Are the Effects of Monetary Policy Asymmetric in Australia?

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This paper examines whether monetary policy shocks have asymmetric effects on output in Australia. Using methods similar to Cover (1992) together with some other simple threshold models, evidence is found of certain types of asymmetries when comparing monetary contractions to monetary policy expansions. Unanticipated decreases in interest rates appear to significantly raise GDP growth rates, whilst unexpected increases in rates do not appear to significantly lower growth. These findings are also found in a brief examination of the investment and consumption channels within the monetary policy transmission process. Economic growth is also significantly higher in a low interest rate regime (when interest rates are below a certain threshold, such as the sample average or average over some longer time period) than in a high interest rate environment. These results appear to refute the idea that monetary policy is like 'pushing on a string', at least for Australian data over the period 1973:1-2005:1.

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1 Introduction

This paper examines the monetary transmission mechanism, in particular the relationship between monetary policy and output, in Australia. Previous work has been unable to find strong links between monetary policy and GDP movements in Australia, despite the popular perception that "credit squeezes" caused several recessions in Australia, and that tight monetary policy in 1990-91 was a major cause of the most recent recession. The reasons given for this lack of success include factors such as the fact that monetary policy is ineffective in a small open economy with fixed exchange rates, thus ruling out any impact from monetary policy until the 1980s, or the fact that the simple reduced form relationships usually estimated are unable to capture the complex links between monetary policy and the real sector.

In this paper the nature of the monetary transmission mechanism is explored from another angle. While theoretical models of the transmission mechanism often postulate, either explicitly or implicitly, a non-linear relationship between monetary policy and GDP, the models that applied econometricians estimate are usually linear. The analysis presented in this paper allows for a number of different forms of non-linearity in the relationship between monetary policy and GDP. The paper is structured as follows :

The next section of the paper presents some non-linear models. Simple threshold type models are estimated that allow for different impacts of tight and loose monetary policy on output as well as the channels within the monetary transmission process. These models provide some simple evaluations of the hypothesis that 'monetary policy is like pushing on a string'. The final section of the paper offers concluding comments.

2 Related Literature

The work directly examining the monetary transmission mechanism in Australia is quite small. Fiebig (1980) followed the VAR methodology pioneered by Sims (1972), and found that there is a feedback relation between money and output, but also that money movements Granger cause movements in output and in prices. Later work by Stevens and Thorp (1989) found that these results were not very robust, and that there is no evidence that monetary policy influences real variables in any systematic manner. They do, however, conclude that this is a puzzle, and non-linear models may be more successful in finding a monetary transmission mechanism. Fahrer and Rohling (1990) find some evidence that interest rates determine real activity and inflation, and that VARs yield similar results pre and post deregulation. Lowe (1992) also finds that the term structure of interest rates is able to predict GDP movements.

There is a much larger literature examining the monetary transmission mechanism in the United States.[1] Bernanke and Blinder (1988,1992) argue that monetary policy changes, represented by movements in the Federal Funds rate, are able to explain movements in GDP. These papers form a part of a debate over whether it is money or credit channels that matters for the monetary transmission mechanism. The interesting point from the perspective of this paper is that attempts to replicate Bernanke and Blinder's work using Australian data meet with less success in explaining movements in real variables than is the case for the US.

Romer and Romer (1994) also present evidence that the interest rate channel is the strongest channel of monetary transmission. They find that monetary tightenings to try and reduce inflation are followed by falls in industrial production and prices. They also provide evidence that it is interest rates, and not credit, that is the cause of these recessions. In addition, they argue that post recession recoveries are aided by loosening of monetary policy, and that fiscal policy drives very little of the post recession recovery.

