OPEN MARKET OPERATIONS IN AUSTRALIA:

A U.S. PERSPECTIVE

Michael Dotsey*

Reserve Bank of Australia

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ABSTRACT

This paper investigates open market operations in Australia and incorporates some key features of these operations into a simple rational expectations macroeconomic model. Where relevant, comparisons with U.S. operating procedures are made. The major finding is that the Reserve Bank of Australia like the Federal Reserve appears to focus closely on overnight interest rates in implementing its monetary policy. Specific features of the Australian money market imply that direct control of the interest rate would be a more efficient policy in Australia than in the United States.

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Michael Dotsey

1. Introduction

This paper presents an analysis of the daily operating procedures of the Reserve Bank of Australia and the resulting interaction between the Reserve Bank and the official money market in Australia. The basic conclusion is that the Reserve Bank of Australia uses its open market operations to regulate reserve pressures in the official money market in order to obtain short-term interest rates that are consistent with the objectives of monetary policy. This policy is quite similar to the Federal Reserve's policy of targeting borrowed reserves, in that each monetary authority focusses closely on interest rates in implementing policy, but does not directly peg the interest rate.

While the procedures followed by both the Reserve Bank of Australia and the Federal Reserve are analytically similar, the actual workings of the two overnight money markets have some interesting differences. Of particular interest are the differences between the way in which reserve requirements are satisfied, the role that dealers play in the respective markets and the implementation of discount window lending by the two central banks. Although these major differences have interesting effects on the daily functions of the respective overnight money markets as well as the daily operating strategies of the two central banks, the similar focus on interest rates in implementing monetary policy implies that the macroeconomic transmission mechanisms of monetary policy are roughly equivalent. Therefore under the current operating procedures followed by each central bank, there exist strong analytical similarities between the two monetary policies.

These similarities can be viewed by imbedding some of the key features of the Australian money market and Reserve Bank operating procedures in a simple macroeconomic model. The model used is similar to McCallum (1981), McCallum and Hoehn (1983), and Dotsey (1987) and therefore allows for direct comparison between the qualitative features of U.S. and Australian monetary procedures.

The structure of the paper is as follows. In Section 2 an examination of the volatility of daily interest rates is presented. The behaviour of these rates along with amount of financial churning undertaken by the two central banks is indicative of the role played by interest rates. Section 3 contains an in-depth description of the daily workings of the official Australian money market. Comparisons with the U.S. system are made to highlight the major differences, but the majority of the discussion is focused on the Australian system. In Section 4 the essential characteristics of the Australian system are incorporated into a simple macroeconomic model in order to investigate the effects that monetary policy has on the eonomy. Section 5 summarises the paper.

2. Interest Rate Volatility and Open Market Operations

This section provides an examination of the scope of open market operations and of the daily volatility of the interest rates that serve as the short-run focus of monetary policy, namely the official market rate in Australia and the federal funds rate in the United States. Specifically, the averages of squared first differences for both selected sample periods and by month are used to examine interest rate volatility. The data are depicted in Tables 1 and 2. The selected sample periods were chosen in an attempt to isolate periods over which policy was unchanging (ie there was not an intentional tightening or loosening of policy). This was done so that policy engineered changes in interest rates do not contaminate the variability measure that is associated with operating procedures. This procedure is admittedly ad hoc and therefore monthly averages have also been included.

The sample periods over which monetary policy in the two countries corresponds most closely is the post float period in Australia and the 8 October 1979 - 30 January 1983 period for the United States. Both of these periods involve an overall tightening of monetary policy as well as the use of lagged reserve requirements. As indicated in tables 1 and 2, the volatility of daily rates over these periods are roughly equivalent in the two countries. For most months these measures indicate daily rates movements on the order of 50-90 basis points. If one looks at the volatility measure over selected sample periods the implication is that daily rates are somewhat less volatile with changes on the order of 30-80 basis points. This type of volatility is inconsistent with an interest rate peg, but it does not rule out a close focus on interest rates in implementing monetary policy.

TABLE 1
Monthly Averages of Squared Deviations in the Daily Official Rate and the Daily Federal Funds Rate

	Australian Official Rate			U.S. Federal Funds Rate						
	1984	1985	1986	1980	1981	1982	1983	1984	1985	1986
Jan.	3.10	.24	.04	.38	1.03	.27	.28	.06	.06	.03
Feb.	2.97	1.78	.08	1.59	.87	.45	.04	.02	.06	.01
Mar.	1.58	.34	.23	.56	.30	.37	.14	.13	.11	.07
Apr.	1.16	.10	.74	2.24	.60	.66	.17	.23	.06	.05
May	.64	.16	.91	1.24	1.07	.17	.02	.21	.05	.01
Jun.	2.54	.73	.24	.54	1.11	.07	.16	.12	.05	.05
Jul.	.52	.50	.33	.18	1.21	.23	.04	.09	.10	.04
Aug.	.68	.17	.29	.37	.72	.15	.02	.04	.06	.01
Sep.	.85	.25	.03	.29	.42	.36	.09	.14	.08	.05
Oct.	.47	.04	.02	.43	.54	.19	.06	.55	.09	.06
Nov.	.50	.33	.04	.73	.24	.05	.02	.05	.17	.18
Dec.	.72	.12	.03	1.55	.11	.14	.13	.20	1.18	3.38
Ave. mthly squared devtns	1.31	.40	.25	.85	.69	.26	.10	.15	.17	.33

TABLE 2
Selected Period Averages of Squared Deviations in the Daily Official Rate and the Daily Federal Funds Rate

	Australian Official Rate
July 2, 1984 - Feb. 19, 1985	.72
Feb. 20, 1985 - Apr. 1, 1985	.40
Apr. 2, 1985 - Apr. 30, 1985	.04
May 1, 1985 - Nov. 11, 1985	.30
Nov. 12, 1985 - Feb. 24, 1986	.14
Feb. 25, 1986 - Apr. 28, 1986	.44
Apr. 29, 1986 - Jul. 28, 1986	.53
Jul. 29, 1986 - Oct. 30, 1986	.11
Oct. 31, 1986 - Dec. 30, 1986	.03

