio and the household savings ratio over the period 1979-80 to 2000-01 is 0.83.

We adopt a broader measure of private saving in order to investigate the potential offset between private sector and government saving over the period 1981:1 to 2001:2. As a proxy for private sector saving we have used household plus corporate savings. Ideally we would use private sector saving calculated according to a methodology outlined in Treasury (1999, 48-50) however, this measure of net private sector saving is not available on a quarterly basis.[5]

Chart 2 illustrates that the household plus corporate savings ratio tracks the private sector savings ratio well, suggesting it is a good proxy for private savings.[6] The correlation coefficient between the private savings ratio and the household plus corporate savings ratio over the period 1979-80 to 2000-01 is 0.91.

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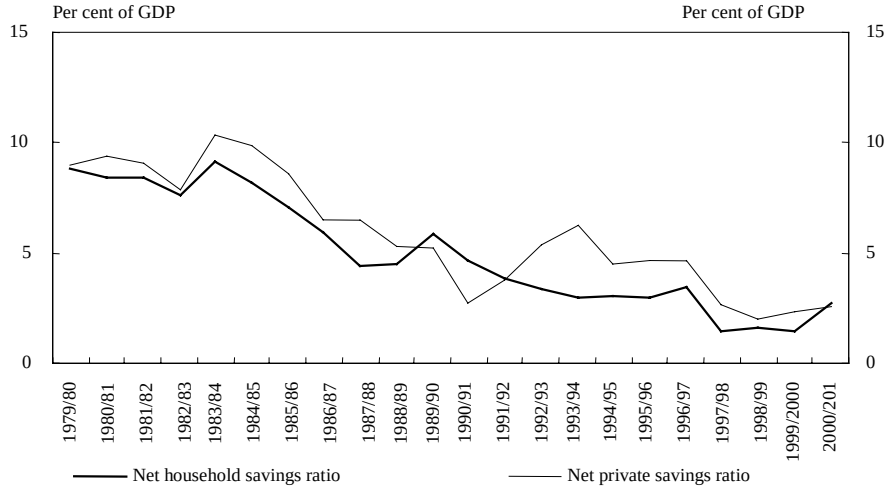
[4] One reason for this may be the long-term trend in Australia towards the incorporation of non-incorporated businesses. This has tended to reduce household saving without necessarily producing an underlying change in private sector savings behaviour. Another reason may be potential piercing of the corporate veil by households. Because corporate savings are essentially private savings changes in corporate savings may illicit changes in household savings without there being an underlying shift in private savings behaviour.

[5] Quarterly data on the split between public and private corporate savings is not available.

[6] An alternate private savings proxy was calculated by extrapolating the annual private/public corporations split into quarterly data. The regression results using this second proxy are substantially similar to those reported in this paper. Results of this regression are available from the authors on request.

Chart 1

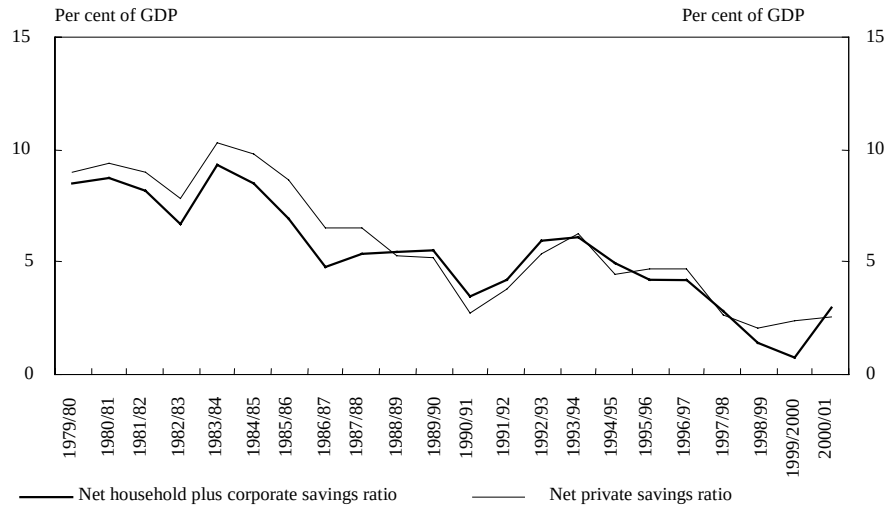
Comparison of net Household and Private Sector Savings Ratios



Source: ABS 5206-61; ABS 5206-56; Treasury Estimates.

Chart 2

Comparison of net Household plus Corporate and Private Sector Savings Ratios



Source: ABS 56206-61; 5206-64; 5206-56; Treasury Estimates (see Spring 1999 Economic Roundup, 'The Measurement of Saving in Australia', pp. 48-50).

Details of all data series used for this study are contained in Appendix 1. All of the data series used in this study were found to be non-stationary in the levels and stationary in first differences, i.e. that the variables are I(1), based on the Augmented Dickey-Fuller and Phillips-Perron Test results presented in Appendix 3.[7] There is evidence of at least one cointegrating relationship between these variables as per Johansen-Julieus procedure in Appendix 3.

The **long-term** 'equilibrium' level of private saving is hypothesised to be a function of general government saving, controlling for the influence of the inflation rate, the unemployment rate, the real interest rate, per capita household disposable income, direct taxes, social assistance paid to households, household wealth, and household debt (a proxy for financial deregulation). In the **short-term**, changes in private saving are hypothesised to be a function of changes in general government saving, controlling for changes in the same 'state' variables.

Private savings are anticipated to be negatively related to general government savings. This supposes that a fall in government saving would lead households to expect increased future tax liabilities and therefore to increase their saving rate in order to offset those expected future tax liabilities. Direct taxes and private wealth should be negatively related, while household disposable income should be positively related to private savings, both in levels and changes. A priori theory provides no unambiguous guide to the sign of the remaining variables.[8]

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[7] All the series in this paper were found to have I(1) characteristics with the exception of national government cyclical savings. Following Hendry (1995), the approach to determining the inclusion of constants and trends in the ADF tests was based on commonsense. As many of the series in question were ratios, only a constant was included. The finding that ratios are unit root processes is inconsistent with theory, however, small sample properties of such series often mimic unit root properties. Under these conditions it can be appropriate to model them as I(1) series. This is the approach adopted here.

[8] *Unemployment*: Increasing unemployment lowers disposable income and, through a greater incidence of liquidity constraints, lowers savings. On the other hand, increases in unemployment may increase the need for precautionary saving.

Inflation: Inflation tends to undermine the value of financial assets and stimulate saving. On the other hand, it may also reduce the return from saving in financial rather than non-financial assets, which tends to lower saving.

Real interest rates: The sign of the effect depends on whether the substitution or income effect dominates.

Deregulation: Financial deregulation may increase the opportunities for, and return to, financial savings, but may also enhance access to credit and thus lower private savings.

The following error correction model was estimated:

$$\Delta PS_t = \alpha_0 + \alpha_1 PS_{t-1} + AX_{t-1} + \beta \Delta X_t + e_t \qquad (1)^9$$

where:

PS_t is the ratio of net household plus net corporate saving to GDP (a proxy for net private sector savings).

Δ represents the one period change operator.

X_t is a vector of I(1) explanatory variables, X={U, Π, R, Y, T, AS, W, D, GS}.

e_t is a random normal error term.

α_1 is the error correction coefficient.

The components of the vector X are defined as follows:

U = Unemployment rate;

Π = Inflation rate;

R = Real interest rate;

Y = Household disposable income per capita;

T = Share of Commonwealth direct taxes to total Commonwealth general government tax revenue;

AS = Ratio of social assistance benefits to household disposable income;

W = Ratio of private wealth to household disposable income;

D = Ratio of household debt to household disposable income (a proxy for financial deregulation); and

GS = Ratio of net general government saving to GDP.[10]

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[9] We tested the robustness of this functional form by estimating the ECM with up to four lags of the difference operator. We did not find evidence of a link between private saving and government saving for any of the lagged difference functional forms. While the formal diagnostics supported the adoption of a longer lag structure in the interest margin study examined later on, for consistency we used the contemporaneous difference operator in both halves of this paper.

[10] The exact definitions and data sources are in Appendix 1.

