CHAPTER 8

Monetary Policy Transmission in India

SONALI DAS

Inflation management requires a clear understanding of the channels through which monetary policy affects the economy. As a demand management policy, the effectiveness of monetary policy in combating inflation depends on the strength of its effects on aggregate demand; that is, on the strength of monetary policy transmission. This chapter provides new evidence on monetary policy transmission in India since 2002.

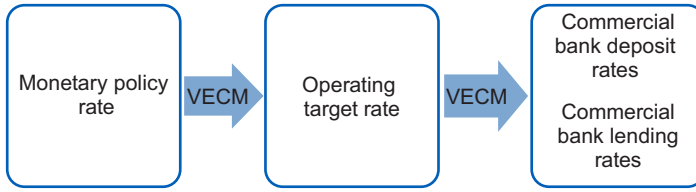
The monetary policy framework of India's central bank has been evolving since the mid-1990s, and the Patel Committee Report to the Reserve Bank of India (RBI 2014) laid out a path for a strengthened framework. Of the potential channels through which monetary policy can affect output—through interest rates, the credit channel, asset prices, and exchange rates—this chapter focuses on the first part of the credit channel, namely pass-through from the policy rate to bank deposit and lending rates. Mishra and Montiel (2012) review the reasons why the credit (bank lending) channel is likely to be the dominant one for developing economies, and previous studies of the potential channels in India have found this to be the case (for example, Sengupta 2014).

The questions this chapter seeks to shed light on are: (1) what are the extent and speed of pass-through from monetary policy to the deposit and lending rates of Indian banks; (2) is pass-through symmetric or do episodes of monetary tightening and loosening have different effects on bank interest rates; and (3) has pass-through changed over time, with changes to the monetary policy operating framework? To answer these questions, we estimate the pass-through from monetary policy changes to bank interest rates in two steps (Figure 8.1): from the monetary policy rate to the interbank market rate that is targeted by the framework, and then from the target rate to bank interest rates (deposit and lending rates).

There are two advantages to this stepwise estimation. The results from the first step indicate how well the framework is set up to control its target market rate.[1] And the interpretation of relationships is clearer than it would be in a vector error cointegration model with multiple (three) cointegrating relationships.

[1] Many studies on transmission in India and in other countries assume a correspondence between the policy stance and the target rate, and use the target rate as a starting point in the analysis of transmission.

Figure 8.1. Stepwise Estimation of Error Correction Models



Source: Author.
Note: VECM = vector error correction model.

In each step, an error correction model is used, which allows for the estimation of the long-run relationship between policy and bank rates, as well as the speed of adjustment to this long-run pass-through. The method also allows for the estimation of asymmetric adjustment parameters to study whether there are differential responses to policy rate increases and decreases.

STUDIES OF MONETARY POLICY TRANSMISSION IN INDIA

Concerns about transmission are not unique to India; the strength of monetary policy transmission in developing economies as a whole has come into question (Mishra and Montiel 2012; Mishra and others 2014).[2] Sengupta (2014) uses a vector autoregression (VAR) to study the various channels of monetary transmission in India from 1993 to 2012. She finds a structural break in transmission corresponding to the introduction of the Liquidity Adjustment Facility (LAF) in 2000, with the bank lending channel remaining important since the facility's introduction, but with the interest rate and asset price channels becoming stronger. Singh (2011) uses a VAR model from March 2001 to June 2012 to estimate pass-through from the policy rate to a variety of short- and long-run market interest rates.[3] He finds significant contemporaneous pass-through under deficit liquidity conditions, as well as significant lagged effects.[4] A drawback of this estimation method is that while it gives an idea of the effect of changes in the policy rate on other interest rates, it does not give a sense of the speed of transmission, which is a factor that policymakers must consider when making policy rate decisions. Mohanty (2012) also narrows in on the interest rate channel, studying policy rate changes through to their effects on output and inflation. Estimating a quarterly structural VAR model, he finds that policy rate increases have a negative

[2]The literature studying the effects of monetary policy is vast. See Christiano, Eichenbaum, and Evans (2000) for a review of the literature on monetary policy transmission; and Beck, Colciago, and Pfajfar (2014) for a review of the role of financial intermediaries in monetary policy transmission.
[3]The study includes 11 interest rates, the exchange rate, a stock index return, the LAF balance, and the wholesale price index to measure inflation.
[4]For example, a 1 percentage point change in the repo rate leads to a 75–80 basis point change in several short-run rates, and to a 50 basis point change in medium- and long-run rates.

effect on output growth with a lag of two quarters and a moderating impact on inflation with a lag of three quarters, with both effects persisting for eight to 10 quarters.