	U.S. Federal Funds Rate
Oct. 8, 1979 - Jan. 31, 1983	.61
Feb. 1, 1983 - Feb. 29, 1984	.08
Mar. 1, 1984 - Dec. 31, 1984	.18
Jan. 1, 1985 - Jan. 30, 1987	.25

Another indication that both central banks look closely at interest rates as a guide to policy is the degree of turnover in their portfolio. For example, in 1985/86 the Reserve Bank of Australia's portfolio of $A assets showed only a small net increase, while gross sales were $28.4 billion and gross purchases were $29.7 billion (of course, part of the gross transactions reflected the Bank's foreign exchange transactions). This is similar to the 1980 US experience documented by Friedman (1982) and by Levin and Meulendyke (1982), where the Federal Reserve made gross transactions on its own account of $393 billion while only adding $4.5 billion to its portfolio. A high level of portfolio turnover is more consistent with a focus on interest rates than it is with a policy of direct control of some reserve measure.

While the evidence presented does not conclusively support the hypothesis that both central banks focus exclusively on interest rates there is a strong implication that interest rates play a large role in implementing monetary policy. The analysis now proceeds to investigate in detail the operating procedures and institutional setting in which monetary policy takes place in Australia. Where relevant, comparisons are made with the United States.

3. The Australian Money Market

(a) Overview

This section describes the functioning of the official money market in Australia. It examines the roles of the major participants; dealers, trading banks, and the Reserve Bank, and how exchange settlement funds are distributed throughout the system. The major characteristics that distinguish the Australian market from the U.S. federal funds market are the requirement that banks meet their statutory reserve deposit (SRD) each day by maintaining a statutory reserve deposit account and non-negative exchange settlement account, and the more central role that dealers play in the flow of exchange settlement funds.

(b) Market Structure

In Australia cheques presented against banks at the Australian Clearing House do not affect balances in exchange settlement accounts until the next morning. Therefore, the Australian money market deals in two types of funds. The first is exchange settlement funds or same day funds. These are funds that accrue to exchange settlement accounts at the Reserve Bank. They include yesterday's cheque clearings, security transactions with the Reserve Bank, and transactions with authorised dealers. The second type of funds are bank cheque funds or next day funds. These are funds transferred by bank cheque and account for the bulk of transactions. These transfers do not affect exhange settlement accounts until the next day.

The market is also categorised into official and unofficial segments. The official market segment refers to the authorised money market dealers while the unofficial segement comprises the rest of the financial market. The main focus of the official market is the allocation of exchange settlement funds between banks, authorised dealers and the Reserve Bank. However, authorised dealers also operate in the unofficial market providing a link between the two markets.

(c) The Participants

(i) Dealers

In terms of the daily functioning of the official market dealers play a pivotal role. This is partly due to the Reserve Bank's policy of almost exclusively dealing with authorised dealers, implying that with the exception of rediscounting all movements in same day funds are initiated through the accounts of dealers at the Reserve Bank of Australia. Further, the timing convention for debiting and crediting the exchange settlement accounts of banks and dealers gives dealers the central role in distributing exchange settlement throughout the system. The interbank market also plays a role, but it is only through transactions with dealers that system wide shortages or excesses can be transferred from one day to the next.

While the basic operations of the nine authorised dealers in Australia are similar to those in the United States they are more highly regulated. The size of a dealers portfolio is constrained by a maximum gearing ratio of 33 to 1, which is measured on their assets weighted according to investment risk. Also, the composition of a dealer's assets is restricted. A dealer can hold up to 30 per cent of its gearing limit in specified assets including certificates of deposits issued by banks, commercial bills accepted or endorsed by banks, and marketable securities of major public authorities. The balance of the portfolio must be composed of Commonwealth government securities (CGS).

Besides portfolio restrictions there also exist restrictions on the type of transactions dealers can undertake with the rest of the market. For example, until recently a dealer's ability to supply funds to the market was limited to outright purchases of securities or the repayment of loans. Repurchase agreements were limited to transactions with the Reserve Bank of Australia. This restriction has at times created problems for the Reserve Bank in carrying out daily operations and sometimes resulted in fairly large discrepancies between rates in the official and unofficial markets. This restriction was lifted in August 1986.

(ii) Trading Banks

In Australia, trading banks maintain two separate accounts with the Reserve Bank. One is an SRD account that pays a below market rate of interest and is based on the previous month's deposits. Banks also maintain an exchange settlement account that is used for cheque clearing purposes and all checkable deposits must be cleared through an account with a major trading bank. However, for understanding the workings of the official market, there is no loss in assuming that all cheques are issued by banks.

Cheques received on a given day are cleared by the Australian Clearing House and settlement is made on the following morning. These cheques include transactions with the Commonwealth Government which banks at the Reserve Bank. Based on the previous day's transactions the banking system as a whole will either have a surplus or shortfall of exchange settlement funds at the beginning of the day. Since each bank must at least maintain a zero exchange settlement balance with the Reserve Bank, a bank that is short at the beginning of the day must acquire same day funds.

This requirement of settling up each day is one of the interesting differences between the U.S. and the Australian systems. In the United States, banks need only meet their reserve requirements on average and therefore have some flexibility in determining the profile of their required reserve balances. Flexibility in terms of adjusting exchange settlement funds on a day to day basis is accomplished in the Australian system through the use of float. As mentioned, interbank settlement is on a next day basis since cheques presented to the Australian Clearing House do not affect exchange settlement balances until the next morning. This means that banks cannot obtain same day funds through transactions with non-banks. Also, the interbank market like the Federal funds market can only distribute funds among banks and cannot provide funds for the banking system as a whole. However, some transactions such as those involving authorised money market dealers are settled on a same day basis. This differential in timing effectively allows the banking system to borrow and lend across days of the week and gives the system some flexibility in satisfying reserve requirements on any day. The use of float, however, can not be used to augment reserves over time.