The Romer and Romer (1994) and Bernanke and Blinder (1992) papers emphasise a symmetric response of the economy to monetary shocks. However, papers which emphasise a credit channel for monetary policy, such as Brunner and Meltzer (1988) and Stiglitz (1988), have the implication that the impact of monetary policy changes should be asymmetric. Tight monetary policy will reduce the amount of credit available to firms, and reduce economic activity. Loose monetary policy will not necessarily cause output to rise, unless the demand for credit is also stimulated. Also, other theories based on credit market imperfections, such as those developed in Azariadis and Smith (1998) and Bernanke and Gertler (1989), suggest that monetary policy is more effective in a recession than in a boom. Similarly, theories based on downward wage rigidities, such as Ball and Mankiw's (1994) menu cost model, suggest that monetary policy has stronger real effects in recessions. Thoma (1994), Gertler and Gilchrist (1994) and Kashyap et al (2000, 1993) all present evidence of asymmetric effects of monetary policy over the

[1] As a starting point, see for example, Tobin (1970) and Hoover and Perez (1994a,b).

cycle.

Such theories also suggest that in either phase of the business cycle, a monetary tightening has more of a real effect than an expansionary monetary policy. Authors such as Parker and Rothman (2004), Karras (1996a,b), Morgan (1993) and Cover (1992) present empirical evidence for asymmetry between positive and negative monetary shocks. Authors such as Beaudry and Koop (1993), Sichel (1994) and Pesaran and Potter (1997) argue more generally, using threshold autoregression models, that positive and negative shocks to output have different persistence properties depending on which phase of the cycle the economy is operating under, although evidence from Elwood (1998) suggests this is actually not the case for the US and Bodman and Crosby (1998a,b) find a similar lack of evidence of such asymmetry for Australia and Canada.

A number of papers provide empirical evidence of nonlinearities in US macroeconomic data. DeLong and Summers (1988) find that negative unanticipated money shocks reduce output, while positive money shocks have no impact on output. Cover (1992) also finds that negative money supply shocks have a larger impact on output than positive shocks. Finally, Estrella and Mishkin (1998) find that the term structure of interest rates is the best predictor of future recessions in the United States. In the next section of the paper a number of different modelling strategies, similar to those employed by Cover (1992), are used to try and uncover nonlinearities of different forms in Australian data. Interest rate, inflation and output data are all taken from the National Accounts database in the ABS TSSP area of the dX database.

3 Linear Output Models with Non-linear Monetary Policy

3.1 Unanticipated Monetary Policy

There are several ways that one might empirically test whether monetary tightenings have different effects to loose monetary policy in their impact on the channels of monetary transmission to output. In the next two subsections two different approaches are employed. Firstly, it is assumed that high interest rates, or rises in interest rates, reflect tight monetary policy, and thus different coefficients on high and on low (or increasing and decreasing) interest rates are allowed for in linear equations. The equations are similar to those estimated for the US by Cover (1992), and more recently, Parker and Rothman (2004).[2]:

$$r_t = \alpha_0 + \sum_{i=1}^{4} r_{t-i} + res_t \tag{1}$$

$$\begin{aligned} y_t \;=\; & \beta_0 + \sum_{i=1}^{4} \beta_i \, y_{t-i} + \sum_{i=1}^{4} \gamma_i \Delta TOT_{t-i} + \sum_{i=1}^{4} \delta_i \, \Delta U_t + \sum_{i=1}^{4} \eta_i \, \pi_{t-i} \\ & + \sum_{i=1}^{4} \rho_i \, pos_{t-i} + \sum_{i=1}^{4} \zeta_i \, neg_{t-i} + \varepsilon_t \end{aligned} \tag{2}$$

where y is output growth (change in the log of real GDP) and $pos = \max[res, 0]$, $neg = \min[res, 0]$. In these equations unanticipated rises in interest rates (representing unanticipated monetary tightenings) are allowed to affect output growth differently from unanticipated interest rate falls. Output growth is also allowed to be affected by terms of trade changes (a proxy for supply shocks) and by unemployment (a proxy for other demand shocks). According to this representation only shocks to monetary policy instruments are allowed to affect output growth.