Equation 1 relates the current change in private savings to lagged values of the explanatory variables (the 'equilibrating error' in the previous period) and current changes in the explanatory variables.[11] We recognise that while there may exist a long run equilibrium relationship between the variables under examination, there may be disequilibrium in the short-term. The framework, therefore, models the change in the dependant variable as a function of changes in the explanatory variables and the error correction mechanism, in which a proportion of the disequilibrium in one period is corrected in the next. Equation 1 was initially estimated and insignificant variables systematically eliminated to produce the following model:

$$\Delta PS_t = \beta_0 + \beta_1 D_{t-1} + \beta_2 GS_{t-1} + \beta_3 PS_{t-1} + \beta_4 \Delta U_t + \beta_5 \Delta D_t + \beta_6 \Delta GS_t + e_t \qquad (2)$$

The results from this model are outlined in Table 1. All estimation and diagnostic procedures undertaken for the purposes of this paper were performed in *EVIEWS 3.1*.

The above model suggests a significant private savings offset of around $^1/_3$ to short-term changes in general government savings. In contrast to the short-term relationship, a long-term statistically significant relationship could not be established between the two variables at the 5 per cent confidence interval.

The model also suggests, that in the short run, the private savings ratio decreases by 1.2 per cent in response to a 1 percentage point increase in the unemployment rate, and falls by 0.03 per cent in response to a 1 per cent increase in household debt to disposable income ratio (the long run proxy for financial deregulation). The model suggests also that in the long run, a 1 per cent increase in the household debt to disposable income ratio elicits a 0.006 per cent decrease in the private savings ratio, so that there is evidence of a long term relationship between private savings and financial deregulation.[12]

Chart 3 illustrates the impulse response for the level of private saving in response to a permanent 1 per cent of GDP increase in government saving. The chart demonstrates that it takes approximately 5

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[11] The 'equilibrating error' is equal to the error term from estimating the 'long-term' level of private savings ratio on the levels of the explanatory variables.

[12] While the coefficients on the financial deregulation terms are low, financial deregulation does seem to have a significant effect on private savings as the household debt to disposable income ratio is a very high value.

Table 1

Results from Error Correction Model 2 (Equation 2)

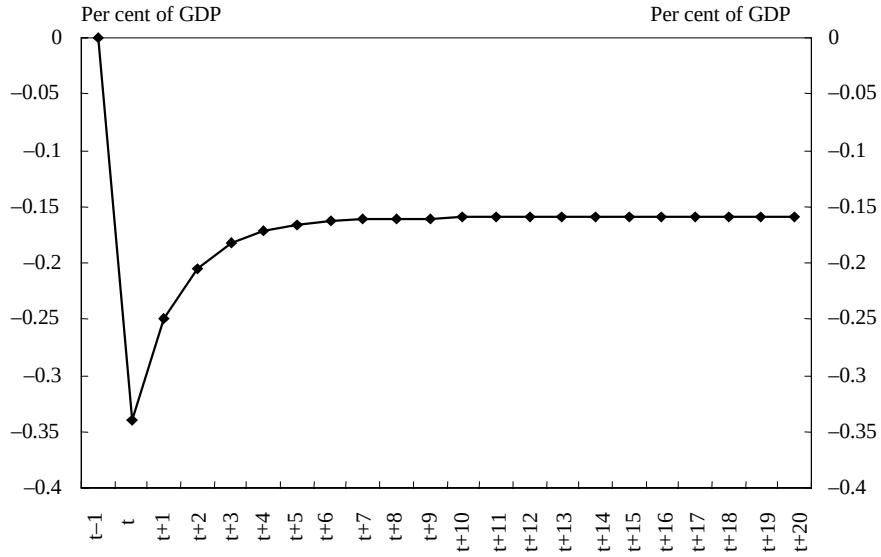
Dependent variable: Δ Private Saving: 1981:1 - 2001:2		
	Coefficient (t statistic)	**L.T. coefficient** [(a)] (t statistic)
Explanatory variables: Short Run		
Constant	6.43 (4.82)	
Δ $Unemployment_t$	-1.19 (-3.83)	
Δ $Deregulation_t$	-0.03 (-4.84)	
Δ $Government\ Saving_t$	-0.34 (-3.36)	
Explanatory variables: Long Run		
$Private\ Saving_{t-1}$	-0.5 (-5.30)	
$Deregulation_{t-1}$	-0.003 (-4.14)	-0.006
$Government\ Saving_{t-1}$	-0.08 (-1.08)[(b)]	-0.16
Major Diagnostics	R-Bar-Squared	0.59
	DW Stat	2.35

(a) The long-term coefficients in the table above are calculated by dividing the coefficients for the relevant variables by the coefficient on the error correction term (lagged value of the dependent variable).

(b) Redundant variable test for the inclusion of GS_{t-1}: F statistic = 1.18 Prob = 0.281, Log Likelihood Ratio = 1.279 Prob = 0.258.

Chart 3

Impulse Response of Private Saving to a 1 per cent of GDP Permanent Increase in Government Saving



periods before the full affect of the shock is unwound and the system returns to its long run equilibrium value of –0.16.

A complete summary of diagnostic tests are reported in Appendix 4. Based on these tests the model seems for the most part to have reliable characteristics. However, there is some evidence of autocorrelation and heterocedasticity. Also, it is likely that the coefficient estimates are unstable over time and as such represent a major caveat on our results.

Another issue is whether private sector savings offsets are more pronounced in the face of 'structural' rather than cyclical changes in government saving. Studies such as Cebula, Hung and Manage (1996) explore this proposition.

Cebula *et al.* break the US federal budget into its structural and cyclical components. The former is hypothesised to be the 'planned deficit', whereas the latter is viewed as the 'unplanned'. They claim that the cyclical deficit can at best be crudely estimated, its determinants are

sufficiently varied and unknown that predicting it is extremely difficult and beyond the capacities of most so called 'rational' individuals. They argue that in a Ricardian world it is reasonable to expect that household saving will depend upon structural deficits, but cyclical deficits are likely to exercise little impact, if any, on household saving.[13] They find for the US there is a private saving offset of around 1/3 on structural deficits, while cyclical deficits do not effect personal saving rates.

We have extended the model developed above by disaggregating general government saving into National general government structural and cyclical savings and State and Local general government savings.[14]

The model was initially run and insignificant variables systematically eliminated to produce the following model:

$$\Delta PS_t = \beta_0 + \beta_1 D_{t-1} + \beta_2 NGSS_{t-1} + \beta_3 NGCS_{t-1} + \beta_4 SLGS_{t-1} + \beta_5 PS_{t-1} + \beta_6 \Delta U_t + \beta_7 \Delta D_t + \beta_8 \Delta NGSS_t + \beta_9 \Delta NGCS_t + \beta_{10} \Delta SLGS_t + e_t \quad (3)$$

where:

NGSS = National Government Structural Savings

NGCS = National Government Cyclical Savings

SLGS = State and Local Government Savings[15]

The results from this model are reported in Table 2.

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13 This point was also made by Barro, (Edey and Britten-Jones, 1990, pp. 120-121), who noted that both public and private savings tend to move cyclically, and in order to determine the effect of public sector deficits on private saving, the exogenous component of the public sector position must first be extracted.

14 The methodology for breaking National general government savings into its structural and cyclical components is provided in Appendix 2. We note that determination of the structural and cyclical components of savings involves a range of complex issues (see Banca D'Italia, 1999). However, while the level of structural savings is particularly difficult to identify it is more straightforward to determine changes in structural savings. The changes in structural savings are of primary importance in generating the results contained in this paper.

15 We have not broken the State and Local Government savings numbers down into structural and cyclical components due to the lack of quarterly data available to conduct the analysis. It is likely that variations in State and Local Government savings positions are primarily structural in nature due to the heavy revenue reliance on the Commonwealth and the fact that State and Local Government outlays are less cyclically sensitive than Commonwealth outlays reflecting the Commonwealth's primary responsibility for income support arrangements. Furthermore, separately identifying the State and Local Government sector is useful as it allows us to focus on the savings behaviour of the Commonwealth Government which in practice is responsible for demand management policy.

Table 2

Results from Error Correction Model 3 (Equation3)

Dependent variable: Δ Private Saving: 1981:1 - 2001:2	**Coefficient** (t statistic)	**L.T. Coefficient[a]** (t statistic)
Explanatory variables: Short Run		
Constant	7.8	
	(5.21)	
Δ Unemployment$_t$	-0.82	
	(-2.10)	
Δ Deregulation$_t$	-0.03	
	(-4.37)	
Δ National Government Stuctural Saving$_t$	-0.35	
	(-3.29)	
Δ National Government Cyclical Saving$_t$	0.92 [b]	
	(1.33)	
D State & Local Government Saving$_t$	-0.33	
	(-2.07)	
Explanatory variables: Long Run		
Private Saving$_{t-1}$	-0.68	
	(-6.18)	
Deregulation$_{t-1}$	-0.004	-0.01
	(-4.48)	
National Government Structural Saving$_{t-1}$	-0.27	-0.40
	(-2.44)	
National Government Cyclical Saving$_{t-1}$	0.73	1.07
	(-2.06)	
State & Local Government Saving$_{t-1}$	-0.19[b]	-0.28
	(-1.01)	
Major Diagnostics	R-Bar-Squared	0.59
	DW Stat	2.14

(a) The long-term coefficients in the table above are calculated by dividing the coefficients for the relevant variables by the coefficient on the error correction term (lagged value of the dependent variable).