Similarly, since exchange settlement accounts pay no interest, banks wish to keep their clearing balances at the Reserve Bank to a minimum. Excess same day funds can only be disposed of through the interbank market and by lending funds to authorised dealers. The latter method is the only way for reducing the entire system's same day funds.

(iii) The Reserve Bank of Australia

The monetary policy of the Reserve Bank of Australia is implemented by influencing its exchange settlement position with the banking system. By controlling the tightness or looseness of market conditions the monetary authority influences overnight interest rates directly and other interest rates indirectly. In turn, this provides a mechanism by which the Reserve Bank attempts to satisfy its broader objectives, among which may be the control of monetary aggregates.

In order to influence the cash position of the banking system the Reserve Bank actively uses open market operations. These operations consist of outright purchases and sales and repurchases and reverse repurchase agreements and are almost exclusively implemented through transactions with authorised dealers, although in unusual circumstances the Reserve Bank may transact directly with banks. Much of the trading would be characterised as defensive in nature. That is, in order to avoid volatility in interest rates the central bank will attempt to offset flows of cash that would tend to move rates. For conditions that are deemed to be short-term or seasonal, repurchase agreements are frequently employed, while outright purchases and sales are more often used to offset longer-term market conditions that do not accord with desired policy.

(c) Interaction of the Major Participants and the Workings of the Market

In order to obtain a basic understanding of how the money market works it will be useful to track the results of an open market operation. Let us assume that at the beginning of the day the banking system's exchange settlement accounts have a zero balance. Further, assume that banks have loans outstanding with dealers of $900 million, and that taxes of $600 million are being paid to the Treasury. At approximately 9.30 a.m. the Reserve Bank announces the systems opening cash figure resulting from the previous day's cheque clearings. In this example the figure is zero. At the same time, the Bank also indicates its dealing intentions.

In Australia, the amount of loans outstanding with dealers is an important indicator of market conditions because it represents the amount of same day funds available for the banking system. Under the current accounting procedures, banks are credited with same day funds when they recall a dealer loan and debited when they lend money to dealers. The loans are collateralised with government securities and the direction of lending is one way. Dealers can not make loans to banks.

In this example banks are not losing any exchange settlement funds on the day in question. However, they are aware that tax payments will be leaving the system and as a result they will have a cash deficit of $600 million tomorrow morning. Reserves leave the system because the Treasury keeps all its accounts with the Reserve Bank. Under the assumptions in this example, banks have enough loans outstanding with dealers to cover the shortfall, but the resulting loss in dealer loans would certainly be greater than banks desire at the existing interest rate. Therefore, individual banks will try to acquire next day funds by bidding for deposits or selling securities either to dealers or non-banks and rates will rise. While any one bank can acquire funds in this manner, the system as a whole can only acquire funds if the Reserve Bank provides accommodation by buying securities from dealers, if dealers finance the purchase of securities through central bank borrowings, or if someone uses the rediscount facility of the Reserve Bank.

If the Reserve Bank does not desire any upward pressure on rates it can add funds today and allow the system to transfer the funds from today until tomorrow. The banks and dealers will do so because exchange settlement funds do not earn interest. For example suppose the Reserve Bank buys $300 million in repurchase agreements from authorised dealers. Dealer's exchange settlement accounts will be up $300 million and they could use these funds to purchase securities from non-banks (or banks) either outright or under repurchase agreements.

Because dealers accounts are debited (or credited) on the same day their exchange settlement funds will now be square. Non-banks will deposit the dealers' cheques with a bank and the funds will be credited to the banking system's exchange settlement accounts on the next day. In effect the $300 million has spilled over to the next day so that banks will only have to reduce their loans with dealers by $300 million rather than $600 million. In this case, the rise in interest rate will be lessened.

The above example highlights an interesting feature of Reserve Bank behaviour that does not seem to be fully understood. Specifically, maintaining the current level of short-term interest rates does not imply that the Bank should merely offset daily injections of funds into the system. Since bank behaviour in bidding for funds depends on the expected flows of cash over subsequent days, the Reserve Bank's operations must also recognise likely flows of cash in the future. Otherwise needless variations in interest rates would arise. Therefore, to ascertain whether the Reserve Bank is seeking to move market rates requires a detailed examination of not only conditions existing on the current day but on conditions that are liable to arise in the near future.

The description of the daily workings of the official market also highlights some of the differences that exist between the Australian and U.S. systems. In the U.S. tax payments would not generally result in a large decline of funds from the banking system since the U.S. Treasury would shift an equivalent amount of deposits between its account at the Fed and its accounts with private banks. In Australia, the use of the Reserve Bank as the Government's bank means that flows between the private sector and the Government result in changes in the banking system's settlement position. These flows, besides arising from government expenditures and tax payments, also arise when the central bank markets government debt and when debt issues mature. While these flows need not cause problems there have been times when the combination of market conditions, restrictions on dealer operations, tax payments and bond tenders have produced problems for operating procedures.

Another major difference between the U.S. and Australian systems is the accounting conventions. In the U.S. open market operations can routinely provide same day funds to the banking system by wiring funds into a dealers account at a bank. In this way an open market transaction directly results in a change in reserve balances. As shown in the proceeding example, an open market operation in Australia immediately affects funds to dealers and only affects the exchange settlement funds of banks and bank loans to dealers on the next day. It is through the expected change in bank loans to dealers that pressures in the official market develop.

The one day lag between transactions that provide exchange settlement funds to banks reduces forecasting errors since banks start each day with a known cash position. If interbank settlement were on a same day basis, the Reserve Bank would have difficulty forecasting banks' needs for cash and this could lead to larger swings in overnight interest rates. Of course there is always the possibility that banks would just hold additional loans with dealers. However an optimal inventory strategy would not cover all contingencies. Also, the ability to borrow and lend across days allows the system to more gradually adjust to movements, especially temporary movements, in settlement funds. Given that the Reserve Bank is adverse to sharp swings in interest rates, this is a desirable characteristic. In the U.S. the regulation that banks only need to meet their reserve requirements on average has much the same effect.