BRIEF DESCRIPTION OF INDIA'S MONETARY POLICY FRAMEWORK

India's monetary policy framework has undergone several changes in recent years.[5] An interim LAF was introduced in April 1999 and then transitioned toward a full-fledged LAF through periodic modifications. The LAF has helped in developing policy interest rates as the main monetary policy instrument, and, since November 2004, has operated using overnight fixed-rate repos and reverse repos with banks. The LAF is the key element in the RBI's operating framework and is meant to operate in a deficit liquidity mode, with liquidity contained around ±1 percent of all banks' net demand and time liabilities. Banks pledge government securities as collateral, most of which should be over and above the securities they must hold to comply with liquidity regulations (the standard liquidity ratio).[6] In May 2011 the LAF was enhanced along several dimensions, a key point of which was the explicit recognition of the weighted-average overnight call money rate (WACMR) as the operating target of monetary policy. Chapter 4 of RBI (2014) discusses likely impediments to monetary transmission and provides exploratory evidence[7] of an asymmetric effect of the policy rate on deposit and lending rates in India. It groups likely impediments to transmission into three broad categories: fiscal dominance, the large informal sector, and financial and credit market frictions.

Because some banks were pricing loans under their advertised prime lending rates, the transparency of lending rates became a concern. The RBI instituted a "base rate" system, which became effective in July 2010, with the aim of enhancing transparency in the lending rates of banks and enabling better assessment of the transmission of monetary policy (RBI 2010). Under this system, a bank's base rate is the minimum rate at which it can lend, as loans are priced from the base rate with the addition of borrower-specific charges. Banks are free to use their own formula to calculate their base rate, as long as it is calculated in a consistent manner and made available for supervisory review. Banks are expected to calculate their base rate taking their costs of funds, costs of complying with certain regulations (cash reserve ratio and standard liquidity ratio), overhead costs, and profits into account. Although banks now price loans from the base rate, they still report prime lending rates. In practice, the prime lending

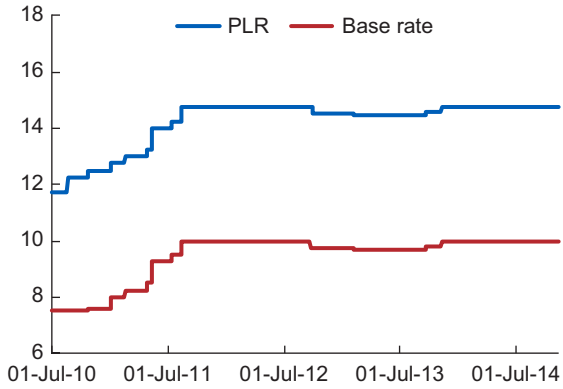
[5] See Mohanty (2011) for a history of the framework up to 2011.

[6] Banks in India are subject to a statutory liquidity ratio—a certain share of net total demand and time liabilities that they must invest in gold and/or government-approved securities. This ratio was 25 percent in 2002, and was decreased from 22 percent to 21.5 percent in February 2015.

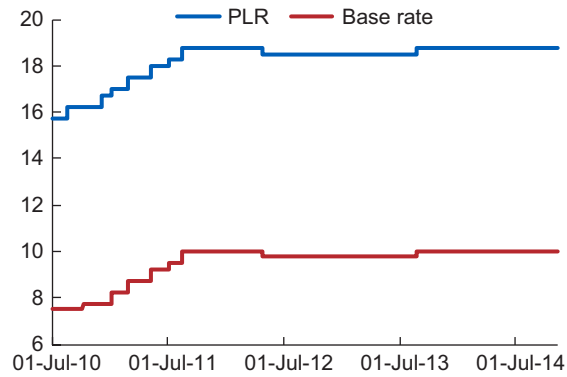
[7] Summary statistics of the policy rate, and deposit and lending rates over periods of monetary tightening and loosening.

Figure 8.2. Bank Base Rates and Prime Lending Rates

1. State Bank of India



2. ICICI Bank



Source: CEIC.
Note: PLR = prime lending rate.

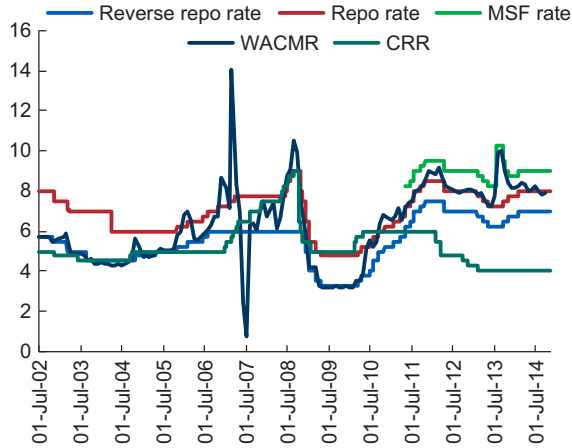
and base rates move together. Figure 8.2 shows both rates at the State Bank of India, the country's largest publicly owned bank, and ICICI Bank, the largest privately owned bank.

