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Does Monetary Policy Expectation Have an Impact on Market Interest Rates in Australia?☆

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Note☆

Abstract

This paper examines the impact of monetary policy expectation on market interest rates in Australia. The one-month OIS (overnight indexed swap) rate is used as an indicator of market expectation regarding the monetary policy of the RBA (Reserve Bank of Australia). Long-term interest rates from the AGB and IRS markets are used to investigate the impacts of monetary policy expectation. The RBA can influence both yield curves for up to ten years through the monetary policy expectation formed in the financial market. A comparison between the two yield curves suggests that the impact of monetary policy expectation is greater on the AGB yield curve than on the IRS yield curve. As a central bank, the RBA needs to pay more attention to the IRS yield curve than to the AGB yield curve to achieve the goal of price stability.

Keywords: Monetary Policy Expectation, Term Structure of Interest Rate, Australia

1. Introduction

Woodford (1999) shows that the forward-looking nature of financial markets can have important implications for determining the optimal setting of monetary policy, and that the effectiveness of monetary policy depends on the speed and extent of the transmission of monetary policy expectations to other asset prices. The term structure of interest rates plays an important role in the conduct of monetary policy. According to Angeloni and Rovelli (1998), there are three potentially useful roles that the term structure of interest rates can perform in the monetary policy process; they are referred to as the transmission role, the informational role, and the policy indicator role.

The transmission of interest rates from the short to the long term is an integral part of the mechanism through which monetary policy affects the economy. As Blinder (2004) points out, a fully transparent central bank keeps the markets well informed and the monetary authorities lead the markets. Monetary policy expectation is mainly formed in the markets through the communications of a central bank. Market players buy and sell financial instruments such as

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government bonds by considering the future path of monetary policy. This is closely related to the ability of the central bank to influence interest rates of various maturities that are relevant to the spending decisions of households and firms. In other words, long-term interest rates affect economic activity and ultimately the rate of inflation.

This paper focuses on the monetary policy expectation and transmission role of the yield curve. It examines the impact of monetary policy expectation on market interest rates in Australia. In other words, this paper investigates whether expectation is fully transmitted to the long end of the yield curve. Monetary policy decisions made by the RBA (Reserve Bank of Australia) are expressed in terms of a target for the cash rate, which is the overnight money market interest rate. This study uses OIS (overnight indexed swap) rate as an indicator of monetary policy expectation[1]. The OIS rate is based on a derivative contract on the overnight rate, and is a measure of the market's expectation of the overnight fund's rate over the term of the contract. For example, when an OIS's maturity term is one month, market participants have an expectation regarding the RBA's monetary policy path during that period when concluding the OIS transaction. There is very little default risk in the OIS market because there is no exchange of principal. The funds are exchanged only at the maturity of the contract, when one party pays the net interest obligation to the other. Thus it can be concluded that OIS rate is an objective indicator of monetary policy expectation available on a daily basis formed in the financial market.

This paper uses two kinds of long-term interest rates, namely AGB (Australian Government Bond) and IRS (interest rate swap): AGB represents a government credit risk; IRS represents private sector credit risk. As a central bank, the RBA needs to pay attention to both yield curves for the price stability because the levels of IRS rates are usually decided by the levels of AGB yields and other factors such as credit risk and liquidity risk[2]. The interest rates for long- term lending are usually determined by the IRS rates rather than the AGB yields. Thus, the spending decisions of households and firms are more closely connected with the IRS rates than with the AGB yields. Therefore the RBA needs to check the movement of IRS rates more closely to achieve the goal of price stability.