Although the accounting procedures in Australia provide the system with some ability to adjust to temporary reserve pressures without movements in rates, a concerted effort by the central bank to move rates will result in a gradual and continued change in loans to dealers. In the case of a tightening in policy, dealers will be forced to seek funds by borrowing from non banks or selling securities. These actions place upward pressure on rates. Eventually, the necessary exchange settlement funds can only come from two sources, lender of last resort loans to dealers and rediscounting of government securities.

(e) Lender of Last Resort Loans and Rediscounting

The final major way for the banking system in Australia to acquire exchange settlement funds is through loans from the central bank. The Reserve Bank of Australia lends funds in two distinct ways. The first is through a line of credit to authorised dealers (in the banking literature). The other is through the rediscounting of specific Treasury notes at the Reserve Bank. The rediscount facility is available to any noteholder but is primarily used by banks and authorised dealers. Unlike the U.S. these loans are not made at subsidised rates and are not as quantitiatively important as discount window lending in the U.S.[1]

Loans under the line of credit to authorised dealers are made with a term of 7-10 days. The minimum term is seven days and it is the dealers perogative on which day he will repay the loan, as long as it is repaid by the tenth day. Since dealers can always acquire same day funds by borrowing from non-banks, dealers will only borrow if overnight rates rise to the level of the lender of last resort loan rate.

Also, since market rates do fluctuate, the interest rate on these loans is adjusted on a regular basis. Because a loan involves a minimum term of seven days, the decision to borrow depends not only on current market rates but on expected market rates over the term of the loan.

With respect to the rediscounting of government securities, the Reserve Bank stands ready to purchase securities at a price P, determined by

$$P = 100\ (1 - nr/365)$$

where r is the rediscount rate and n is the number of days to maturity on the note. As Poole (1981) points out, this procedure produces an effective rediscount rate of r*, commonly known as the "give-up yield", given by

$$r^* = (365/n)\ ((100-P)/P) = r\ [1 - nr/365]^{-1}.$$

This implies that the effective rediscount rate is larger than r and varies inversily with the number of days to maturity on the rediscounted note.

Borrowing behaviour by banks and dealers is depicted in Chart 1 and in Table 3. One observes that rediscounting usually occurs when market rates exceed the rediscount rate. Similarly, authorised dealers only borrow from the central bank when market rates are expected to rise above the rate on the central bank's line of credit.

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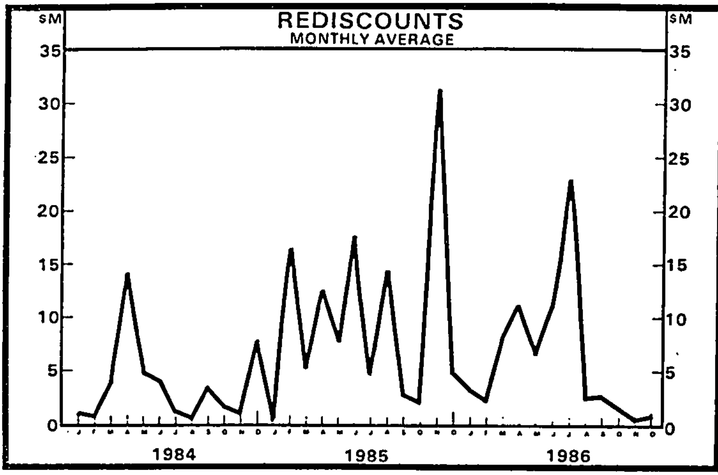
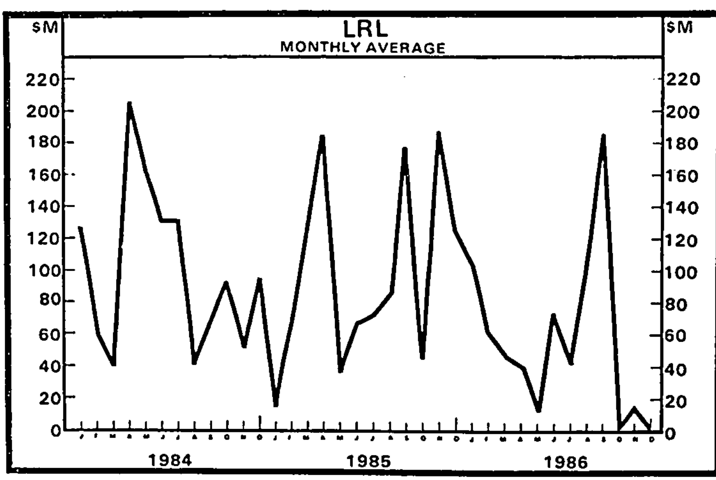
1. Technically, rediscounting is not a loan. However, it is equivalent to borrowing at a penalty rate for the remaining term of the security

CHART 1



$M
REDISCOUNTS
MONTHLY AVERAGE
$M
35
30
25
20
15
10
5
0
1984
1985
1986



$M
LRL
MONTHLY AVERAGE
$M
220
200
180
160
140
120
100
80
60
40
20
0
1984
1985
1986

TABLE 3
Instances of Large Rediscountings from the Reserve Bank (1986)

Date	Rediscounts	Rediscount Rate	Official Market Rate	Unofficial Market Rate
17/1/86	63	19.0	18.7	19.0
11/3/86	115	18.0	17.5	17.9
8/4/86	85	16.5	16.3	17.8
10/6/86	83	14.6	14.1	15.4
16/6/86	110	14.6	12.4	16.0

These lending methods differ significantly from the operation of the discount window in the United States.[2] In the U.S., discount window loans are usually at a subsidised rate. Therefore, controlling their volume involves some sort of non-price rationing. Since rediscounting involves a penalty rate and excess same day funds are allowed to earn market rates of interest through loans to dealers, the central bank lending facilities in Australia are quantitiatively less important than those in the United States. Also, bank loans to dealers in Australia are proportionately greater than excess reserve holdings in the U.S. This implies that a substantial draining of reserves would be required in order to induce banks in Australia to use the rediscount facility.