DATA AND DESCRIPTIVE STATISTICS

The data come from CEIC[8] and Thomson Reuters Datastream and are made up of two groups of variables: those capturing the monetary policy stance, and information on bank interest rates and balance sheets (Figures 8.3 and 8.4). The sample runs from the end of March 2002 to the end of October 2014; each observation is a two-week period. Daily data on interest rates and LAF transactions are averaged over two-week periods; the bank balance-sheet data are

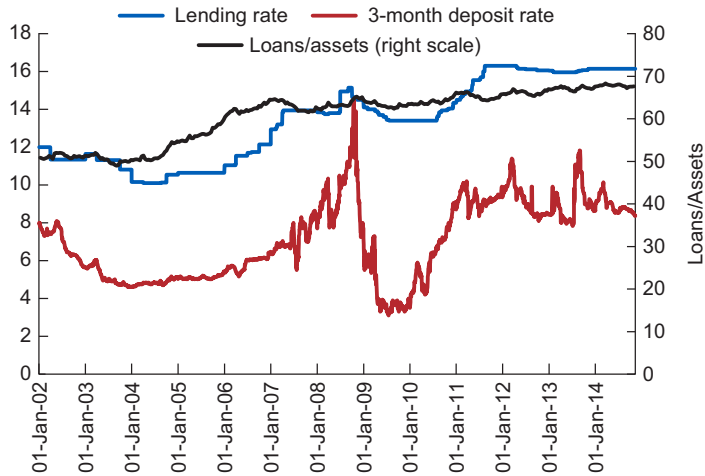
[8] CEIC sources these data series from the RBI.

Figure 8.3. Monetary Policy Rates



Source: CEIC.
Note: CRR = cash reserve ratio; WACMR = weighted-average call money rate; MSF = marginal standing facility.

Figure 8.4. Interest Rates and the Aggregate Ratio of Bank Loans to Assets



Sources: CEIC; and Thomson Reuters Datastream.
Note: WACMR = weighted-average call money rate.

available on a biweekly basis (see Box 8.1). The monetary policy rates considered are the reverse repo rate and the repo rate. The daily net injection by the RBI to banks through the LAF is equal to the amount lent through the overnight repo facility (amount outstanding on a given day), plus the amount lent through the term repo facility, less the amount borrowed through the reverse repo facility. The

Box 8.1 Empirical Method

The variables used in this chapter are I(1) with the exception of the Liquidity Adjustment Facility net injection, which is I(0). A lag length of four two-week periods is used in both steps of the estimation, based on the Hannan-Quinn information criterion.

Step 1: Pass-Through to the Target Rate from Monetary Policy

An error correction model that has two stages, corresponding to the long-run pass-through and short-run dynamics, is estimated as follows:

$$(LR)\ WACMR_t = \beta_0 + \beta_1\ \text{RepoRate}_t + \varepsilon_t$$

$$(SR)\ \Delta WACMR_t = \alpha ECT_t + \sum_{k=1}^{K} \delta_{2k} \Delta WACMR_{t-k} + \delta_{3k} \Delta (LAFnetinj\ /\ NTDL)_{t-k} + v_t$$

where the error correction term:

$$ECT_t = WACMR_{t-1} - \hat{\beta}_0 - \hat{\beta}_1\ \text{RepoRate}_{t-1}$$

is the residual from the LR equation, which measures period $t-1$ deviations from the long-run stationary relationship.

The identifying assumption that underlies this step of the empirical method is that the repo rate is weakly exogeneous to the WACMR. That is, there is no feedback to the repo rate from the WACMR. This is a reasonable assumption, in that the repo rate is a policy rate decided by the central bank.

The average elasticity of WACMR with respect to the repo rate is:

$$\eta = \beta_1 \frac{mean(\text{RepoRate})}{mean(\text{WACMR})}$$

and the α coefficient is the share of the deviation from the LR equilibrium that decays each month, representing the speed of adjustment.

Alternate specification: in principle, the repo rate is the one policy rate that signals the stance of monetary policy, with the reverse repo rate being a fixed distance under the repo rate and the marginal standing facility rate being a fixed distance above the repo rate. However, before implementation of the Liquidity Adjustment Facility, there were considered to be two effective policy rates, depending on the liquidity situation:

- Reverse repo rate when in a liquidity surplus ($LAFnetinj < 0$)
- Repo rate when in a liquidity deficit ($LAFnetinj > 0$)

To account for the effective policy rate depending on the liquidity situation, a specification is estimated where both the reverse repo rate and repo rate are included in the long-run stage:

$$(LR1)\ WACMR_t = \beta_0 + \beta_{11}\text{RevRepoRate}_t \times LiqDef_t + \beta_{12}\text{RepoRate}_t \times LiqDef_t + \varepsilon_t$$

$$\text{where}\ \ LiqDef_t = \begin{cases} 0 & \text{if}\ \ LAFnetinj < 0 \\ 1 & \text{if}\ \ LAFnetinj > 0 \end{cases}$$

Step 2: Pass-Through to Bank Interest Rates from the Target Rate

As Johansen's trace statistic method suggests the presence of two cointegrating relationships between the WACMR, the deposit rate, and the lending rate, a vector error correction model is estimated with the following cointegrating relationships:

Box 8.1 (*continued*)

$$(LRl)\ LendingRate_t = \theta_0^l + \theta_1^l WACMR_t + \varepsilon_{1t}$$

$$(LR2)\ DepositRate_t = \theta_0^d + \theta_1^d WACMR_t + \varepsilon_{2t}$$

The key short-run equations of interest in the vector error correction model are represented as follows:

$$(SRl)\ \Delta LendingRate_t = \alpha_1^l ECT1_t + \alpha_2^l ECT2_t + \sum_{k=1}^{K} \delta_{3k} \Delta Rate_{it-k} + \delta_{4k} \Delta WACMR_{t-k} + \delta_{5k} \Delta Loans / Assets_{t-k} + v_{lt}$$

$$(SRd)\ \Delta DepositRate_t = \alpha_1^d ECT1_t + \alpha_2^d ECT2_t + \sum_{k=1}^{K} \delta_{3k} \Delta Rate_{it-k} + \delta_{4k} \Delta WACMR_{t-k} + \delta_{5k} \Delta Loans / Assets_{t-k} + v_{dt}$$

where the error correction terms are:

$$ECT1_t = \hat{\varepsilon}_{1t} \text{ and } ECT2_t = \hat{\varepsilon}_{2t}$$

The identifying assumptions that underlie this step of the empirical method are that the lending rate is weakly exogenous to the WACMR, and that the deposit rate is weakly exogenous to the WACMR. The first assumption is reasonable because changes in interest rates on bank loans, which will be of longer maturity, are unlikely to have feedback effects on overnight call money transactions. The second assumption is perhaps more difficult in that an increase in the cost of deposits could make raising funds in the overnight market more attractive. This funding strategy would not be viable for an extended period, however, so any feedback effects are likely to be small.

The coefficient on the first error correction term, *ECT*1, in (*SRl*) represents the speed of adjustment of the lending rate to a deviation in the relationship between the lending rate and the WACMR. The coefficient on the second error correction term, *ECT*2, in (*SRl*) represents the speed of adjustment of the lending rate to a deviation in the relationship between the deposit rate and the WACMR. Similarly, the coefficient on the first error correction term, *ECT*1, in (*SRd*) represents the speed of adjustment of the deposit rate to a deviation in the relationship between the lending rate and the WACMR. The coefficient on the second error correction term, *ECT*2, in (*SRd*) represents the speed of adjustment of the deposit rate to a deviation in the relationship between the deposit rate and the WACMR.

Asymmetric Speed of Adjustment

The error correction terms in the step 2 estimation, *ECT*1 and *ECT*2, are then split into their positive and negative components (corresponding to a decrease in the WACMR and an increase in the WACMR, respectively) to test whether the adjustment parameters are the same for instances of monetary loosening and tightening.

market interest rate targeted by the monetary policy framework is the WACMR, and the two main bank interest rates considered are the rate on three-month certificates of deposits and the average prime lending rate of five major banks. All quantity series are deflated using the consumer price index. See Table 8.1 for descriptive statistics.

TABLE 8.1

Descriptive Statistics

	Mean	Standard Deviation	Minimum	Maximum
Reverse repo rate	5.56	1.14	3.25	7.5
Repo rate	6.99	1.09	4.75	9
LAF net injection/NDTL (%)	0.22	1.26	−3.21	2.93
Cash reserve requirement	5.26	1.06	4	9
Statutory liquidity ratio	24.4	0.83	22	25
WACMR	6.30	1.82	2.42	10.5
Deposit rate, 3-month	7.03	2.05	3.4	11.5
Prime lending rate	13.4	2.12	10.1	16.3
Bank securities/loans	52.0	15.6	36.9	85.7
Bank loans/assets	61.0	6.0	49.0	68.3

Source: Author's calculations.
Note: 328 observations. LAF = Liquidity Adjustment Facility; NDTL = net demand and time liabilities; WACMR = weighted-average call money rate.

RESULTS

The vector error correction model (VECM) estimation method is used because of the presence of cointegrating vectors in the variables. In the first step, trace statistics suggest the presence of a cointegrating vector between the repo rate and the WACMR. In the second step, no cointegrating vector between the deposit rate and the lending rate is found, but test results indicate two cointegrating vectors between the WACMR, the deposit rate, and the lending rate.

Deposit rates are expected to have an effect on lending rates, as deposit rates make up part of a bank's cost of funds, which should in turn affect the cost at which a bank lends out funds. The relationship between the rate on deposits of a particular maturity and the lending rate could be weak, however, when the deposit instrument under consideration does not make up an important part of the bank's borrowed funds, and because lending rate decisions are determined only in part by the bank's cost of funds. Although this chapter shows no cointegrating vector between the deposit rate and lending rate, this does not indicate that there is no empirical relationship between these two variables, but only that there is no long-run relationship over the sample period (see Table 8.2).