Table 1
Cover's Model of Unanticipated Monetary Policy Shocks

α_0	α_1	α_2	α_3	α_4
0.484	1.172	-0.304	0.212	–0.133
(0.016)	(0.000)	(0.142)	(0.259)	(0.2244)

$\sum_{i=1}^4 \gamma_i = 0$	$\sum_{i=1}^4 \delta_i = 0$	$\sum_{i=1}^4 \eta_i = 0$	$\sum_{i=1}^4 \rho_i = 0$	$\sum_{i=1}^4 \zeta_i = 0$
1.529	25.398	2.009	1.180	10.458
(0.822)	(0.000)	(0.734)	(0.881)	(0.033)
			$\sum_{i=1}^4 \hat{\rho}_i = -0.002$	$\sum_{i=1}^4 \hat{\zeta}_i = -0.0115$

[2] Cover (1992) used money rather than interest rates as his policy variable. In Australia it seems reasonable to assume that interest rates are the right policy variable in these types of regressions, and that the money supply responds endogenously to changes in interest rates.

The result from estimation of these equation are found in Table 1. The top part of the table contains coefficient estimates for estimation of the cash rate equation (1) together with robust t-statistics in parentheses. The lower part of the table contains Wald test statistics for joint exclusion tests for the lags of the various variables in equation (2) as well as their associated p-values in parentheses. Also included are the sums of the coefficients of the lag lengths of the asymmetric interest rate variables. The results suggest that unanticipated decreases in interest rates have a statistically significant effect in increasing output growth, but unanticipated rises in interest rates do not affect output growth. The coefficients are signed as expected, but these results are the opposite of those found by Cover (1992). If anything, unanticipated interest rate changes help, but do not hinder, growth in output in Australia.[3]

3.1.1 Asymmetric Effects on Consumption and Investment?

Given the results in the previous subsection, one might want to ask where exactly in the monetary transmission mechanism these asymmetries lie. The standard textbook approach to the transmission mechanism specifies that monetary policy changes (changes in the cash rate in Australia) influence broader monetary factors (other interest rates, credit etc.) which in turn affect the level of investment (and possibly consumption) and hence aggregate demand and output. It is of some interest therefore to examine whether unanticipated positive interest rate shocks differ in their effects on investment and consumption variables than do negative shocks and whether any asymmetries found mirror those found in the direct relationship between interest rates and GDP growth.[4]

To this end, similar Cover-type regressions were run to those in the previous section (except that the terms of trade and unemployment variables

[3]These results were found to be robust to the omission of the inflation variable, whether the inflation variable was included in differences or in levels, to reasonable variations in lag length and to changes in the sample period to cover only the 1983:1-2005:1 period.

[4]Some limited investigation was made of possible asymmetries between changes in the cash rate and changes in other interest rates, reflecting the possibility that there exists a credit or lending channel effect in monetary transmission. No evidence of asymmetries was found using the Cover type models or models using anticipated policy changes and so results are not reported here for such tests.

were omitted - this did not affect the results), for various consumption and investment variables. Results are presented in Table 2 below.

Table 2
Asymmetries Within the Transmission Mechanism

Total Investment	
$\sum_{i=1}^{4} \rho_i = 0$ 5.137 ($p = 0.399$)	$\sum_{i=1}^{4} \zeta_i = 0$ **16.008** ($p = 0.007$)
$\sum_{i=1}^{4} \hat{\rho}_i = -0.008$	$\sum_{i=1}^{4} \hat{\zeta}_i = -0.021$
$[\sum_{i=1}^{4} \hat{\rho}_i = \sum_{i=1}^{4} \hat{\zeta}_i] : p = 0.271$	

Private Investment	
$\sum_{i=1}^{4} \rho_i = 0$ 2.548 ($p = 0.636$)	$\sum_{i=1}^{4} \zeta_i = 0$ **10.930** ($p = 0.027$)
$\sum_{i=1}^{4} \hat{\rho}_i = -0.011$	$\sum_{i=1}^{4} \hat{\zeta}_i = -0.042$
$[\sum_{i=1}^{4} \hat{\rho}_i = \sum_{i=1}^{4} \hat{\zeta}_i] : p = 0.0397$	