Although the use of rediscounting and the central bank line of credit may not be as great as discount window use in the United States, this does not imply that the nature of these facilities are unimportant in affecting both bank's and dealer's behaviour. These facilities represent a cost of acquiring same day funds and the rates charged and the rate on LLR loans will play an important role in determining the supply of bank loans to dealers and the demand for short term funds by dealers. In essence, the penalty rate charged for same day funds represents the cost of being caught short and will therefore be an important determinant for banks in deciding how much of an inventroy of same day funds they should maintain.

(f) Reserve Bank Operations

As noted earlier, the major aim of the Reserve Bank's domestic market operations is to maintain cash rates at levels consistent with the objectives of monetary policy. This type of policy has been implemented since the floating of the exchange rate in December 1983. However, while the Reserve Bank uses the cash rate as its operating instrument it does not peg the interest rate. Rather its policy can be viewed as a combination of two theoretically differenct approaches neither of which is solely followed in practice. Under one approach the bank could peg the interest rate at a level consistent with policy objectives while under an alternative approach it could target some reserve measure. As shown in Section 4, this latter method is really an indirect interest rate instrument.

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2. A detailed analytical treatment of the discount window can be found in Goodfriend (1985).

In Australia, bank's loans to authorised dealers are an important indicator of market conditions because they are generally the only source of same day funds. If these loans are low banks run the risk of rediscounting and incurring the associated penalty. Therefore, a decrease in bank's loans to dealers forces banks to bid for funds and places upward pressure on interest rates. The relationship between bank's loans to dealers and interest rates provides the Reserve Bank with a useful indication of how market operations will affect rates. However at times there can be a conflict between the signals provided by bank's loans to dealers and the interest rate. The Reserve Bank appears to regard the interest rate as the more reliable guide for market operations.

This type of procedure allows for some variability in interest rates and is similar to the procedure currently followed by the Federal Reserve System under borrowed reserve targeting. However, as shown in the next section institutional arrangements in the two countries imply that the economic consequencies of the two pure policies differ and that an interest rate peg is likely to be more efficient than reserve targeting in Australia.

4. An Economic Model

(a) Overview

The purpose of this section is to consider the theoretical effectiveness of different operating procedures for controlling money. Given that the Reserve Bank employs lagged reserve requirements, the basic instrument of monetary control must be the official market rate. This rate can be used directly or can be used indirectly through the targeting of some reserve measure. The discussion in Section 3 indicates that in Australia the level of banks' loans to dealers is the best approximation of how much discretionary cash balances the banks have at their disposal. That is, banks' loans to dealers can be used as an indicator of the operations required to bring about the desired cash rate. This procedure has some similarities with the Federal Reserve's policy of targeting discount window borrowing. Like the U.S., there is often a conflict between strictly following a reserve quantity objective and maintaining a desired level of interest rates. The following analysis suggests that under existing institutional arrangements in Australia monetary control can best be achieved by the use of an interest rate peg. This contrasts with the results for the United States (see Dotsey (1987)) where an indirect interest rate procedure leads to better results. However, it should be stressed that neither monetary authority follows a pure procedure of pegging the interest rate or of strictly adhering to a reserve target. The analysis below is intended to examine the differences in these two types of pure policies and to, therefore, shed some light on the procedures employed by the Reserve Bank of Australia.

The material in this section is related to the literature on instruments and targets. In terms of that literature the policy maker has a certain goal, say some desired value of real or normal income, and employs an instrument, either the interest rate or the monetary base, that most efficiently atttains that goal. The seminal piece on this topic is Poole (1979) and his analysis has been extended to models employing national expectations by Dotsey and King (1983), (1986) and Canzoneri, Henderson and Rogoff (1983).

However, in this paper which deals with operating policy over a period of two weeks to a month, it is implicitly assumed that there is insufficient information regarding the monetary authority's goal to directly target that goal. Rather the monetary authority chooses an intermediate target, say some monetary aggregate, in order to best achieve its desired policy. A monetary aggregate is chosen because in models employing rational expectations a nominal quantity must explicitly be pinned down for the model to be determinate (see McCallum (1981), (1986)). Again the monetary authority may have a choice as to whether to directly use a reserve instrument such as the base or the interest rate. But in a regime of lagged reserve requirements the base is esentially a state variable and the only choice is some form of an interest rate instrument. The two polar cases considered below are an interest rate peg and an indirect interest rate instrument that involves targeting a reserve measure.

(b) The Market for Reserves

Capturing the major attributes of the Australian money market in an analytically tractable manner requires a degree of abstraction. It is therefore important to isolate the key features that characterise the market for reserves. These features appear to be the presence of lagged reserve requirements, the requirement that banks exchange settlement accounts be non-negative, and the intertemporal decision involved in rediscounting, lender of last resort loans, and bank loans to dealers. In order to capture the intertemporal nature of bank behaviour, it is assumed that the average maturity of a rediscounted security is two periods, where a period would be of the order of one week. Similarly, central bank loans to dealers are assumed to be for two periods. One may also wish to think of the reserve maintenance period as being two periods in length, although this is not crucial. It will be evident for the two alternative operating procedures analysed that the particular reserve accounting regime is irrelevant.

The basic equilibrium relationship in the money market is given by

$$(1)\quad R_t^s + BR_t^d = SRD_t + (DL_{t+1}^s - DL_t^s)$$

where R_t^s are reserves supplied by Reserve Bank open market operations, BR_t^d is borrowing from the Reserve Bank by dealers plus the volume of rediscounting, SRD_t is the amount of reserves held in statutory reserve deposit accounts, and DL_t are bank loans to dealers. At time t, SRD_t is given and depends on past deposits. Equation (1), therefore, reflects the fact that when reserves are added or subtracted from the system bank loans to dealers respond accordingly.