(b) Redundant variable test for the inclusion of GS_{t-1}: F statistic = 1.18 Prob = 0.281, Log Likelihood Ratio = 1.279 Prob = 0.258.

The above model suggests that short-term increases in the National general government structural savings ratio of 1 per cent are partly offset by decreases in private sector savings of 0.35 per cent. Furthermore, the coefficient on the short-term changes in National general government cyclical savings term is not significant, suggesting that changes in this term do not elicit private sector savings responses. These results are consistent with the results reported above for the model incorporating an aggregate government saving measure.

However, in contrast to the earlier model, the disaggregated model also suggests a negative long-run relationship between National general government structural savings and private sector savings. A one per cent increase in the government structural savings ratio is associated with a 0.4 per cent decrease in the private savings ratio in the long-term.

While the model suggests a positive long-term relationship between cyclical government savings and private sector savings, we suspect that this relationship is largely due to cyclical factors effecting both terms rather than cyclical government savings provoking private sector responses. The long-term coefficient of 1.07 suggests that this is the case as both government cyclical savings and private savings seem to be effected one-for-one by cyclical factors. That said, we have estimated the equation with a range of cyclically sensitive variables, none of which appear to be statistically significant. We would also note that cyclical government savings in the long-term are equal to zero. Therefore, any long-term affect between the two variables must be negated.

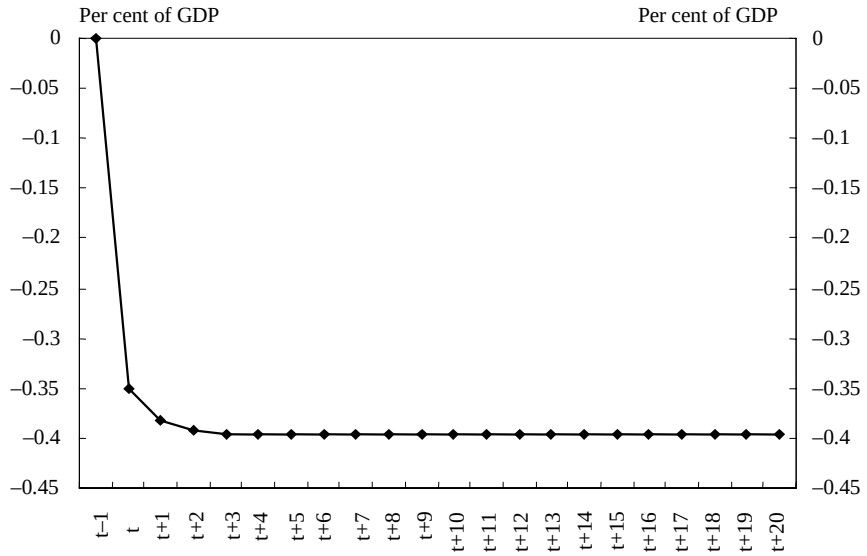
The model also suggests that changes in the unemployment rate and financial deregulation remain significant explanatory factors of private sector savings.

Chart 4 illustrates the impulse response for the level of private saving in response to a permanent 1 per cent of GDP increase in national government structural saving. The chart demonstrates that it takes approximately 3 periods before the full affect of the shock is realised as the system reaches its long-run equilibrium value of –0.40.

A summary of standard diagnostic test statistics is reported in Appendix 4. Based on these the model passes the usual tests at standard significance levels, adjusted for heterocedasticity. However, once again, there is evidence that the coefficient estimates are unstable over time.

Chart 4

Impulse Response of Private Saving to a 1 per cent of GDP Permanent Increase in National Government Structural Saving



However, given the relatively small sample we did not proceed with sub sample estimation.

These results suggest that the structural/cyclical decomposition is significant in terms of explaining private savings offsets. The previous model did not identify a statistically significant long-term equilibrium relationship between fiscal policy and private sector savings due to its focus on aggregate fiscal variables.[16]

The results of this model have interesting policy implications for the usefulness of fiscal policy as a demand management tool. Discretionary fiscal policy changes are (almost by definition) structural changes in government savings. Therefore the results suggest that discretionary policy

[16] This factor may also help to explain the results of Lee (1999), where, in addition to using the household savings ratio as the dependant variable, the study used cointegration analysis on the levels of the household savings and actual general government savings ratios.

changes aimed at influencing aggregate demand are likely to be offset somewhat by private sector savings responses. This implies that any fiscal package needs to be larger than it otherwise would be in the absence of private sector savings offsets to have an effect on output.

However, in contrast to this, the operation of automatic stabilisers is unlikely to provoke private savings offsets as they represent cyclical changes in government savings. As a result automatic stabilisers may be seen as a more reliable option for managing demand than discretionary policy changes. That said, this needs to be qualified by the fact that there is scope to make the magnitude of discretionary policy changes substantially larger than the magnitude of automatic stabilisers. Furthermore, the results reported here necessarily refer to aggregate changes in savings behaviour. In principle certain individual fiscal measures may have much larger demand effects (for example, those that seek to change the timing of capital expenditure).

While the results from the above models have important implications for the effectiveness of fiscal policy, there is an important caveat.

It is possible that private saving is determined simultaneously with some explanatory variables in the regression equation. Explanatory variables that are likely to be endogenous with private savings include, government savings, and income growth. If such an endogeneity problem exists, the coefficient estimates of the model will be biased and inconsistent. While instrumental variables may be used to address this potential problem, finding persuasive instruments is difficult.

3. Fiscal Policy and Interest Rates in Australia

The impact of fiscal policy on interest rates is important as the level of interest rates in Australia has significant short-term and long-term consequences. In general higher interest rates will have adverse consequences for growth.

- If expansionary fiscal policy results in higher real interest rates, then this would operate to undermine short-term demand management by crowding-out to some extent the initial stimulus.
- Higher real interest rates can also lead to a lower long-term capital stock and a lower output level due to reduced investment levels.

Lower capital stock and output level on average lowers living standards, real wages and employment levels (Elmendorf and Mankiw 1998, 28 and 29).

- Higher real interest rates also raise the long-term cost of servicing the stock of net foreign debt and thereby increase the level of transfers to foreign lenders (both public and private). It is possible that higher interest rates on debt also increase the cost of servicing foreign equity holdings. This is a particularly important issue for Australia given our relatively high level of net external liabilities (most of which have been incurred by the private sector).

There is little international evidence of a short-term link between fiscal policy and interest rates (Ford and Laxton, 1999, 80). Elmendorf (1996, 1) states that this may be due to the fact that the true relationship is between interest rates and the expected values of fiscal policy variables. Studies that have considered the link between interest differentials and expected fiscal policy, or 'risk premia' and expected fiscal policy, have found some evidence of a link to fiscal policy.[17]

In contrast, pooled time series studies have established a link between interest differentials and actual fiscal policy. Orr, Edey and Kennedy (1995) show for seventeen developed countries between 1981:2 and 1992:2 that a 1 per cent of GDP fiscal stimulus increases the real interest rate differential on 10-year bonds by 15 basis points. Lane and Milesi-Ferretti (2001) examined the OECD countries for the period 1970-98. Over this period they found a statistically significant relationship between public debt and the real interest differential (at the 10 per cent significance level).

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[17] For example:

Elmendorf (1993) uses **survey data** of expected value of fiscal policy for the USA to show that a 1 per cent increase in the GNP leads to a 50 basis point rise in the real bond yield (for 3-year bonds).

Elmendorf (1996) uses **announcement dates** of fiscal adjustments and could not reject the hypothesis of a statistical relationship between the announcement of fiscal stimulus and long-term interest rate yields.