Step 1: Pass-Through to the Target Rate from Monetary Policy

Results from the first step of estimation show there is a cointegrating vector between the monetary policy rate and the operating target rate. The coefficient

TABLE 8.2

Summary of Cointegration Test Results

Variables	Maximum Rank
WACMR, repo rate	1
Lending rate, deposit rate	0
Lending rate, deposit rate, WACMR	2

Source: Results from Johansen tests for cointegration, at 95 percent confidence level.
Note: WACMR = weighted-average call money rate.

on the repo rate in column 1 of Annex Table 8.1.1 of 1.287 indicates a long-run elasticity between the repo rate and the WACMR of 1.43. Another aspect of monetary policy, the cash reserve ratio, was not found to have a significant relationship with the WACMR.[9] From the estimates of the alternate specification, where the effective policy rate is the reverse repo rate when there is a liquidity surplus and the repo rate when there is a liquidity deficit, we see that both rates are part of a cointegrating relationship with the WACMR. The long-run elasticity of the WACMR for the reverse repo rate is 0.48 and the elasticity for the repo rate is 0.99, shown in column 2 of Annex Table 8.1.1, which together come to about the same elasticity with the WACMR as the repo rate does in the first specification. The repo rate appears to sufficiently capture the monetary policy stance of the RBI.

Turning to the estimates of the adjustment parameters and short-run coefficients, in Annex Table 8.1.2, we find an estimate of α equal to –0.06. This indicates that, when there is deviation from the equilibrium between the WACMR and the repo rate, the WACMR adjusts by 6 percent per time period toward the repo rate to reestablish equilibrium. At this rate, it would take 5.6 months (11.2 two-week periods) to achieve 50 percent of the pass-through from an increase in the repo rate.

Step 2: Pass-Through to Bank Interest Rates from the Target Rate

The long-term results of the VECM estimated in the second step are shown in Annex Table 8.1.3. The top part shows the cointegrating vector between the lending rate, the WACMR, and the share of loans in assets. The elasticity of the lending rate with respect to the WACMR is 0.30, meaning that, on average, only 30 percent of a change in the WACMR gets passed on to the lending rate. The coefficients in the lower panel indicate an elasticity of the three-month deposit rate with respect to the WACMR is 1.11.

The estimates of the (symmetric) adjustment parameters and short-run coefficients, in Annex Table 8.1.4, show that the speed of adjustment has also increased in recent years. The adjustment coefficients are as expected: with a negative and statistically significant coefficient in the differenced lending (deposit) rate equation on the lending (deposit) error correction model and the other adjustment parameter coefficients being mainly statistically insignificant. The coefficient of –0.042 indicates that the lending rate adjusts by 4 percent per time period toward the WACMR after a deviation from equilibrium, resulting in 8.1 months to achieve 50 percent of the pass-through from a change in the WACMR. This estimate does not allow us to distinguish between instances of monetary tightening and loosening, which are explored in a later section with estimates of asymmetric adjustment parameters. The deposit rate adjusts to

[9]The cash reserve ratio was not found to have a cointegrating vector with the WAMCR; nor was it found to Granger-cause WACMR after a simple VAR with both variables.

deviations between the deposit rate and the WACMR more quickly, with the coefficient of –0.081 indicating 4.1 months to achieve 50 percent of pass-through.

Cumulative Pass-Through and Adjustment

This section combines the results of the two steps of estimation to give an overall picture of the transmission of monetary policy to deposit and lending rates. Over the two steps of the analysis, the cumulative long-run elasticity of the deposit rate with respect to the repo rate is 1.58. This indicates that a 1 percentage point increase in the repo rate is associated with a 1.58 percentage point increase in the deposit rate over time. Pass-through to the lending rate is partial—the cumulative long-run elasticity of the lending rate with respect to the repo rate is 0.43. A larger pass-through to the deposit rate than to the lending rate is as expected, because the deposit rate in the analysis is a three-month rate, while loans tend to have longer maturities. This is also consistent with previous studies that find greater pass-through to interest rates with shorter maturities.

Next, we consider the speed of adjustment under the assumption that adjustment to a monetary tightening and loosening is symmetric. This assumption is relaxed in the next section to estimate potential asymmetric adjustment speeds. Pass-through to deposit and lending rates is relatively slow and the deposit rate adjusts more quickly to monetary policy changes than the lending rate does (Table 8.3). In the first step of transmission, it takes about 5.6 months for 50 percent of the pass-through from a change in the repo rate to the WACMR. In the second step, 50 percent of the pass-through from a change in WACMR passes through to the deposit rate in four months, while it takes eight months to pass through to the lending rate.

The pass-through is nonlinear, with more of the adjustment taking place in earlier periods than later. It takes considerably longer for a pass-through of, say, 80 percent to occur. Figure 8.5 shows the path of adjustment to the long-run equilibrium over time, where each tick on the x-axis denotes a two-week period.