The important behavioural variable in this relationship is the supply of bank loans to dealers. It is assumed that the quantity of loans is supply determined with dealers accepting any amount of loans at the going rate. Banks hold loans with dealers because funds in exchange settlement accounts do not earn interest. Their inventory of same day funds will be based on the cost of running short. Specifically, if a bank must rediscount a two period security in order to obtain exchange settlement funds the cost is $d_t - 1/2(r_t + E_t r_{t+1})$ where d_t is the effective rediscount rate and r_t is the rate in the official money market. The expression $1/2(r_t + E_t r_{t+1})$ is the rate that a two period security will earn given effective arbitrage in the money market. The log of the supply of bank loans desired by bank z to dealers is therefore written as

$$(2)\quad dl_t^s(z) = d_1 d_t - d_2 r_t - d_3 E_{zt} r_{t+1} + \delta_t(z)$$

where $\delta_t(z)$ is a mean zero independently normally distribute random variable with variance σ_δ^2 and E_{zt} is the expectation operator conditional on information possessed by bank z at period t. In (2) the coefficients on r_t and $E_{zt} r_{t+1}$ are allowed to differ since it is possible that some portion of rediscounting will be done with one period securities.

(c) The Economy[3]

The model of the economy used is a standard rational expectations model similar to McCallum (1980) involving a basic IS expenditure curve in which the log of output demanded, y_t^d, depends negatively on the expected real rate of interest, an output supply function that incorporates the natural rate hypothesis, and a demand for money function. The model is given by

$$(3) \quad y_t^d = -b(r_t+p_t-E_{t-1}^*p_{t+1}) + u_t$$

$$(4) \quad y_t^s = a(p_t-E_{t-1}^*p_t) + w_t$$

$$(5) \quad m_t^d = p_t-c_1r_t+c_2y_t+v_t$$

where y_t^s is the log of output supplied, p_t is the log of the price level, m_t^d is the log of money demand and E_{t-1}^* is the expectations operator conditioned on information contained in the set I_{t-1}^*. This set is assumed to include all prices, quantities, and random disturbances dated t-1 and earlier. The disturbance terms u_t and w_t are for simplicity independently normally distributed random variables with means zero and variances σ_u^2 and σ_w^2 respectively. The money demand disturbance displays some persistence and is given by $v_t=\rho v_{t-1}+e_t$ where $0<\rho<1$ and e_t is a mean zero independently distributed random variable with variance σ_e^2.[4]

(d) An Interest Rate Instrument

One basic means for controlling money is a policy of directly using the interest rate. The efficiency of this policy is measured by the expected squared deviation of money from its target, m_t^*. The targeted level of money could arise from some complicated feedback mechanism on past and expected values of various economic variables that are chosen to satisfy broader policy objectives. That is m_t^* should be viewed as an intermediate target. However, the actual choice of m_t^* is not crucial (see McCallum and Hoehn (1983)), and for simplicity it is assumed that $m_t^*=(1+\mu)m_{t-1}^*$.

3. The model used represents a closed economy. Extending the result to open economy would be of interest but the basic mechanism that drives the results does not seem to be sensitive to such an extension.

4. A degree of permanence could be modelled for the other variables without affecting the qualitative results.

In order to use an interest rate instrument, the Reserve Bank would peg the time t nominal interest rate at a level that will produce m_t^* in an expected value sense. Hence

$$(6)\quad r_t^* = (1/c_1)(E_{t-1}^* p_t + c_2 E_{t-1}^* y_t + \rho v_{t-1} - m_t^*)$$

where r_t^* is the interest rate objective. Under such a policy, the deviation of money from target can be expressed as

$$(7)\quad m_t - m_t^* = -\frac{1-c_2 b}{a+b} u_t + \frac{1+c_2 a}{a+b} w_t + e_t$$

The corresponding expected squared deviation of money from target, V_r is expressed as

$$(8)\quad V_r = \frac{(1-c_2 b)2}{(a+b)^2}\sigma_u^2 + \frac{(1+c_2 a)2}{(a+b)^2}\sigma_w^2 + \sigma_e^2$$

(e) A Reserves Objective

Alternatively, the Reserve Bank could attempt to achieve a desired level of money by aiming at a desired reserve measure. That reserve measure is bank loans to dealers. This procedure would amount to an indirect interest rate instrument and involves targeting the level of loans that is expected to produce an interest rate that is consistent with a level of money demand equal to m_t^*.

Formally, the targeted level of loans, dl_t^*, will be

$$(9)\quad dl_t^* = d_1 d_t + d_2 r_t^* - d_3 E_{t-1}^* r_{t+1}.$$

That is, at time t-1, dl_t^* is the value of bank loans to dealers that is expected to be consistent with r_t^* and hence m_t^*. In actuality, the interest rate that yields a value of bank loans to dealers of dl_t^* will be somewhat different. Combining (2) and (9) yields

$$(10)\quad r_t = r_t^* - (d_3/d_2)(\overline{E_{zt}} r_{t+1}^* - E_{t-1}^* r_{t+1}) + (1/d_2)\delta_t$$

where the "bar" over E_{zt} indicates the average of all bank's expectations. Under this policy the interest rate is allowed to fluctuate around r_t^* due to expectational errors and the random disturbance to the supply of loans.

This policy, therefore, introduces some added volatility into the interest rate. However, whether this policy increases or decreases the precision of monetary targeting depends on the covariance between the interest rate and the aggregate disturbances in the model. This is more easily seen by examining

$$(11) \quad m_t - m_t^* = -\left[\frac{b(1+ac_2)}{a+b} + c_1\right](r_t - E_{t-1}^* r_t) - \left[\frac{1-bc_2}{a+b}\right]u_t + \left[\frac{1+ac_2}{a+b}\right]w_t + e_t$$

If, for example, the interest rate were positively correlated with the current innovation in the money demand disturbance then it is possible for the overall effect of money demand shocks on deviations of m_t from m_t^* to be dampened.

In order to see if this possibility exists, the reduced form expression for the interest rate must be derived. This derivation depends on the information available to agents and the stochastic structure of the model. It is assumed that each bank observes its own balance sheet and therefore observes part of the money stock $m_t(z)=m_t+x_t(z)$, where $x_t(z)$ is a mean zero independently distributed normal variable with variance σ_x^2. Therefore, bank z's information set, $I_t(z)$, is $I_t(z)=I_{t-1}^*$ plus $m_t(z)$. Regarding the stochastic structure of the model, all shocks with the exception of the money demand shock are white noise.