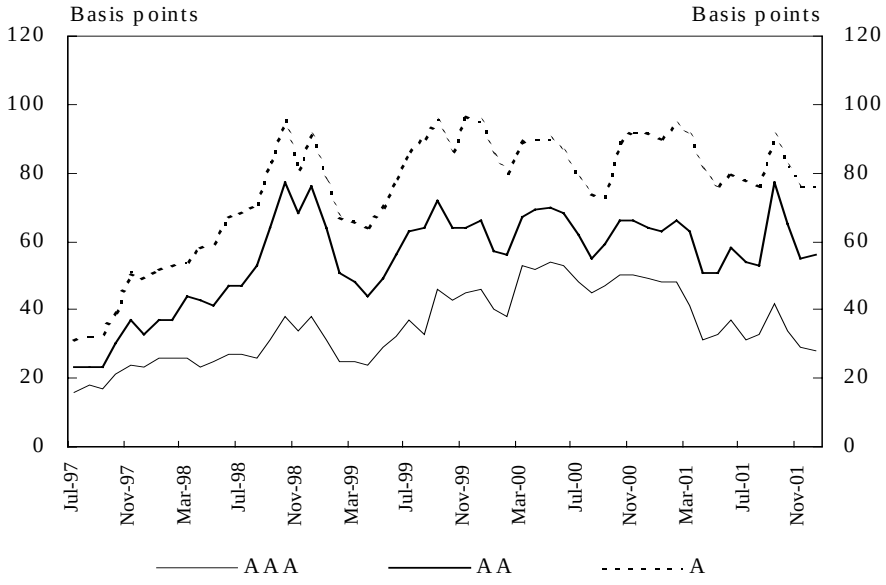
Giorgianni (1997) uses a **VAR model** measure of expected fiscal policy and a **survey data** measure of the exchange risk premia and for Italy 1987-94. He estimated for the period 1987:2 to 1996:7, an anticipated permanent reduction of 1 percent in the Italian deficit-GDP ratio would bring about a reduction of approximately 90 basis points in the lira/Deutsche Mark risk premium. In the period 1987-1994 the average risk premium was about two percent, a zero lira risk premium could have been obtained in the presence of a credible reduction by less than 3 percentage points of the Italian deficit-GDP ratio.

For higher real interest rates to have significant economic affects they must operate at the long end of the yield curve by influencing society's preference (discount rate) for consumption over saving. Therefore, when considering the effect of interest rates on the economy it is important to focus on long-term bond rates which may be closer to the key determinants of long-term saving and investment decisions. This is not to say that short-term rates have no effect on saving and investment decisions. For example, home mortgage rates in Australia are closely tied to short-term interest rates.

In addressing the issue of the level of interest rates in Australia we focus on the return on Australian Commonwealth Government bonds. Of course Australian Government bonds may not be a perfect measure of the interest rate facing economic decision makers. However, we would expect that over reasonable periods of time arbitrage arrangements will result in the Government bond rate being a reasonable proxy for the level of interest rates facing economic agents. Chart 5 shows a relatively stable spread

Chart 5

Spread between Australian Government and Corporate Bonds



Source: RBA Bulletin, Table F.03m: Capital Market Yields and Spreads: Corporate Bonds: Monthly.

relationship between Australian Government and corporate bonds over the time period for which data is available. Analysing the government bond market also has the advantage that the market is highly liquid, reducing the risk of price discovery. Data are also readily available and collected on a consistent basis.

The interest rate on Australian Government bonds can be thought of as comprising of a number of components.

- First, if Australia is considered to be a small open economy there will be an infinitely elastic demand for Australian Government bonds. The interest coupon on these instruments can then be thought of as the base level of Australian interest rates given by the supply and demand for funds on the world market.
- Second, if we relax the assumption of an infinitely elastic demand then the interest rate may need to rise in order to attract additional investors. This effect can be thought of as the impact of the additional supply of bonds on the world market. This effect can be expected to be very small in the Australian context. Of course, if the same question were analysed for a country such as the United States, then this effect could be quite significant.
- Third, the above two possible determinants of Australian interest rates implicitly assume that all bonds are homogeneous. However, Australian bonds are likely to be viewed by investors as imperfect substitutes for other bonds. Investors may not be indifferent to the currency in which the bonds are denominated. Given that investors prefer to hold a balanced portfolio, they may require a higher return to increase the proportion of a particular country's assets in their portfolio, i.e. a portfolio risk premium (Frankel, 1979, 381).
- Fourth, investors may also demand a default premium to compensate for the probability that a country may default on its foreign debt obligations (Lonning, 2000, 262).[18]

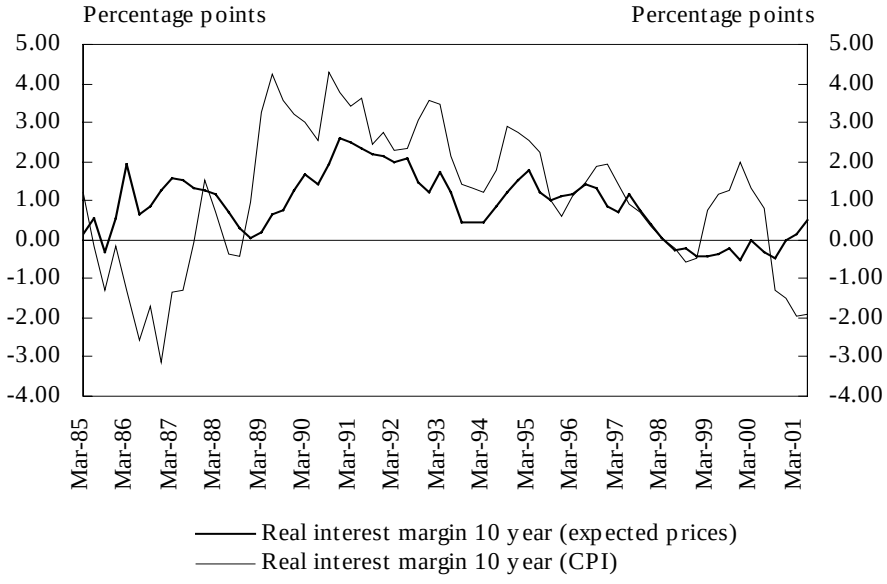
[18] Conceptually the default risk premium is a subset of portfolio risk. It is one of the reasons why investors do not view all government bonds as perfect substitutes. That said, we believe that it is useful to identify it separately as the risk of default is a common focus when sovereign debt issues are considered. Separately identifying default risk highlights the fact that investors may believe that there is a zero default risk, but still demand higher returns to hold a higher proportion of a particular countries' bonds. This is important for a country like Australia where default risk is likely to be perceived by investors as close to zero.

In this paper we focus on the margin on 10-year Treasury Bonds between Australia and the United States adjusted for expected inflation (see Data Appendix). The United States is used here as a proxy for the world market because it has historically been a major provider of capital to Australia and due to its role as a global safe haven. In terms of the taxonomy presented above, this methodology seeks to identify the combined effect of portfolio risk and default risk. The effect of Australian Government bond issuance on world interest rates (proxied here by the United States) will not be identified. Of course, other factors may affect the margin and so the estimates presented below need to be treated with caution.

This measured real interest margin calculated with expected prices is outlined for the period 1985:1 to 2001:2 in Chart 6. For purposes of comparison we have included a real interest margin measure constructed using actual prices as well.

Chart 6

The 10-Year Bond Real Interest Margin Between Australia and the United States



Source: Nominal interest rates and indexed bonds data obtained from RBA Bulletin and calculated as per methodology outlined in Appendix 1.

The high point of the 'expected' margin was 257 basis points in December 1990 and the low point was –47 basis points in September 2000. In general, low values of the margin correspond to periods of fiscal consolidation in Australia (late 1980s and late 1990s) and high values during periods of fiscal expansion (early to mid 1990s).[19] The following analysis seeks to explore this 'observed' relationship more rigorously.

We have investigated the potential link between the interest margin outlined in Chart 6 and actual fiscal policy over the period 1985:1 to 2001:2. Details of all data sources used for this study are contained in Appendix 1.

Again all the data series are non-stationary in levels and stationary in changes with evidence of at least one cointegrating relationship between them from the Johansen-Julieus procedure; as per Appendix 3. We examined an error correction model of the following form:

The model is constructed as follows: [20]

$$\Delta IM_t = \alpha_0 + \alpha_1 IM_{t-1} + AX_{t-1} + \beta \Delta X_t + e_t \qquad (4)$$

where:

IM_t is the real interest margin between Australia and the United States for 10-year government bonds

Δ represents the one period change operator

X_t is a vector of I(1) explanatory variables, X={*BB, PD, Π, RGDPg CA, ND*}

e_t is a random normal error term

α_1 is the error correction coefficient

The components of X are defined as follows:

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[19] Of course there is an issue of observational equivalence here because in times of high growth a government has more capacity to eliminate debt which will assist in driving down yields, and *vice versa* in periods of recession.