Among the studies analyzing the relationship between monetary policy and the term structure of interest rates in Australia, the studies of Karfakis and Moschos (1995), Masih et al (2005) and Lee (2012) are the most frequently cited. Although, as mentioned above, the impact of monetary policy expectation on market interest rates is a very important subject, none of the previous studies focus on the impact of monetary policy expectation on the term structure of interest rates. In addition, they do not use two kinds of yield curve for comparison. Karfakis and Moschos (1995) examine the expectation theory of the term structure of interest rates in Australia. Their bivariate vector autoregressive (VAR) analysis indicates that the spreads between the long-term and the short-term rates are informative about changes in short-term rates. Masih et al (2005) indicate that in Australia, contrary to popular belief, long-term interest rates more often than not lead shorter-term interest rates, at least for the interest rates and time period under investigation. Lee (2012) examines the Australian interest rate futures market's reaction to changes in RBA monetary policy and finds evidence that interest rate futures react strongly to target rate announcements across the maturity spectrum, with a stronger reaction evident in short maturity

[1] As for OIS, see Thornton(2009)

[2] The RBA has an inflation target policy and seeks to keep consumer price inflation in the economy to 2–3 per cent, on average, over the medium term. For details, see Reserve Bank of Australia home page http://www.rba.gov.au/

futures.

In light of the related literatures, the contributions of this paper are twofold. First, this study is the first to investigate the transmission of monetary policy expectations to market interest rates in Australia. Even though, as mentioned above, this point is significant, the impact of monetary policy expectation on long-term interest rates has never been investigated. Second, long-term interest rates from the AGB and IRS markets are used to investigate the impacts of monetary policy expectation. Thus, a comparison between the AGB and IRS markets is possible. Even though this point is very important, to date, such a comparison has never been made.

The remainder of this paper is organized as follows: Section 2 describes the data and provides summary statistics; Section 3 discusses the framework of the analysis; Section 4 presents the results; and Section 5 concludes the paper.

2. Data

One-month OIS rate is used as an indicator of market expectation regarding the RBA's monetary policy. The daily closing data are provided by Tullett Prebon (Australia) Pty Ltd. As mentioned in Section1, the OIS is the rate on a derivative contract on the overnight rate and is a measure of the market's expectations of the overnight funds rate over the term of the contract. Bank accepted bill yields of 30 days, 90 days and 180 days are used as short- term interest rates. Daily data on these yields are provided by the Australian Financial Markets Association (AFMA).

The AGB yields and IRS rates of two, three, four, five, seven and ten years are used as long-term interest rates. Daily data on these AGB yields and IRS rates are provided by Bloomberg. The sample period is from July 2, 2001 to March 18, 2011.The descriptive statistics of the data are presented in Table 1.

3. Methodology

3.1Unit Root Test

It is necessary to examine whether the data used in this study contain unit roots because the empirical analyses from the mid-1980's through to the mid-1990's show that data such as interest rates, foreign exchange rates, and stock prices are non-stationary. The ADF (Augmented Dickey Fuller) test and the PP (Phillips Perron) test are used[3]. The ADF and PP tests state the null hypothesis that "unit roots exist" and the alternative hypothesis that "unit roots do not exist". Fuller (1976) provides the table for the ADF and PP tests. First, the original data are analyzed to find out whether they contain a unit root. Then, the data with first difference are analyzed to test whether they have a unit root in order to confirm that data are I (1) processes.

[3] For details, see Dickey and Fuller (1979), Dickey and Fuller (1981), and Phillips and Perron (1988).

Table 1. Descriptive Statistics of Data for Analysis

Variable	Average	SD	Min	Max	Median
OIS1M	5.141	1.052	2.875	7.315	5.260
BA30D	5.272	1.076	3.075	7.770	5.370
BA90D	5.338	1.106	3.000	8.115	5.400
BA180D	5.406	1.128	2.845	8.245	5.430
AGB2Y	5.167	0.862	2.335	7.197	5.156
AGB3Y	5.277	0.736	2.844	7.047	5.261
AGB4Y	5.356	0.669	3.048	6.965	5.321
AGB5Y	5.416	0.592	3.306	6.859	5.392
AGB7Y	5.502	0.511	3.710	6.823	5.500
AGB10Y	5.570	0.451	3.961	6.793	5.584
IRS2Y	5.571	0.957	2.945	8.266	5.542
IRS3Y	5.697	0.848	3.342	8.213	5.615
IRS4Y	5.839	0.775	3.666	8.213	5.739
IRS5Y	5.900	0.717	3.797	8.088	5.808
IRS7Y	5.987	0.621	4.081	7.873	5.935
IRS10Y	6.057	0.550	4.287	7.683	6.050

Notes:
Whole sample period is from July 2, 2001 to March 18,2011.
OIS = Overnight Indexed Swap, BA = Bank Accepted Bill
AGB = Australian Government Bond, IRS = Interest Rate Swap

3.2 Cointegration Test

In general, the OLS (ordinary least squares) method is used to analyze the relationship among variables. However, when the non-stationary variables are included, the ordinary hypothesis test tends to provide inaccurate results because the coefficient of determination and the t-statistics do not follow a simple distribution.