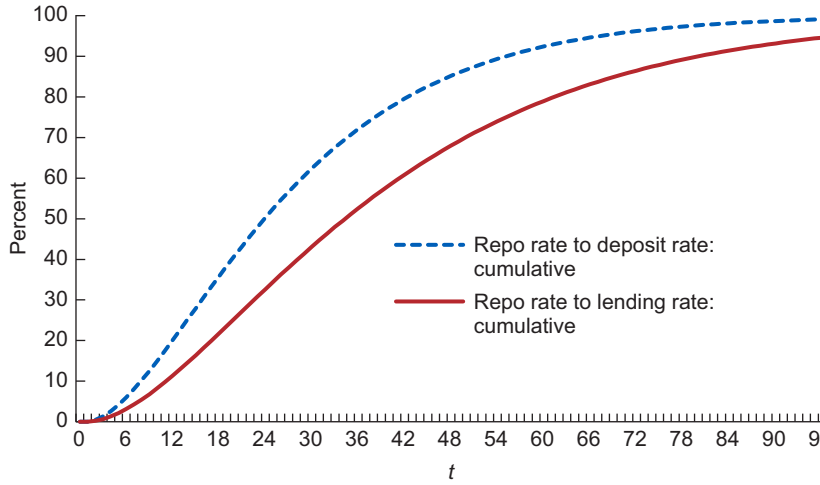
TABLE 8.3

Speed of Adjustment: Number of Months Required to Complete 50 Percent Pass-Through of Repo Rate Increase

Lending Rate	Repo-WACMR	WACMR-Lending	Total
Adjustment coefficient	–0.06	–0.042	
Number of periods	11.2	16.2	34
Number of months	5.6	8.1	17
Deposit Rate	**Repo-WACMR**	**WACMR-Deposit**	**Total**
Adjustment coefficient	–0.060	–0.081	
Number of periods	11.2	8.2	24
Number of months	5.6	4.1	12

Source: Author's calculations, using Annex Tables 8.1.2 and 8.2.2.
Note: WACMR = weighted-average call money rate.

Figure 8.5. Cumulative Speed of Adjustment



Source: Author's calculations.

Sørensen and Werner (2006) apply a similar method to estimating monetary policy transmission in the euro area. Across euro area countries, they estimate speeds of adjustment of short-run lending rates ranging from –0.027 to –0.925, with an average elasticity of 0.7 with respect to the policy rate. For deposit rates, they estimate adjustment parameters from –.054 to –0.320, with an average elasticity of 0.145. Although the results are not exactly comparable to the estimates in this paper,[10] it is interesting to note that the pass-through to deposit and lending rates in India is within the ranges of pass-through estimates for a variety of maturities of euro area deposits and loans found by Sørensen and Werner (2006).

Asymmetric Speed of Adjustment

There is evidence of asymmetry in the pass-through to bank interest rates. In Table 8.4, the coefficient on ECT1 pos (lending) corresponds to a decrease in the WACMR, and ECT1 neg (lending) to an increase in the WACMR. The estimates of these speed-of-adjustment coefficients indicate that the lending rate adjusts more quickly to an increase in the WACMR than to a decrease. On the right side of Table 8.4, the coefficient on ECT2 pos (deposit) corresponds to a decrease in the WACMR, while ECT1 neg (deposit) corresponds to an increase in the WACMR. The estimated speed-of-adjustment coefficients indicate that the deposit rate adjusts downward when the WACMR falls, but not upward

[10] Instead of focusing on a particular monetary policy indicator, their analysis is on the pass-through from different market interest rates to bank interest rates of comparable maturity. Their paper is focused on studying interest rates of different maturities and heterogeneity in the euro area.

TABLE 8.4

Bank Interest Rates and WACMR: Asymmetric Short-Run VECM Results

	Lending Rate D.Lending Rate Full sample		Deposit Rate D.Deposit Rate Full sample
ECT1 pos (lending)	–0.033	ECT1 (lending)	0.014
	(0.022)		(0.025)
ECT1 neg (lending)	–0.042***		
	(0.009)		
ECT2 (deposit)	0.010	ECT2 pos (deposit)	–0.111***
	(0.007)		(0.029)
		ECT2 neg (deposit)	–0.033
			(0.032)
Number of observations	324	Observations	324
F-test: lending ECT asymmetry *(p*-value*)*	0.73	*F*-test: deposit ECT asymmetry *(p*-value*)*	0.07

Note: Standard errors in parentheses. Constant and lags of differenced WACMR, lending rate, deposit rate, loans/assets also included. ECT = error correction term; VECM = vector error correction model; WACMR = weighted-average call money rate.

*** $p < 0.01$.

to a monetary tightening. The adjustment coefficient on ECT2 pos (deposit) is negative and statistically significant, indicating that the deposit rate adjusts downward in response to a monetary loosening. The insignificant coefficient on ECT2 neg (deposit) indicates, however, that it does not adjust upward after a tightening.

HAS MONETARY POLICY TRANSMISSION IMPROVED?