[20] To test the robustness of the functional form the ECM was initially estimated with up to 4 lags of the difference operator. Results obtained including as many as 4 lags are qualitatively the same as those reported below.

BB = Budget balance (expressed either as Headline balance or as Structural balance) as a proportion of GDP

PD = Stock of net public debt as a proportion of GDP

Π =Inflation rate

RGDPg = Real GDP growth

CA = Current account expressed as a proportion of GDP

ND = Stock net foreign debt expressed as a proportion of GDP

The model had two components. First, a **long-term** 'equilibrium' component where the level of the interest margin is hypothesised to be a function of the levels of both the flow and stock of fiscal policy, the inflation rate, real GDP growth rate, as well as the flow and stock of net foreign debt. Second, a **short-term** changes component where changes in the interest margin are hypothesised to be a function of changes in the budget balance, stock of public debt, inflation rate, real GDP growth rate, the current account, and net stock of foreign debt.

The interest margin is expected to rise in response to a deterioration in the budget balance or a rise in the stock of public debt. The interest margin is also hypothesised to be positively related to levels and changes in the inflation rate, and the stock of net foreign debt and negatively related to levels and changes in GDP growth and the current account.

The results obtained from estimating the full model (Equation 4) are presented in Table 3, using the headline budget balance or structural budget balance, alternatively, as the fiscal flow variable.

In addition, we examined a 'simple model' resulting from general to specific elimination of insignificant variables. The simple model is outlined in Equation 5:

$$\Delta IM_t = \beta_0 + \beta_1 PD_{t-1} + \beta_2 \Pi_{t-1} + \beta_3 RGDPg_{t-1} + \beta_4 CA_{t-1} + \beta_5 IM_{t-1} + \beta_6 \Delta BB_t + \beta_7 \Delta IM_t + e_t \quad (5)$$

Columns 3 and 4 of Table 3 present the results from estimating the 'simple model', using the headline budget balance or structural budget balance, respectively, as the fiscal flow variable.

Table 3

Full and Simple Model Results (as per Equations 4 and 5)

Dependent variable: Δ	10-Year Bond Real Interest Margin 1985:1 - 2001:2			
	Full Model (HB) Coefficient *(t statistic)*	Full Model (SB) Coefficient *(t statistic)*	Simple Model (HB) Coefficient *(t statistic)*	Simple Model (SB) Coefficient *(t statistic)*
Explanatory variables: Short Run				
Constant	0.410	1.249	-0.265	-0.279
	(0.32)	(0.81)	(1.09)	(1.17)
Δ Interest Margin	0.347	0.354	-0.327	0.296
	(1.95)	(1.96)	(2.35)	(2.16)
Δ Structural Balance		-0.258		-0.319
		(2.11)		(2.96)
Δ Headline Balance	-0.222		-0.200	
	(2.38)		(2.64)	
Δ Stock Public Debt	-0.047	0.000		
	(0.62)	(0.00)		
Δ Inflation Rate	0.115	0.108		
	(1.54)	(1.39)		
Δ Real GDP Growth	-0.111	-0.115		
	(1.74)	(1.77)		
Δ Current Account	-0.047	-0.068		
	(0.59)	(0.85)		
Δ Stock Net Foreign Debt	0.012	0.042		
	(0.22)	(0.81)		
Explanatory variables: Long Run				
Interest Margin	-0.446	-0.446	-0.407	-0.395
	(2.80)	(2.84)	(3.68)	(3.63)
Headline Balance	-0.007			
	(0.15)			
	-0.016 [a]			
Structural Balance		-0.036		
		(0.44)		
		0.081		
Public Debt	0.073	0.052	0.059	0.060
	(1.95)	(1.12)	(2.83)	(2.92)
	0.164	0.117	0.145	0.152
Inflation	0.034	0.018	0.041 [b]	0.042 [c]
	(0.85)	(0.44)	(1.81)	(1.85)
	0.076	0.040	0.101	0.106
Real GDP Growth	-0.162	-0.177	-0.125	-0.116
	(2.35)	(2.57)	(2.74)	(2.55)
	-0.363	-0.397	-0.307	-0.294
Current Account	-0.074	-0.048	-0.071 [b]	-0.062 [c]
	(1.16)	(0.73)	(1.67)	(1.48)
	-0.166	-0.108	-0.174	-0.157
Net Stock Foreign Debt	-0.017	-0.028		
	(0.7)	(0.98)		
	-0.038	-0.061		
R-Bar-Squared	0.21	0.19	0.22	0.24
DW Stat	1.99	2.05	1.91	2.21

(a) The long-term coefficients for each equation are shaded grey and calculated by dividing the estimated coefficients for the relevant variables by the coefficient on the error correction term (lagged value of the dependent variable).[21]

(b) Redundant variable test for the inclusion of $Inflation_{t-1}$ and $Current\ Account_{t-1}$: F statistic = 3.83 Prob = 0.028 Log Likelihood Ratio = 8.31 Prob = 0.016.

(c) Redundant variable test for the inclusion of $Inflation_{t-1}$ and $Current\ Account_{t-1}$: F statistic = 3.57 Prob = 0.036 Log Likelihood Ratio = 7.77 Prob = 0.020.

[21] Importantly, when the long-term levels component of these models is estimated as a separate equation, the Adjusted R^2 is equal to 0.64 (see Appendix 4), indicating that the long-term equation explains around $^2/_3$ of the variation in the interest margin. When the lagged value of the dependent variable is included on the RHS the Adjusted R^2 rises to 0.88.

The simple model results reveal:

For the long-term levels component the fiscal stock variable (e.g. stock of public debt) and real GDP growth were significant. The *t* statistic on the current account and inflation variable were not large enough to indicate a significant statistical relationship at the 5 per cent confidence interval. However they are large enough to suggest there may exist a 'meaningful' relationship between these variables and the interest margin.

For the short-term changes component, only the fiscal flow variables (e.g headline balance or structural balance) were statistically significant.

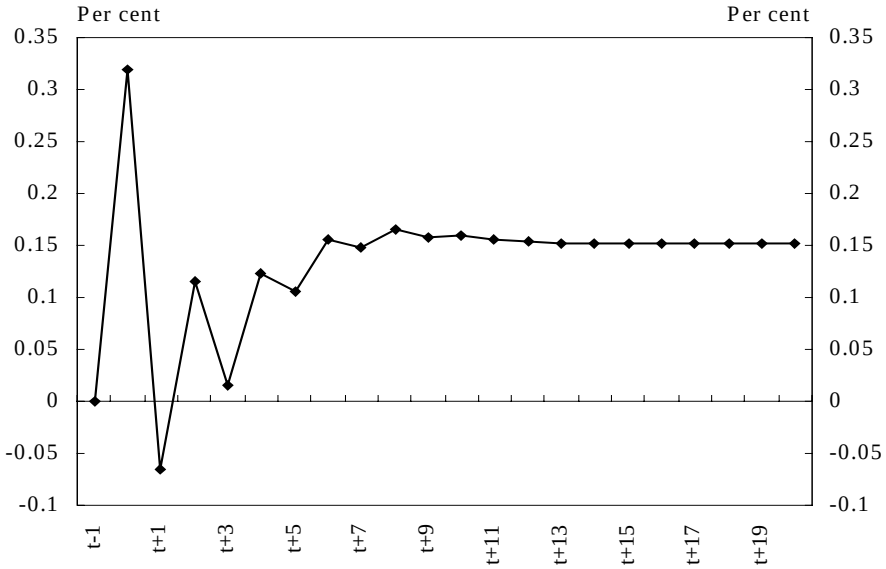
The economic interpretation of the fiscal variables results in Table 3 is as follows. The interest margin increases by approximately 20 basis points in response to a one per cent of GDP deterioration in the headline budget balance. This is approximately the same magnitude of increase in the margin caused by a one percent of GDP increase in the stock of public debt at around 15 basis points. In contrast, a one percent of GDP deterioration in the structural budget increases the margin by approximately 32 basis points.

The economic interpretation of the 'state' economic variables results in Table 3 is as follows. A one per cent of GDP increase in the current account deficit increases the margin by approximately 17 basis points in the long-term. A similar increase in the inflation rate increases the margin by approximately 10 basis points in the long-term. Importantly, a one-percentage point increase in the real GDP growth rate decreases the margin by approximately 31 basis points in the long-term.