These assumptions are important if there is to be a possibility for reserve targeting to outperform interest rate targeting. The essential requirements are that the model contain some propagation mechanism and that there is some contemporaneous information available. If, for example, all shocks were white noise and the effects of these shocks were not propagated over time then $r_t=r_t^*+(1/d_2)\delta_t$. The interest rate would be uncorrelated with the other aggregate shocks in the model and would add variability to the behaviour of money.

Although important, the assumptions are not unreasonable. Agents do obtain contemporaneous information and disturbances are propagated over time. The use of an autoregressive process for the money demand disturbance is merely a simple way of illustrating the mechanism.

In this model banks have two pieces of information that are useful in discriminating among the various shocks. These signals, the interest rate and their own balance sheet, convey a linear combination of the underlying random disturbances. The interest rate conveys the information $s_r=\psi_3 e_t+\psi_4 u_t+\psi_5 w_t+\psi_6 \delta_t$, while the balance sheet conveys the signal $s_m=-m_1 u_t+m_2 w_t+e_t+x_t(z)$. Banks use these signals to calculate $E_{zt} r_{t+1}$ according to

$$(12) \quad E_{zt} r_{t+1} = E^*_{t-1} r_{t+1} + \alpha_1 s_r + \alpha_2 s_m$$

Solving for α_1 and α_2 and using equation (10) yields the reduced form expression (for details see Appendix)

$$(13) \quad r_t-E^*_{t-1} r_t = -(d_3/d_2)\theta\psi_2[e_t-m_1 u_t+m_2 w_t]+[1/d_2(1-\phi)]\delta_t$$

where $\psi_2 = \frac{\rho(1-\rho)}{1+c_1(1-\rho)}$. The coefficients θ and ϕ involve ratios of the various variances in the model and take on values between zero and one.

Examining (13) and (11) one observes that the covariances between $-(r_t-E^*_{t-1} r_t)$ and e_t, $-u_t$, and w_t are all positive. Hence, the particular form of reserve targeting that employs bank loans to dealers unambiguously produces a higher variance of money from target while simultaneously creating additional variability in the interest rate.[5] This result is just the opposite to that obtained by Dotsey (1987) for borrowed reserve targeting in the United States.

The intuition behind the covariance relationship between $r_t-E^*_{t-1} r_t$ and the aggregate disturbances is straightforward. For example, assume there is a positive money demand shock. Banks will perceive part of this shock through the signals s_r and s_m. Also, the positive money demand shock implies that r^*_{t+1} will be higher and hence $E_{zt} r^*_{t+1}$ rises. This reduces the supply of loans to dealers which means that interest rates must fall for $dl_t=dl^*_t$. But a fall in the interest rate only exacerbates the increases in money caused by the money demand shock. Therefore, monetary control is lessened.

The above results indicate that from the standpoint of monetary control, a reserves objective is likely to be inferior to an interest rate peg

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5. With respect to the variability of output, $E(y_t - E^*_{t-1} y_t)^2$, as long as σ_u^2 does not dominate all the other variances, then a peg is more efficient.

in Australia. In terms of actual operations this would imply that the Reserve Bank of Australia should be more concerned with the interest rate than with bank loans to dealers. The analysis cannot, however, explain the actual procedures used in Australia which fall somewhere between the two policies and which therefore allow a certain amount of daily interest rate volatility. In order to completely analyse the introduction of variability would require a more detailed dynamic model with explicit references to public and private welfare functions. Models such as Cukierman and Meltzer (1986) and McKibbin (1987) provide reasons (although different ones) as to why noise or ambiguity may be introduced into policy. The purpose of this analysis is to provide a detailed description of the two types of policies that span the actual policy employed by the Reserve Bank of Australia.

5. Summary

This paper presents a comparison between operating procedures and money market institutional arrangements in Australia and the United States. The basic findings are that although there are significant institutional differences between the two countries, both monetary authorities use similar operating procedures. These similar procedures account, at least in part, for the similar behaviour of interest rates in the two countries. However, institutional differences do imply some interesting differences regarding the types of policies that produce optimal monetary control. The analysis suggests that, with existing institutional arrangements in Australia, interest rates are more appropriate than reserves as an intermediate objective in terms of monetary control.

APPENDIX

The purpose of this appendix is to derive the reduced form expression for interest rates in (13). From (11) the information contained in

$$m_t(z) = m_t + x_t(z) = -\frac{1-bc_2}{a+b}u_t + \frac{1+ac_2}{a+b}w_t + e_z + x_t(z) = m_1u_t + m_2w_t + e_t + x_t(z).$$

Further, postulate the following undetermined coefficient solution for the interest rate.

$$\text{A(1)} \quad r_t = \psi_0 + \psi_1 m_t^* + \psi_2 v_{t-1} + \psi_3 e_t + \psi_4 u_t + \psi_5 w_t + \psi_6 \delta_t$$