Dwelling Investment	
$\sum_{i=1}^{4} \rho_i = 0$ **23.591** ($p = 0.000$)	$\sum_{i=1}^{4} \zeta_i = 0$ **12.333** ($p = 0.015$)
$\sum_{i=1}^{4} \hat{\rho}_i = -0.018$	$\sum_{i=1}^{4} \hat{\zeta}_i = -0.056$
$[\sum_{i=1}^{4} \hat{\rho}_i = \sum_{i=1}^{4} \hat{\zeta}_i] : p = 0.061$	

Inventory Investment	
$\sum_{i=1}^{4} \rho_i = 0$ 2.421 ($p = 0.659$)	$\sum_{i=1}^{4} \zeta_i = 0$ **19.499** ($p = 0.000$)
$\sum_{i=1}^{4} \hat{\rho}_i = 104.955$	$\sum_{i=1}^{4} \hat{\zeta}_i = 681.789$
$[\sum_{i=1}^{4} \hat{\rho}_i = \sum_{i=1}^{4} \hat{\zeta}_i] : p = 0.048$	

Total Consumption	
$\sum_{i=1}^{4} \rho_i = 0$ 6.0123 ($p = 0.305$)	$\sum_{i=1}^{4} \zeta_i = 0$ **15.131** ($p = 0.009$)
$\sum_{i=1}^{4} \hat{\rho}_i = -0.001$	$\sum_{i=1}^{4} \hat{\zeta}_i = -0.001$
$[\sum_{i=1}^{4} \hat{\rho}_i = \sum_{i=1}^{4} \hat{\zeta}_i] : p = 0.883$	

Household Consumption	
$\sum_{i=1}^{4} \rho_i = 0$ 3.748 ($p = 0.586$)	$\sum_{i=1}^{4} \zeta_i = 0$ 9.012 ($p = 0.109$)
$\sum_{i=1}^{4} \hat{\rho}_i = 0.002$	$\sum_{i=1}^{4} \hat{\zeta}_i = 0.003$
$[\sum_{i=1}^{4} \hat{\rho}_i = \sum_{i=1}^{4} \hat{\zeta}_i] : p = 0.478$	

As can be seen from Table 2, significant asymmetries appear to exist in the relationship between unanticipated interest rate shocks and the various measures of investment and consumption. In almost all cases, positive shocks to interest rates have no significant effect on the growth of investment of consumption, but negative shocks have highly significant (positive) effect on growth. The exceptions appear to be dwelling investment, in which both positive and negative shocks are significant and household consumption in which neither are significant. In the case of dwelling investment however, the parameter estimates, together with a Wald test of the equality of the joint magnitude of these estimates across the two types of shocks, suggests that negative interest rate movements increase dwelling investment by a significantly larger amount (around 3 times as large) as positive interest rate movements stifle dwelling formation.

3.2 Anticipated Monetary Policy

The model above only allows for unanticipated changes in monetary policy to affect output growth. Non New-Classical macroeconomic theories also allow anticipated monetary policy to have real effects.[5] To test these models we now use anticipated variables in our regressions. Tightness/looseness in monetary policy is proxied in two ways. Firstly, different coefficients on interest rates are allowed when rates are above and when they are below average. Secondly, we allow for different coefficients on rising, and on falling, interest rates.

Model 1
Firstly use the same regression given above by (4), but now

$$\begin{aligned} neg &= r_t \quad if \quad r_t < \bar{r} \\ &\quad 0 \quad otherwise \end{aligned}$$

$$\begin{aligned} pos &= r_t \quad if \quad r_t > \bar{r} \\ &\quad 0 \quad otherwise \end{aligned}$$

[5] Early formal studies such as Barro (1978) seemed to provide evidence that indeed only unanticipated changes in monetary policy (money stock) mattered for output movements. Two influential articles examining the effects of anticipated monetary policy on output for the US are Boschen and Grossman (1982) and Mishkin (1982).

This regression tests the idea that there is a threshold level of the interest rate, which is assumed is simply the average interest rate, above which, rates have a different impact on output than is the case below this threshold.