Table 3 reveals that the error correction term coefficient is around 0.40 for either version of the simple model and is statistically significant. The economic interpretation of this number is that the system reverts back to its long-term mean by 40 per cent in each quarter. Therefore it takes upwards of five quarters for short-term deviations from the long-term relationship to be unwound. This point is illustrated by examining the impulse response in Chart 7 which illustrates the adjustment path for the level of the interest margin after a temporary 1 per cent of GDP structural deterioration in the Commonwealth budget. The systems reverts to its long-term value implying an increase in the interest margin of around 0.15 percentage points after approximately five quarters.

Chart 7

Impulse Response of the Interest Margin to a 1 per cent of GDP Temporary Deterioration in the Commonwealth Structural Budget



The model passes all the usual diagnostic tests at the standard significance levels.

The fiscal policy implications stemming from these results are quite straightforward. Increases in the interest margin arising from public policy, eg. default/portfolio risk, may reduce the effectiveness of fiscal policy to influence aggregate demand, and may have significant impacts on long-term growth and employment prospects.

Moreover, it seems likely from these results that changes in the structural budget (e.g. discretionary spending) drive short-term changes in the interest margin. This implies that significant discretionary fiscal policy movements may have large associated costs.

Finally we would note that the magnitudes of the fiscal coefficients estimated previously are quite large given that Australia is a small open economy, although they are consistent with the international literature

examined previously. As such we would not want to overplay the significance of the magnitudes presented here.

For completeness we note that there are some important provisos that must be placed on the numbers described previously.

The results may suffer from endogeneity problems given budget deficits, income and interest rates may be determined simultaneously.

There is no role of information and expectations in the simple model which is unorthodox given that we are attempting to explain the interest margin between two financial assets.

4. Conclusion

The paper considers the effectiveness of fiscal policy with respect to two key issues: potential private sector savings offsets; and the link between fiscal policy and interest rates in Australia. These two issues are important when considering the role of fiscal policy in Australia. Evidence of significant private sector savings offsets would indicate that fiscal policy is less effective as a demand management tool than it otherwise would be. Evidence of increasing interest rates in response to higher budget deficits would indicate that fiscal policy is less effective as a demand management tool and that there may be adverse consequences for long-term living standards.

Previous Australian studies have found little evidence of substantial private savings offsets. In contrast, our results indicate the existence of a substantial private savings offset. We investigate the relationship between private and public savings in two ways. First we estimate a model that focuses on aggregate government savings. The results of this model suggest that there is a private savings offset of around one third in the short run. The results from this model do not support the existence of a long run relationship between private and government savings. Second, we estimate a model that disaggregates government savings into structural and cyclical components. The disaggregated model suggests a similar short-term private savings offset of around one third. However the disaggregated model provides two additional insights. First, the disaggregated model suggests that the short run private savings offset is associated with changes in structural government savings, but that there is no statistically significant

relationship between private savings and cyclical government savings. Second, the disaggregated model suggests that there is a long run private savings offset of around a third to changes in structural government saving.

There are two key implications of these results. First, the magnitude of any fiscal stimulus will need to be larger than it would otherwise need to be in the absence of savings offsets to have the same affect on aggregate demand. Second, the operation of automatic stabilisers (which are inherently changes in cyclical government saving) are likely to be relatively more effective than discretionary changes in policy (which are inherently changes in structural government saving). This last observation needs to be qualified by the observation that our results are based on aggregate data and therefore may not capture the demand effects of specific policies that may in practice have more potent demand effects.

The paper also considers the link between fiscal policy and interest rates in Australia. We estimate a model that seeks to explain variations in the 10-year bond real interest margin with the United States with reference to variables including the headline budget balance, and the level of net public debt. The results suggest that a deterioration of the headline balance of one per cent of GDP is associated with an increase in the margin of around 20 basis points in the short run and that an increase in public debt of one per cent of GDP is associated with an increase in the margin of around 15 basis points in the long run. Furthermore, when we re-estimate the model using the structural balance instead of the headline balance, we find that the effect of changes in the structural balance on the margin is even higher at around 30 basis points.

These results suggest that higher budget deficits (or lower surpluses) can have a significant effect on interest rates in Australia. The associated costs of higher interest rates should be borne in mind when setting fiscal policy. That said, the size of the interest rate changes suggested by these results appear very high for a small economy with access to international financial markets such as Australia. Accordingly, we believe that these results should be treated with some caution. These coefficients belong to an era of higher debt. We would be surprised if further debt reduction had as large an incremental effect in this era of low debt.

APPENDIX 1

DATA

Savings Offsets

PS = Ratio of net household plus corporate saving to GDP. Net household savings (ABS 5206-61); Net corporate savings calculated as the residual of net national savings minus net household savings and net general government savings; GDP (ABS 5206-56).

Y = Household disposable income per capita. Nominal Household Disposable Income (ABS 5206-61); CPI (RBA Bulletin Table G.01); Population (ABS 3101-04).

U = Unemployment rate (ABS 6202-04).

Π = Inflation rate (RBA Bulletin Table G.01).

r = Real interest rate. Interest Rate (10 year Treasury bond yield (RBA Bulletin Table F.02)); Inflation (RBA Bulletin Table G.01).

GS = Net General Government Savings to GDP ratio (ABS 5206-64)

NGSS = Net Commonwealth General Government Structural Savings to GDP ratio. For methodology see Appendix 2.

NGCS = Net Commonwealth General Government Cyclical Saving to GDP ratio. For methodology see Appendix 2.

SLGS = Net State and Local General Government Savings to GDP ratio (ABS 5206-66).

T = Share of Commonwealth indirect taxes to total Commonwealth General Government taxation revenue (RBA Bulletin Table E.01m).

Ass = Social assistance benefits to household disposable income ratio (ABS 5206-61).

D = Household debt to household disposable income ratio (RBA Bulletin Table D.02).

W = Private wealth to household disposable income ratio (ABS TRYM Database Table 33).

All components were seasonally adjusted using X11 in EVIEWS.

Interest Margin

10-Year Bond

The 10-year bond yield was taken for the Commonwealth Government Securities (CGS) 10-Year bond yield sourced from the RBA Bulletin (see Table F.02d Capital Market Yields Government Bonds: Daily). Daily data was then converted into monthly and then quarterly averages.

Expected Inflation

From 1985:3 onwards, expected inflation rates were calculated from data obtained from the RBA Bulletin Database as the difference between nominal 10-year bond rates and inflation indexed bond yields (see Table F.02d Capital Market Yields Government Bonds: Daily). The only complication to this calculation is that from 1999:3 an adjustment was made for the impact of the passing of the Goods and Services Tax. This is accomplished by directly reducing inflation expectations by 20 basis points from this period for the next 10 years (this is a simple averaging assumption to distribute the full estimated 10-year 2 percentage point increase in the measured CPI over the whole 10 year period).

For 1985:1 to 1985:2 inflation indexed bond yield data is not available for Australia. We calculated a proxy of inflation expectations for these dates using a weighted average of the lagged values of actual GDP deflator. The expected inflation rate for 1985:1 and 1985:2 was then calculated as explained previously.

Federal General Government Headline Balance

Data was sourced from RBA Bulletin Database (Table E.01m), Commonwealth Headline Balance, Current Prices, and Not Seasonally Adjusted. Data was converted into quarterly averages and seasonally adjusted using the X11 program in EVIEWS. This data was then annualised and divided by annualised level of GDP, seasonally adjusted, quarterly data obtained from OECD Main Economic Indicators (Table Aus.01: Australian National Accounts. June 2001).

Federal General Government Structural Balance

Seasonally adjusted data was obtained from Fiscal Policy Unit of the Australian Treasury – the construction of this data is explained in Attachment 2 and is based on a net lending concept. The data was then divided by annualised level of GDP, seasonally adjusted, quarterly data obtained from OECD Main Economic Indicators (Table Aus.01: Australian National Accounts. June 2001).

Public Net Debt

Public debt numbers are sourced from the ABS (Table 5302.35 total public sector, net public debt total, for all Australian governments). Data for the general government Commonwealth net debt was not available. However, Australian States have historically held only a small proportion of total net debt. There are nine missing data points in the Australian data – 1985:1, 1985:3, 1985:4; 1986:1; 1986:3, 1986:4; 1987:1, 1987:3, 1987:4. No attempt has been made to replace missing data points as we feel this would introduce systematic bias into the error terms of our equation estimates.