Granger and Newbold (1974) call this problem “spurious regression”. Phillips (1986) points out two things about the analysis of non-stationary data- : (1) the coefficient of determination tends not to measure the relationship among variables, and (2) the estimated equation with a low Durbin-Watson ratio can possibly face the problem of spurious regression.

A non-stationary time series model is necessary to cope with the problems mentioned above. There are mainly two types of cointegration test-: the Johansen (1988) test, and the Engle and Granger (1987) test. The most difficult part of a cointegration analysis starting from the VAR model is how to determine the number of cointegration relationships. When more than three variables are analyzed, the number of cointegration relationships may be one or two. The Engle and Granger test cannot cope with this problem, but the Johansen test is able to determine the number of cointegration relationships[4]. Thus, the Johenasen cointegration test is applied in the way mentioned below after it is confirmed that the data used for analysis are non-stationary I (1) variables.

Johansen suggests starting an analysis with the *k* order VAR model. Here, the VAR model is presented with *k* order against vector X_t with *p* variables. In this case, variables are the one-month OIS rate as an indicator of monetary policy expectation and the market interest rates. Trace tests are conducted to investigate the cointegration relationship. The critical values at the 5 % level are used from Osterwald-Lenum (1992).

$$X_t = \Pi_1 X_{t-1} + \ldots + \Pi_k X_{t-k} + \lambda + u_t \qquad (1)$$

All the *p* elements of X_t are considered to be I (1) variables. u_t is an error term with zero mean. λ is a constant term. Johansen cointegration tests are applied in two sets of yield curves.

(1) One-month OIS, bank accepted bill yields of 30, 90, and 180 days, and AGB yields of two, three, four, five, seven and ten- ears. (ten series)

(2) One-month OIS, bank accepted bill yields of 30, 90, and 180 days, and IRS rates of two, three, four, five, seven, and ten-years. (ten series)

An alternative interpretation of the cointegration among yields of different maturities arises from the relationship between cointegration and common trends. Stock and Watson (1988) show that when there are ($n-p$) linearly independent cointegration vectors for a set of *n* I (1) variables, then each of these *n* variables can be expressed as a linear combination of *p* I (1) common trends and ($n-p$) I (0) components[5].

Applying the result to this study, it is expected that there will be a couple of non-stationary common trends in the yield curve of different maturities. Hall et al (1992) is relevant to this part of the analysis. They conduct the Johansen cointegration test using the monthly data of the US Treasury bill data (eleven series: one month through eleven months) from 1970 through to 1988. They find that the entire series comprised of ten cointegration vectors and one common trend. Denoting the I (1) common trends by $W(t_1) \ldots W(t_n)$, a simple representation of how they link the yield curve is given by

$$R(1,t) = A(1,t) + b_1 W(t_1)$$

[4] For details, see Engle and Granger (1987) and Johansen (1988).
[5] They draw the following conclusion. The multivariate time series in the cointegration relationship has at least one common trend. They test to extract common trends by using multivariate time series both with and without drift. Both types of test include the roots obtained by regressing the time series into the first lag. The critical values for the test are calculated and the power is investigated by the Monte- Carlo method. In general, economic time series are modeled as having a unit root or a common trend. They also draw the conclusion from an empirical analysis that the time series with three variables (federal funds rate, 90 - day US Treasury bills, one - year US Treasury bills) has two cointegration vectors and a common trend.

$$R(2,t) = A(2,t) + b_2 W(t_1) + b_2 W(t_2)$$

……..

$$R(n,t) = A(n,t) + b_n W(t_1) + b_n W(t_2)....b_n W(t_n)$$

where $A(i,t)$ are I(0) variables. Since $W(t_n)$ is I(1) and $A(i,t)$ are I(0), the observed long-run movement in each yield is mainly due to the common trend(s). $W(t_n)$ drives the time series behavior of each yield and determines how the entire yield curve change over time. $W(t_n)$ is considered as something exogenous to the yield curve system. When a single trend is found by the Johansen cointegration test, the yield curve is assumed to be moving as a result of s single trend caused by monetary policy expectations.