The coefficients α_1, α_2 can be thought of coefficients in a population regression given by (12). Therefore

$$\text{(A2)} \quad \begin{bmatrix}\alpha_1\\ \\ \alpha_2\end{bmatrix} = \begin{bmatrix}\psi_3^2\sigma_e^2 + \psi_4^2\sigma_u^2 + \psi_5^2\sigma_w^2 + \psi_6^2\sigma_\delta^2 & \psi_3\sigma_e^2 - m_1\psi_4\sigma_u^2 + m_2\psi_5\sigma_w^2\\ \\ \psi_3\sigma_e^2 - m_1\psi_4\sigma_u^2 + m_2\psi_5\sigma_w^2 & m_1^2\sigma_u^2 + m_2^2\sigma_w^2 + \sigma_e^2 + \sigma_x^2\end{bmatrix}^{-1}\begin{bmatrix}\psi_2\psi_3\sigma_e^2\\ \\ \psi_2\sigma_e^2\end{bmatrix}$$

or

$$\text{(A3)} \quad \begin{bmatrix}\alpha_1\\ \\ \alpha_2\end{bmatrix} = \frac{1}{\Delta}\begin{bmatrix}m_1(\psi_3m_1+\psi_5)\sigma_e^2\sigma_u^2 + m_2(\psi_3m_2-\psi_7)\sigma_e^2\sigma_w^2 + \psi_3\sigma_e^2\sigma_x^2\\ \\ \psi_4(\psi_3m_1+\psi_5)\sigma_e^2\sigma_u^2 - \psi_5(\psi_3m_2-\psi_7)\sigma_e^2\sigma_w^2 + \psi_6^2\sigma_e^2\sigma_\delta^2\end{bmatrix} = \frac{1}{\Delta}\begin{bmatrix}\psi_3\sigma_e^2\sigma_x^2\\ \\ \psi_6\sigma_e^2\sigma_\delta^2\end{bmatrix}$$

where the last equality makes use of the fact that one can show that $(\psi_3m_1+\psi_5)=(\psi_3m_2-\psi_7)=0$. Δ is the determinant of the 2x2 matrix in equation (A2)

and is given by $\Delta = \sigma_x^2(\psi_3^2\sigma_e^2+\psi_4^2\sigma_u^2+\psi_5^2\sigma_w^2+\psi_6^2\sigma_\delta^2) + \psi_6\sigma_\delta^2(\sigma_e^2+m_1^2\sigma_u^2+m_2^2\sigma_w^2)$.

The undetermined coefficients are then solved for by equating their value on each side of (10). The result is $\psi_2 = \frac{\rho(1-\rho)}{1+c_1(1-\rho)}$, $\psi_3 = -(d_3/d_2)\psi_2\theta$, $\psi_4 = -m_1\psi_3$,

$\psi_5 = m_2\psi_3$, and $\psi_6 = (1/d_2(1-\phi))$ where $\theta \equiv (\psi_3^2\sigma_e^2\sigma_x^2 + \psi_6^2\sigma_e^2\sigma_\delta^2)/\Delta$ and

$\phi \equiv \psi_3^2\sigma_e^2\sigma_x^2 \;/\; (\psi_3^2\sigma_e^2\sigma_x^2 + \psi_6^2\sigma_e^2\sigma_\delta^2)$.

REFERENCES

Canzoneri, Mathew, Dale Henderson, and Kenneth Rogoff (1983) "The Information Content of Interest Rates and the Effectiveness of Monetary Policy Rules". Quarterly Journal of Economics, 98, 545-566.

Cukierman, Alex and Allan H. Meltzer (1986) "A Theory of Ambiguity, Credibility, and Inflation Under Discretion and Asymmetric Information". Econometrica, 54, 1099-1128.

Dotsey, Michael (1986) "Japanese Monetary Policy, a Comparative Analysis". Bank of Japan Monetary and Economic Studies, 4, 105-127.

________ (1987) "Monetary Control Under Alternative Operating Procedures". Federal Reserve Bank of Richmond, processed.

Dotsey, Michael and Robert G. King (1983) "Monetary Instruments and Policy Rules in a Rational Expectations Environment". Journal of Monetary Economics, 12, 357-382.

________ (1986) "Informational Implications of Interest Rate Rules". American Economic Review, 76, 33-42.

Farmer, David (1984-85) "The Australian Interbank Money Market". Bulletin of Money, Banking and Finance, 46, 1-31.

Friedman, Milton (1982) "Monetary Policy: Theory and Practice". Journal of Money Credit and Banking, 98-118.

Goodfriend, Marvin (1983) "Discount Window Borrowing, Monetary Policy, and the Post-October 6, 1979 Federal Reserve Operating Procedures". Journal of Monetary Economics, 12, 343-356.

Levin, Fred J. and Ann-Marie Meulendyke (1982) "Monetary Policy: Theory and Practice, A Comment". Journal of Money Credit and Banking, 399-403.

Lucas, Robert J (1973) "Some International Evidence on Output-Inflation Tradeoffs". American Economic Review, 63, 326-334.

McCallum, Bennett T (1980) "Rational Expectations and Macroeconomic Stabilisation Policy". Journal of Money Credit and Banking, 12, 716-746.

____________________ (1981) "Price Level Determinancy with an Interest Rate Policy Rule and Rational Expectation". Journal of Monetary Economics, 8, 319-329.

____________________ (1986) "Some Issues Concerning Interest Rate Pegging, Price Level Determinary, and the Real Bills Doctrine," Journal of Monetary Economics, 17, 135-160.

McCallum, Bennett T. and James G. Hoehn (1983) "Instrument Choice for Money Stock Control with Contemporaneous and Lagged Reserve Accounting". Journal of Money Credit and Banking, 15, 96-101.

Macfarlane, I.J. (1984) "Methods of Monetary Control in Australia". Paper presented at the New Zealand Association of Economists Annual Conference, Massey University. Reprinted in The Economics and Management of Financial Institutions, J.D. Jutlner and T. Valentine (eds) Longman Cheshire (forthcoming).

_______________ (1986) "Open Market Operations Since the Float". Reserve Bank of Australia Bulletin.

McKibbin, Warwick (1987) "Monetary Policy Credibility: A Survey of the Issues". In process.

Meek, Paul (1985) "Open Market Operations - A Brief Comparative Study". Paper presented at Seminar on Central Banking International Monetary Fund.

Poole, William (1970) "Optional Choice of Monetary Instruments in a Simple Stochastic Macro Model". Quartery Journal of Economics, 84, 197-216.

_______________ (1981) "Australian Monetary Policy: An Outsiders View". Paper presented at 51st ANZAAS Congress.

Reserve Bank of Australia (1985) "The Reserve Bank's Domestic Market Operations". Reserve Bank of Australia Bulletin.

Reserve Bank of Australia, "Market Operations and Monetary Control: A Comparison of the U.S., U.K. and Australia", processed.

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