The net public debt data was then divided by annualised level of GDP, seasonally adjusted, quarterly data, obtained from OECD Main Economic Indicators (Table Aus.01: Australian National Accounts. June 2001).

Inflation

Inflation rate for Australia was sourced from the ABS (Table 6401.011) as of September 2001. The CPI measure includes all groups excluding housing. The rate was calculated as the log difference.

Real GDP Growth

Real GDP growth rates were calculated from real GDP level data obtained from OECD Main Economic Indicators. (Table Aus.01: Australian National Accounts. June 2001). The rates were calculated as the log difference.

Current Account

The current account (Table 5302-04) and GDP (Table 5206-22) data were obtained from the ABS. Both series were seasonally adjusted.

Net Foreign Debt

Data is sourced from ABS (Table 5302.31F), not seasonally adjusted, in current prices. This data was then divided by annualised level of GDP, seasonally adjusted, quarterly data obtained from OECD Main Economic Indicators (Table Aus.01: Australian National Accounts. June 2001). There are nine missing data points for the net foreign debt data – 1985:1, 1985:3, 1985:4; 1986:1; 1986:3, 1986:4; 1987:1, 1987:3, 1987:4. No attempt has been made to replace missing data points as we feel this would introduce systematic bias into the error terms of our equation estimates.

APPENDIX 2

STRUCTURAL/CYCLICAL METHODOLOGY

Quarterly net National general government structural/cyclical savings were derived using the following methodology:

Output Gap

Quarterly output gaps were produced using a methodology similar to the OECD's output gap methodology.[22] These quarterly output gaps measure the gap between quarterly actual GDP and quarterly trend GDP.

Firstly, using quarterly data from the ABS TRYM Database, a two-factor Cobb-Douglas production function for the private business sector is estimated for given sample average labour shares.

$$\ln Y_t = \alpha \ln(N_t \cdot H_t) + (1-\alpha) \ln K_t + \ln e_t \qquad (1)$$

where Y_t is private business sector output, N_t is private business sector employment, H_t is an index of aggregate hours worked in all industries divided by an index of total employment in all industries, K_t is the private business sector capital stock, α is average labour share of output for the private business sector over the period of consideration, and e_t is a residual series that represents total factor productivity.

The estimated residuals, e_t from the equation are then smoothed using a Hodrick-Prescott (HP) filter to provide a measure of trend total factor productivity, e_t^*.[23]

The trend factor productivity series is then substituted back into the production function along with the actual capital stock, K_t, and trend labour input, $(N_t^* \cdot H_t^*)$, to provide a measure of the log of private business sector trend output Y_t^*.

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[22] C. Giorno *et al.* (1995), pp. 167-209. The main difference between the two methodologies is that the OECD produces a potential employment input based on the NAIRU, while this paper produces a trend employment input using a HP filter.

[23] All HP filters that smooth series in this methodology use a lambda of 1600.

$$\ln Y_t^* = \alpha \ln(N_t^* \cdot H_t^*) + (1-\alpha) \ln K_t + \ln e_t^* \quad (2)$$

Trend labour input, $(N_t^* \cdot H_t^*)$, is calculated by smoothing private business sector employment, N_t, and the hours index, H_t, with a HP filter.

Trend private sector business output, Y_t^*, is then added to actual general government sector output, actual government enterprise sector output, and dwelling output to gain trend GDP.

The output gap is calculated as the difference between actual output and the estimate of trend output, $(Y_t - Y_t^*)$, expressed as a percentage of trend output.

Savings Data

Quarterly net national general government savings was broken into its revenue and expenditure components using data from ABS 5206-65.

National general government net expenditure was calculated as National general government total income payable + National general government final consumption expenditure + National general government consumption of fixed capital. This quarterly series was then seasonally adjusted using X11 in EVIEWS.

National general government revenue was calculated as National general government total gross income. This series was then seasonally adjusted using X11 in EVIEWS.

National general government revenue minus National general government net expenditure equals National general government net saving.

The expenditure component was then further broken down into unemployment benefits and other expenditure components. Unemployment benefits were derived using Commonwealth government unemployment benefits data from ABS 5206-38. This series was then seasonally adjusted using X11 in EVIEWS.

The income component was further broken into taxation and non-taxation revenue components. Taxation revenue was calculated as

National general government total current taxes + National general government taxes on production and imports (ABS 5206-65). This series was then seasonally adjusted using X11 in EVIEWS.

Cyclical Expenditure Adjustment

Commonwealth government unemployment benefits were adjusted for cyclical factors using the formula:

$$UB_t^* = UB_t \,/ U_t \cdot U_t^* \tag{3}$$

where UB_t^* is trend unemployment benefits, UB_t is actual unemployment benefits, U_t is actual unemployed and U_t^* is trend unemployed.

Trend unemployment is equal to:

$$U_t^* = LF_t^* - E_t^* \tag{4}$$

where LF_t^* is equal to labour force at trend, which is calculated as the product of the working age population[24] and trend participation rate,[25] E_t^* is equal to employment at trend, which is calculated as the summation of trend private business sector employment,[26] N_t^* and employment in the general government and government enterprise sectors.[27]

Cyclical Revenue Adjustment

Taxation revenues were adjusted to structural levels by incorporating an elasticity of taxation revenues to GDP with the output gap.

$$Tax_t^* = Tax_t - ((Tax_t \cdot Elast) \cdot Gap_t / 100)) \tag{5}$$

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[24] Working age population data is provided by the TRYM ABS Database.

[25] Trend participation rate is produced by smoothing actual participation rate with a HP filter. The actual participation rate is calculated by working age population and labour force from the TRYM ABS Database.

[26] Calculated from the output gap model.

[27] Information on employment in these sectors is provided by data from the TRYM ABS Database.

where Tax_t^* is structural taxation revenue, Tax_t is actual taxation revenue, $Elast$ is the elasticity of taxation revenues to GDP, and Gap_t is the output gap.

The elasticity of taxation revenue to GDP is assumed to be 1.1.[28]

Calculation of Structural Net Savings

The cyclically-adjusted taxation revenue and unemployment benefits were then added back to the other revenue and expenses items to produce structural net savings.

Structural Net Lending

For the interest margin analysis structural net lending rather than structural net saving was calculated. Structural net lending is calculated using the same methodology, however, National general government gross fixed capital formation (ABS 5206-65) was added to net expenditure to produce net lending.

[28] This elasticity is estimated by taking the average of the OECD Australian tax revenue elasticity estimates (direct tax on households and business and indirect tax) and weighting by the historical share of each component in the tax base. Full details of this calculation are available on request from the authors. C. Giorno *et al.*, (1995) p.192 and Banca D'Italia, 1999, p. 81.

APPENDIX 3

UNIT ROOT AND JOINT TESTS

Savings Offsets Variables and Unit Root Tests

Data Period 1981:1 - 2001:2	(Constant, time trend and lag)	ADF Test Statistic (5 per cent critical value)		(Constant, time trend and truncated lag)	Phillips-Perron Test (5 per cent critical value)	
		Level	1st difference		Level	1st difference
Dependent variable:						
Private Saving	**(0,0,3)**	**-1.13**	**-5.35**	**(0,0,3)**	**-1.85**	**-14.07**
		(-1.95)	(-1.95)		(-1.95)	(-1.95)
Explanatory variables:						
Unemployment	(C,0,2)	-3.71	**rho = 0.92**	(C,0,2)	-2.13	-4.00
		(-2.90)			(-2.90)	(-2.90)
Inflation	(C,0,2)	-2.73	-7.44	(C,0,2)	-4.50	
		(-2.90)	(-2.90)		(-2.90)	
Real interest rates	(0,0,1)	-0.99	-8.24	(0,0,1)	-1.01	-12.48
		(-1.95)	(-1.95)		(-1.95)	(-1.95)
Household income	(0,0,1)	-1.94	-5.86	(0,0,3)	-2.14	
		(-1.95)	(-1.95)		(-1.95)	
Direct Tax	(0,0,1)	-1.09	-7.21	(0,0,1)	-0.84	-14.63
		(-1.95)	(-1.95)		(-1.95)	(-1.95)

Savings Offsets Variables and Unit Root Tests (continued)