Since changes have been made to the monetary policy operating framework, and the base rate system was put into place in 2010, it may be the case that monetary policy transmission has strengthened in recent years. In this section, the sample is split into two periods: from the end of March 2002 to the end of August 2010 and from the start of September 2010 to the end of October 2014. The long- and short-run pass-through from monetary policy to the deposit and lending rates is estimated for both periods. The LAF was in deficit for the duration of the second period.[11] The overall result is that the extent of pass-through to the deposit rate decreased somewhat in the later period, but the pass-through to the lending rate has increased. The speed of transmission to both the deposit rate and lending rate has increased.

[11] After alternating between liquidity deficit and surplus since the start of the LAF, liquidity has been in deficit continuously since September 9, 2010.

Annex Table 8.1.5 shows the results of the long-run stage of the VECM estimated over the two periods. The extent of pass-through from the WACMR to the lending rate appears to have risen since 2010, with an elasticity of 0.20 in the first part of the sample and 0.32 in the period since September 2010. The extent of pass-through to the deposit rate appears to have fallen, from an elasticity of 1.33 in the first eight years of the sample to an elasticity of 0.71 in the last four years. Annex Table 8.1.6 shows the results of the short-run stage of the VECM estimated over the two periods. The estimated speeds of adjustment of both the deposit rate to the WACMR and the lending rate to the WACMR are higher in the second period than in the first.

Finally, estimation of separate adjustment parameters for monetary loosening and tightening was also done for both sample periods. Annex Table 8.1.7 shows the results. The asymmetric adjustment of the lending rate to monetary tightening and loosening is present in both periods. For the deposit rate, the asymmetry whereby deposit rates adjust downward to loosening but not upward to tightening is present in the first period, but in the second period the estimated adjustment coefficients suggest that the deposit rate adjusts similarly to both loosening and tightening.

CONCLUSION

This chapter provides new evidence on monetary policy transmission in India from the end of March 2002 to the end of October 2014. A two-step VECM was used to estimate the pass-through from changes in the monetary policy stance to the operating target rate, and from the target rate to bank deposit and lending rates. The results show a significant, albeit slow, pass-through of policy changes to bank interest rates in India. The extent of pass-through to the deposit rate is larger than to the lending rate, and the deposit rate adjusts more quickly to changes in the policy rate. There is evidence of asymmetric adjustment to monetary policy. Throughout most of the sample period, deposit rates do not adjust upward in response to monetary tightening, but they do adjust downward to loosening; and the lending rate adjusts more quickly to monetary tightening than to loosening. The extent of pass-through to the lending rate increased in the latter part of the sample, to a cumulative elasticity of 0.46 with respect to the policy rate. For both the deposit rate and lending rate, the speed of adjustment to changes in the policy rate increased in the latter part of the sample. As changes in bank lending rates are only the first step in the bank lending channel, further research on bank lending behavior is needed to understand the importance of the bank lending channel in India.

ANNEX 8.1

ANNEX TABLE 8.1.1

WACMR and Policy Rate: Long-Run ECM Results

	(1) WACMR Full Sample	(2) WACMR Full Sample
Repo rate	1.287***	
	(0.213)	
Reverse repo rate * Liq deficit dummy		1.815***
		(0.379)
Repo rate * Liq deficit dummy		1.285***
		(0.244)
Number of observations	324	324
Pass-through elasticity (reverse repo rate)		0.48
Pass-through elasticity (repo rate)	1.43	0.99
Mean dependent variable	6.30	6.30

Source: Author's calculations.

Note: Standard errors in parentheses. ECM = error correction model; Liq = liquidity; WACMR = weighted-average call money rate.

*** $p < .01$.

ANNEX TABLE 8.1.2

WACMR and Policy Rate: Short-Run ECM Results

	(1)	
	D. WACMR Full Sample	D. Repo Rate Full Sample
Error correction term	–0.060***	0.009
	(0.015)	(0.006)
LD.repo rate	0.510***	0.401***
	(0.147)	(0.054)
L2D.repo rate	0.080	–0.121**
	(0.160)	(0.059)
L3D.repo rate	–0.148	0.264***
	(0.144)	–0.053
LD.WACMR	0.746***	0.049**
	(0.055)	(0.020)
L2D.WACMR	–0.305***	–0.029
	(0.066)	(0.025)
L3D.WACMR	0.133**	0.037*
	(0.058)	(0.021)
R^2	0.449	0.3288
Number of observations	324	324

Source: Author's calculations.

Note: Standard errors in parentheses. Specification includes constant and lags of differenced LAFnetinj/NDTL (the net injection under the Liquidity Adjustment Facility as a share of net demand and time liabilities). ECM = error correction model; LD = one lag of differenced variable; WACMR = weighted-average call money rate.

*** $p < .01$, ** $p < .05$, * $p < .1$.

ANNEX TABLE 8.1.3

Bank Interest Rates and WACMR: Long-Run VECM Results

Lending Rate	Lending Rate Full Sample
WACMR	0.638***
	(0.100)
Number of observations	324
Pass-through elasticity (WACMR)	0.30
Mean dependent variable	13.44

Deposit Rate	Deposit Rate Full Sample
WACMR	1.235***
	(0.116)
Number of observations	324
Pass-through elasticity (WACMR)	1.11
Mean dependent variable	7.01

Source: Author's calculations.
Note: Standard errors in parentheses. VECM = vector error correction model; WACMR = weighted-average call money rate.
*** $p < .01$.