3.3 Granger Causality Test

The Granger causality test analyzes whether x (one-month OIS rate as an indicator of monetary policy expectation) affects y (market interest rates such as AGB and IRS) or y affects x or x and y affect one another mutually in the time series model with regard to variables x and y. The original data are usually transformed into the change ratio to avoid the problem of spurious regression. However, using these data is considered to cause an error. Toda and Yamamoto (1995) developed the Granger causality test in which non-stationary data are used. According to their method, the null hypothesis H_0 is tested as to the influence from y to x and the influence from x to y. However, the trend term *t* and *p* + 1 (original lag plus one) are added for the estimation.

$$x_t = u_0 + u_t + \sum_{i=1}^{p+1} \alpha_i x_{t-i} + \sum_{i=1}^{p+1} \beta_i y_{t-i} + u_t \qquad (2)$$

$$H_0 : \beta_1 = \beta_2 = \cdots \beta_p = 0$$

$$H_1 : \text{Either } \beta_i \neq 0 \quad (i = 1,2,\cdots,p)$$

$$y_t = v_0 + v_t + \sum_{i=1}^{p+1} \gamma_i x_{t-i} + \sum_{i=1}^{p+1} \delta_i y_{t-i} + v_t \qquad (3)$$

$$H_0 : \gamma_1 = \gamma_2 = \cdots \gamma_p = 0$$

$$H_1 : \text{Either } \gamma_i \neq 0 \quad (i = 1,2,\cdots,p)$$

The F test is conducted by estimating (2) and (3) through OLS and summing the squared error. If the null hypothesis H_0 in the formula (2) is rejected, y is considered to explain x; in other words, the market interest rate affects the one-month OIS rate. If the null hypothesis of H_0 in the formula (3) is rejected, x is considered to explain y; in other words, the one-month OIS rate affects the market interest rate.

4. Results

4.1 Unit Root Test

The ADF and PP tests are conducted for the original series. The results of the PP test for ten-year AGBs with and without trend show that the data does not contain a unit root at the 5 % level. However, the result of the PP test for ten-year AGBs with trend shows that the data contains a unit root at the 1 % level[6]. All of the results except for these cases show that the data contain a unit root at the 5 % level. From these results, it cannot be denied that all the variables contain unit roots. The results are shown in Table 2.

Table 2. Results of ADF and PP Unit Root Tests (Original Series)

Variable	Without Trend	With Trend	Without Trend	With Trend
	ADF Test		PP Test	
OIS1M	−0.354	−1.324	−0.628	−0.652
BA30D	−0.304	−1.105	−0.660	−0.663
BA90D	−0.326	−1.289	−0.764	−0.739
BA180D	−0.322	−1.418	−0.929	−0.890
AGB2Y	−0.479	−1.798	−1.789	−1.799
AGB3Y	−0.532	−2.182	−2.182	−2.184
AGB4Y	−0.531	−2.147	−2.415	−2.416
AGB5Y	−0.522	−2.713	−2.714	−2.718
AGB7Y	−0.514	−3.207	−3.203	−3.212
AGB10Y	−0.517	−2.675	−3.670*	−3.688*
IRS2Y	−0.476	−1.488	−1.646	−1.636
IRS3Y	−0.541	−1.802	−1.961	−1.958
IRS4Y	−0.565	−1.981	−2.193	−2.197
IRS5Y	−0.555	−2.127	−2.324	−2.332
IRS7Y	−0.541	−2.438	−2.605	−2.620
IRS10Y	−0.517	−2.767	−2.956	−2.967

Notes:
* indicates significance at the 5% level.
5% critical values are −2.86 (without trend) and −3.41 (with trend).
OIS = overnight indexed swap, BA = bank accepted bill
AGB = Australian Government Bond, IRS = interest rate swap

[6] The results of the ADF test for ten-year AGBs with and without trend indicate that the data contain a unit root at the 5 % level.