The second set of regressions uses the change in the interest rate, rather than the average interest rate, as the threshold variable. The interest rate variables in this regression are now defined as

Model 2

$$
\begin{aligned}
neg &= \Delta r_t \quad if \quad \Delta r_t < 0 \\
& \quad 0 \quad otherwise
\end{aligned}
$$

$$
\begin{aligned}
pos &= \Delta r_t \quad if \quad \Delta r_t > 0 \\
& \quad 0 \quad otherwise
\end{aligned}
$$

These regressions allow for possibly different impacts of tight and of loose monetary policy on GDP growth. Tests of the non-linearity assumption involve simple Wald tests (or alternatively an F-test) of the assumptions that the coefficients on the lags of the *pos* and the *neg* variables are jointly significant and that they are jointly equal. The results from estimation of these models are presented in Table 3.

Table 3
Simple Threshold Models of Anticipated Monetary Shocks

Model 1

$\sum_{i=1}^{4} \rho_i = 0$	$\sum_{i=1}^{4} \zeta_i = 0$	$\sum_{i=1}^{4} \rho_i = \sum_{i=1}^{4} \zeta_i$	
8.688	12.186	0.928	$\sum_{i=1}^{4} \hat{\rho}_i$ =0.0010
(0.694)	(0.016)	(0.335)	$\sum_{i=1}^{4} \hat{\zeta}_i$ =0.0004

Model 2

$\sum_{i=1}^{4} \rho_i = 0$	$\sum_{i=1}^{4} \zeta_i = 0$	$\sum_{i=1}^{4} \rho_i = \sum_{i=1}^{4} \zeta_i$	
2.344	4.484	0.220	$\sum_{i=1}^{4} \hat{\rho}_i$ =-0.0028
(0.673)	(0.345)	(0.639)	$\sum_{i=1}^{4} \hat{\zeta}_i$ =-0.0043

It can be seen from the table that coefficient estimates are in the expected direction and that the kinds of asymmetries that the models estimated are trying to capture do reveal themselves to be significant features of the data when a levels threshold is used (Model 1). Whilst a Wald test fails to reject the null hypothesis that high or low interest rates, relative to some threshold, have asymmetric effects in magnitude on growth rates, only the low interest rate regime is significant. In a low interest rate environment, monetary policy has a significant, positive impact ($\sum_{i=1}^{4} \hat{\zeta}_i$ =0.0004) on GDP growth rates. Estimation of Model 2 indicates that the asymmetric relationship between interest rates and growth is not determined by whether rates are rising or falling. Neither positive or negative anticipated shocks significantly affect (predict) output growth and a simple Wald test suggests that positive and negative anticipated shocks affect output growth symmetrically.[6]

4 Conclusions

The results presented in this paper, using the methods of Cover (1992) and some other simple threshold models, suggest that some evidence is found of certain types of asymmetries when comparing monetary contractions to monetary policy expansions. Unanticipated decreases in interest rates appear to significantly raise GDP growth rates, whilst unexpected increases in rates do not appear to significantly lower growth. These findings are also found in a brief examination of the investment and consumption channels within the monetary policy transmission process. Economic growth is also significantly higher in a low interest rate regime (when interest rates are below a certain threshold, such as the sample average or average over some longer time period) than in a high interest rate environment, and monetary policy appears to be more effective in a low interest rate regime.

Clearly more research needs to be done in uncovering the potential for nonlinearities in the monetary policy transmission mechanism. The results presented here appear to clearly refute the idea that monetary policy is like 'pushing on a string', at least for Australian data over the period 1973:1-2005:1. The results appear to be robust to choice of lag length, the omission / inclusion of proxies for other types of demand shocks and for supply shocks and choice of sample period.

[6] Once again it should be noted that the results of this subsection are robust to using real interest rate variables instead of using nominal rates together with the inclusion of inflation variables in the regressions. Experimentation with other values for the thresholds also did not affect the results of either model greatly.

Further investigation into potential asymmetries within the credit channel, asset prices and through open economy channels, such as effects through the exchange rate, may provide interesting insights into the transmission process that might have important benefits to monetary policymakers. Recent work in this regard has been done by, for example, Mishkin (2001), although nonlinearities / asymmetries have not been emphasised.

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