ANNEX TABLE 8.1.4

Bank Interest Rates and WACMR: Short-Run VECM Results

	Lending Rate D.Lending rate Full sample	Deposit Rate D.Deposit rate Full sample
ECT1 (lending)	–0.042***	0.031
	(0.008)	(0.022)
ECT2 (deposit)	0.010	–0.081***
	(0.008)	(0.022)
LD.WACMR	0.007	0.311***
	(0.024)	(0.065)
L2D.WACMR	–0.053*	–0.177**
	(0.030)	(0.081)
L3D.WACMR	0.084***	0.195***
	(0.026)	(0.071)
Number of observations	324	324

Source: Author's calculations.
Note: Standard errors in parentheses. Specifications include constant, and lags of differenced lending rate, deposit rate, and loans/assets. ECT = error correction term; LD = one lag of differenced variable; VECM = vector error correction model; WACMR = weighted-average call money rate.
*** $p < .01$, ** $p < .05$, * $p < .1$.

ANNEX TABLE 8.1.5

Bank Interest Rates and WACMR: Long-Run VECM Results, Split Sample

Lending Rate	Lending Rate April 2002–August 2010	Lending Rate September 2010–October 2014
WACMR	0.442***	0.637***
	(0.123)	(0.095)
Number of observations	216	108
Pass-through elasticity (WACMR)	0.20	0.32
Mean dependent variable	12.2	15.8
Deposit Rate	**Deposit Rate April 2002–August 2010**	**Deposit Rate September 2010–October 2014**
WACMR	1.466***	0.806***
	(0.129)	(0.166)
Number of observations	216	108
Pass-through elasticity (WACMR)	1.33	0.71
Mean dependent variable	6.00	9.03

Source: Author's calculations.
Note: Standard errors in parentheses. VECM = vector error correction model; WACMR = weighted-average call money rate.
*** $p < .01$.

ANNEX TABLE 8.1.6

Bank Interest Rates and WACMR: Short-Run VECM Results, Split Sample

	April 2002–August 2010		September 2010–October 2014	
	Lending Rate D.Lending Rate	Deposit Rate D.Deposit Rate	Lending Rate D.Lending Rate	Deposit Rate D.Deposit Rate
ECT1 (lending)	–0.045***	0.046	–0.063***	–0.160
	(0.015)	(0.033)	(0.016)	(0.102)
ECT2 (deposit)	–0.002	–0.067**	0.025**	–0.153***
	(0.012)	(0.026)	(0.011)	(0.056)
LD.WACMR	–0.002	0.248***	0.025	1.076***
	(0.029)	(0.067)	(0.045)	(0.227)
L2D.WACMR	–0.067*	–0.153*	0.041	–0.575**
	(0.037)	(0.084)	(0.055)	(0.281)
L3D.WACMR	0.089***	0.219***	–0.053	–0.119
	(0.033)	(0.075)	(0.046)	(0.233)
Number of observations	216	216	108	108

Source: Author's calculations.
Note: Standard errors in parentheses. ECT = error correction term; LD = one lag of differenced variable; VECM = vector error correction model; WACMR = weighted-average call money rate. Specifications include constant, and lags of differenced lending rate, deposit rate, and loans/assets.
*** $p < .01$, ** $p < .05$, * $p < .1$.

ANNEX TABLE 8.1.7

Bank Interest Rates and WACMR: Asymmetric ECM Results, Split Sample

Lending Rate	D.Lending Rate April 2002–August 2010	D.Lending Rate September 2010–October 2014
ECT1 pos (lending)	0.009	0.004
	(0.033)	(0.053)
ECT1 neg (lending)	–0.053***	–0.061***
	(0.015)	(0.019)
ECT2 (deposit)	0.000	0.030**
	(0.010)	(0.012)
Number of observations	216	108
F-test: lending ECM asymmetry (*p*-value)	0.08	0.28
Deposit Rate	**D.Deposit Rate April 2002–August 2010**	**D.Deposit Rate September 2010–October 2014**
ECT1 (lending)	0.036	–0.215**
	(0.034)	(0.083)
ECT2 pos (deposit)	–0.113***	–0.117*
	(0.033)	(0.091)
ECT2 neg (deposit)	–0.023	–0.221***
	(0.026)	(0.130)
Number of observations	216	108
F-test: deposit ECM asymmetry (*p*-value)	0.01	0.04

Source: Author's calculations.

Note: Standard errors in parentheses. Constant and lags of differenced WACMR, lending rate, deposit rate, loans/assets also included. ECM = error correction model; ECT = error correction term; WACMR = weighted-average call money rate.

*** $p < .01$, ** $p < .05$, * $p < .1$.

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