Next, ADF and PP tests are conducted for the first differenced series. The results show that none of the data contain unit roots. Thus, it is clear that all of the variables for the analysis are non-stationary I (1). The results are shown in Table 3.

Table 3. Results of ADF and PP Unit Root Tests (Series with First Difference)

Variable	Without Trend	With Trend	Without Trend	With Trend
	ADF Test		PP Test	
⊿OIS1M	−11.090*	−11.078*	−50.305*	−50.316*
⊿BA30D	−18.002*	−17.972*	−43.457*	−43.466*
⊿BA90D	−14.017*	−13.989*	−44.351*	−43.360*
⊿BA180D	−14.532*	−14.461*	−44.691*	−44.697*
⊿AGB2Y	−47.428*	−47.173*	−47.438*	−47.438*
⊿AGB3Y	−48.247*	−47.993*	−48.258*	−48.258*
⊿AGB4Y	−48.901*	−48.592*	−48.913*	−48.913*
⊿AGB5Y	−50.357*	−50.073*	−50.369*	−50.369*
⊿AGB7Y	−51.759*	−51.536*	−51.771*	−51.772*
⊿AGB10Y	−52.493*	−52.239*	−52.505*	−52.506*
⊿IRS2Y	−54.231*	−53.988*	−54.243*	−54.244*
⊿IRS3Y	−53.820*	−53.545*	−53.833*	−53.833*
⊿IRS4Y	−54.686*	−54.451*	−54.699*	−54.699*
⊿IRS5Y	−54.724*	−54.449*	−54.737*	−54.737*
⊿IRS7Y	−53.748*	−53.557*	−53.761*	−53.761*
⊿IRS10Y	−53.861*	−53.687*	−53.873*	−53.875*

Notes:
* indicates significance at the 5% level.
5% critical values are −2.86 (without trend) and −3.41 (with trend).
OIS = overnight indexed swap, BA = bank accepted bill
AGB = Australian Government Bond, IRS = interest rate swap

4.2 Cointegration Tests

Johansen cointegration tests are applied for the two kinds of yield curve detailed below. The results of each analysis are reported below.

(1) One-month OIS, bank accepted bill yields of 30, 90, and 180 days, and AGB yields of two, three, four, five, seven and ten- ears. (ten series)

The analysis indicates that there are nine cointegration vectors and one common trend and that the whole term structure is driven by a single common trend. The results are shown in Table 4. Thus, the entire yield curve of AGB is considered to be driven by expectations regarding the RBA's monetary policy.

(2) One-month OIS, bank accepted bill yields of 30, 90, and 180 days, and IRS rates of two, three, four, five, seven, and ten-years. (ten series)

The analysis indicates that there are eight cointegration vectors and two common trends and that the whole term structure is driven by two common trends. The results are shown in Table 4. Thus, the entire yield curve of IRS is considered to be driven by expectations regarding the RBA's monetary policy expectations and another trend.

Table 4. Results of Johansen Cointegration Test

Null	Alternative	Test Statistics AGB	Test Statistics IRS	5% Critical Value
r = 0	r = 1	799.930*	1739.422*	291.40
r ≦1	r = 2	493.597*	1188.983*	244.15
r ≦2	r = 3	345.808*	799.984*	202.92
r ≦3	r = 4	242.284*	516.118*	165.58
r ≦4	r = 5	148.044*	289.505*	131.70
r ≦5	r = 6	102.174*	174.422*	102.14
r ≦6	r = 7	64.940*	94.459*	76.07
r ≦7	r = 8	38.267*	46.690*	53.12
r ≦8	r = 9	21.351*	19.829	19.96
r ≦9	r = 10	5.541	5.942	9.24

Notes:
The Johansen cointegration trace test is conducted using 10 series data.
For AGB yield curve, there are nine cointegration vectors and one common trend.
For IRS yield curve, there are eight cointegration vectors and two common trends.
* indicates signigicance at the 5 % level.
AGB = Australian Government Bond, IRS = interest rate swap

4.3 Granger Causality Test

First, the impacts of the one-month OIS rate on each interest rate of the entire term structure are investigated. It influences the bank accepted bill yields of 30, 90 and 180 days, and the entire term structure of both AGB and IRS. The one-month OIS is assumed to have greater influence on the shorter maturities from two to ten years in both AGB and IRS yield curves because the F-statistics increase as the maturities of the interest rate get shorter. The results are shown in Table 5.