Data Period 1981:1 - 2001:2	(Constant, time trend and lag)	ADF Test Statistic (5 per cent critical value)		(Constant, time trend and truncated lag)	Phillips-Perron Test (5 per cent critical value)	
Explanatory variables: (continued)						
Assistance	(0,0,1)	-1.36	-6.16	(0,0,1)	-1.16	-13.79
		(-1.95)	(-1.95)		(-1.94)	(-1.94)
Wealth	(C,T,1)	-2.81	-7.08	(C,T,1)	-3.40	-9.07
(trend in series although ratio)		(-3.47)	(-3.47)		(-3.47)	(-3.47)
Deregulation	(C,0,1)	-1.26	-5.57	(C,0,1)	-0.98	-8.61
(trend in series although ratio)		(-2.90)	(-2.90)		(-2.90)	(-2.90)
Government Saving	(0,0,1)	-1.68	-8.24	(0,0,3)	-1.99	
		(-1.95)	(-1.95)		(-1.95)	
National Government Structural Saving	(0,0,2)	-1.87	-7.64	(0,0,2)	-3.73	
		(-1.95)	(-1.95)		(-1.95)	
National Government Cyclical Saving	(0,0,2)	-3.73		(0,0,2)	-2.77	
		(-1.95)			(-1.95)	
State & Local Government Saving	(C,T,4)	-2.17	-7.73	(C,T,4)	-7.34	
(trend in series although ratio)		(-3.47)	(-3.47)		(-3.47)	

Savings Offsets Variables and Joint Tests

Joint Significant (all variables) Intercept & no trend			**Johansen Cointegration Test**	
Variables (PS, U, INF, r, Y, T, AS, W, D, GS)			5 per cent	1 per cent
Trace Statistic	At most 5	68.00	68.52	76.07
Max- Eigen Statistic	At most 3	43.66	45.28	51.57
Variables (PS, U, INF, r, Y, T, AS, W, D, NGSS, SLGS)				
Trace Statistic	At most 7	37.68	47.21	54.46
Max- Eigen Statistic	At most 4	42.81	45.28	51.57

Interest Margin Variables and Unit Root Tests

Data Period 1985:1 - 2001:2	(Constant, time trend and lag)	ADF Test Statistic (5 per cent critical value)		(Constant, time trend and truncated lag)	Phillips-Perron Test (5 per cent critical value)	
		Level	1st difference		Level	1st difference
Dependent variable:						
Interest Margin	**(0,0,2)**	**-1.04**	**-3.95**	**(0,0,2)**	**-1.30**	**-8.49**
		(-1.95)	**(-1.95)**		**(-1.95)**	**(-1.95)**
Explanatory variables:						
Headline balance	(0,0,3)	-2.11		(0,0,3)	-1.95	-6.64
		(-1.95)			(-1.95)	(-1.95)
Structural balance	(0,0,3)	-1.86	-3.00	(0,0,3)	-1.66	-6.84
		(-1.95)	(-1.95)		(-1.95)	(-1.95)
Stock public debt	(0,0,2)	-0.75	-2.92	(0,0,2)	-0.56	-6.70
		(-1.95)	(-1.95)		(-1.95)	(-1.95)
Inflation	(0,0,3)	-1.44	-4.05	(0,0,3)	-0.52	-7.54
		(-1.95)	(-1.95)		(-1.95)	(-1.95)
Real GDP growth	(0,0,4)	-0.84	-4.14	(0,0,1)	-1.32	-7.07
		(-1.95)	(-1.95)		(-1.95)	(-1.95)
Current Account	(C,0,4)	-4.22		(C,0,4)	-2.62	-7.41
		(-2.91)			(-2.91)	(-2.91)
Stock Net Foreign Debt	(0,0,1)	-1.42	-3.96	(C,T,1)	-1.63	-6.03
		(-1.95)	(-1.95)		(-1.95)	(-1.95)

Interest Margin Variables and Joint Tests

Joint Significant (all variables) Intercept & no trend			Johansen Cointegration Test	
Variables (IM, HB PD, INF, RGDPg, CAD, ND)			5 per cent	1 per cent
Trace Statistic	At most 2	68.43	68.52	76.07
Max- Eigen Statistic	None	41.15	45.28	51.57
Variables (IM, HB PD, INF, RGDPg, CAD, ND)				
Trace Statistic	At most 1	92.16	94.15	103.18
Max- Eigen Statistic	None	39.20	45.28	51.57

APPENDIX 4

DIAGNOSTICS

Savings Offsets Parsimonious Models

		Simple Model Results Table 1		Simple Model Results Table 2	
			Probability		Probability
Normality:					
Jarque-Bera statistic	X^2-statistic	1.23	0.539	0.37	0.820
Serial Correlation:					
Breusch-Godfrey Serial (4 lags)	F-statistic	2.28	0.060	0.94	0.443
Correlation LM Test	X^2-statistic	9.35	0.053	4.39	0.355
AR Cond. Heteroskedasticity:					
ARCH LM Test	F-statistic	1.47	0.229	1.91	0.117
	X^2-statistic	5.82	0.213	7.40	0.116
Heteroskedasticity:					
White Heteroskedasticity Test (cross terms)	F-statistic	3.65	0.000	2.61	0.024
	X^2-statistic	49.2	0.000	73.9	0.209
Stability:					
Chow Breakpoint Test (mid sample = 1991:1)	F-statistic	3.64	0.000	3.09	0.002
	L-R statistic	26.2	0.000	36.9	0.000
Specification Error:					
Ramsay RESET Test (with 4 fitted values)	F-statistics	1.54	0.200	0.11	0.980
	L-R statistic	6.84	0.144	0.52	0.971

Interest Margin

		Simple Model Results (SB fiscal flow variable) Table 3	
			Probability
Normality:			
Jarque-Bera statistic	X^2-statistic	0.10	0.942
Serial Correlation:			
Breusch-Godfrey Serial (4 lag terms)	F-statistic	0.71	0.588
Correlation LM Test	X^2-statistic	3.41	0.490
AR Cond. Heteroskedasticity:			
ARCH LM Test (4 lag terms)	F-statistic	0.27	0.898
	X^2-statistic	1.16	0.885
Heteroskedasticity:			
White Heteroskedasticity Test (cross terms)	F-statistic	0.95	0.565
	X^2-statistic	35.01	0.467
Stability:			
Chow Breakpoint Test (mid sample = 1993:1)	F-statistic	0.96	0.477
	L-R statistic	9.93	0.269
Specification Error:			
Ramsay RESET Test (with 4 fitted values)	F-statistics	1.10	0.366
	L-R statistic	5.39	0.250

APPENDIX 5

OTHER REGRESSION RESULTS

SAVINGS OFFSET MODEL

Extension of Blundell, Wignall and Stevens (1992) Model

Dependent variable: Δ Private Saving: 1974-75 - 1999-00	**Coefficient** (t statistic)	
Explanatory variables		
Constant	-0.38 (-1.54)	
Δ Unemployment$_t$	-0.35 (-1.56)	
Δ Income$_t$	0.16 (1.15)	
Δ Inflation$_t$	-0.28 (-2.45)	
Δ Real interest rate$_t$	-0.34 (-2.47)	
Δ Public Saving$_t$	-0.45 (-2.60)	
Major Diagnostics	R-Bar-Squared	0.47
	DW Stat	1.57

INTEREST MARGIN MODELS

Levels Equation

Dependent variable: 10-Year Bond Real Interest Margin 1985:1 - 2001:2		
	Coefficient *(t statistic)*	
Explanatory variables:		
Constant	-0.041 (0.03)	
Headline Balance$_{t-1}$	-0.013 (0.26)	
or		
Structural Balance$_{t-1}$	-0.006 (0.08	
Public Debt$_{t-1}$	0.137 (4.47)	
Inflation$_{t-1}$	0.082 (1.76)	
Real GDP Growth$_{t-1}$	-0.324 (6.76)	
Current Account$_{t-1}$	-0.113 (1.55)	
Net Stock Foreign Debt$_{t-1}$	-0.003 (0.15)	
Major Diagnostics	R-Bar-Squared DW Stat	0.64 0.88

Changes Equation

Dependent variable: Δ 10-Year Bond Real Interest Margin 1985:1 - 2001:2		
	Coefficient *(t statistic)*	
Explanatory variables:		
Constant	-0.011 (0.22)	
Δ Structural Balance$_t$	-0.251 (2.05)	
or		
Δ Headline Balance$_t$	-0.179 (2.13)	
Δ Stock Public Debt$_t$	-0.076 (1.21)	
Δ Inflation Rate$_t$	0.113 (1.61)	
Δ Real GDP Growth$_t$	-0.048 (0.95)	
Δ Current Account$_t$	-0.060 (0.91)	
Δ Stock Net Foreign Debt$_t$	0.006 (0.15)	
Major Diagnostics	R-Bar-Squared	0.05
	DW Stat	1.59

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