Next, the influences of each market interest rate on the one-month OIS rate are analyzed. Bank accepted bill yields of 30, 90, and 180 days, as well as the AGB yields and IRS rates of two years, are found to have an influence on the one-month OIS rate. In other words, the AGB yields and the IRS rates of three, four, five, seven, and ten years have no impact on the one-month OIS rate. The results are shown in Table 5.

Table 5. Results of Granger Causality Test

F Statistics 1 Month OIS Rate and Market Interest Rates			
Causality of 1 month OIS rate on Market Interest Rates		Causality of Market Interest Rates on 1 month OIS rate	
BA30D	35.882*	BA30D	57.116*
BA90D	27.827*	BA60D	10.578*
BA180D	54.007*	BA90D	18.823*
AGB2Y	45.697*	AGB2Y	3.000*
AGB3Y	35.672*	AGB3Y	1.482
AGB4Y	32.076*	AGB4Y	1.855
AGB5Y	30.276*	AGB5Y	1.824
AGB7Y	20.534*	AGB7Y	2.321
AGB10Y	15.770*	AGB10Y	1.769
IRS2Y	45.734*	IRS2Y	2.118*
IRS3Y	32.531*	IRS3Y	1.381
IRS4Y	27.654*	IRS4Y	1.071
IRS5Y	24.889*	IRS5Y	1.840
IRS7Y	20.172*	IRS7Y	1.423
IRS10Y	16.028*	IRS10Y	1.769

Notes:
* indicates significance at the 5 % level.
OIS = Overnight Indexed Swap, BA = Bank Accepted Bill
AGB = Australian Government Bond, IRS = Interest Rate Swap

5. Conclusion

The purpose of this paper is to examine the impact of monetary policy expectation on market interest rates in Australia. The one month OIS rate is used as an indicator of market expectation regarding the RBA's monetary policy. Bank accepted bill yields of 30, 90 and 180 days are used as short-term interest rates. AGB yields and IRS rates of two, three, five and ten years are used as long-term interest rates.

The yield curve of AGB comprises a single common trend driven by expectations regarding the RBA's monetary policy. On the other hand, the yield curve of IRS comprises two common trends: expectation regarding the RBA's monetary policy and another trend. The RBA can influence the yield curves of AGB and IRS for a maturity of up to ten years through the monetary policy expectation formed in the financial market. A comparison between the two yield curves suggests that the impact of monetary policy expectation is greater on the AGB yield curve than on the IRS yield curve. Monetary policy expectation can have a greater impact on the shorter maturities of both AGB and IRS; in other words, the impact lessens as the maturities of AGB and IRS get longer.

The maturities of three to ten years are influenced by monetary policy expectation unilaterally. On the other hand, mutual causalities between the one-month OIS rate and market interest rates up to two years are confirmed. The term structure up to two years is considered as forming a single zone in the short-term market in which interest rates are formed by mutual causalities through arbitrage activities. But the causalities from the one-month OIS rate to market interest rates are much stronger than those from market interest rates to the one- month OIS rate except for the bank bill yield of 30 days.

The fact that the AGB yield curve comprises a single trend, but the IRS yield curve comprises two trends has the following implications. In terms of monetary policy, the RBA can possibly exert more control on the AGB yield curve than on the IRS yield curve through the communication with the financial markets. This is because, in comparison with the AGB, the IRS market has a greater risk premium caused by the credit difference between the private sector of the IRS market and the government sector of the AGB market. As a central bank, the RBA needs to pay more attention to the IRS yield curve than to the AGB yield curve to achieve the goal of price stability because the interest rates for both housing and equipment investments loans are more closely connected with IRS than with AGB.

In the future, this paper will be extended in two ways: (1) the framework of inflation targeting will be incorporated into the analysis of this study. and (2) the impact of monetary policy expectation on market interest rates will be compared among major countries and regions such as the US, the UK, and the Euro Zone.

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