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RESEARCH ARTICLE

Reserve Money Transmission to Monetary Aggregates in Bangladesh: Short-Run Dynamics and Limited Persistence

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ABSTRACT

For two decades Bangladesh ran monetary policy through a reserve money programme, with broad money as the intermediate target for price stability. The programme assumed that changes in the base pass durably into the wider aggregates, yet this link has seldom been tested directly. This paper tests it, asking whether reserve money innovations reach narrow and broad money and, if so, whether the effect lasts. Monthly data for January 2003 to April 2025 (268 observations) are taken from Bangladesh Bank's Economic Trends, and observations from February 2023 onward are corrected for a unit inconsistency. The money multiplier enters only as a derived accounting ratio, because including it beside its own components would make the system singular. Unit root tests point to integration of order one and Johansen tests to cointegration, so the model is a vector autoregression in log levels with two lags and monthly seasonal dummies. Innovations are orthogonalised by a Cholesky decomposition, and confidence bands come from a moving-block bootstrap. A reserve money innovation of 3.25 per cent lifts broad money by 0.43 per cent on impact. The response is insignificant after eleven months, and most of the injection itself is reversed within a year. The derived multiplier drops by 2.83 per cent on impact in every specification tried, and in the baseline the fall loses significance after nine months. How narrow money responds depends on the identifying order. The evidence supports measurable short-run transmission alongside limited persistence, indicating that base money is a serviceable liquidity instrument but not a sufficient instrument of monetary control. The analysis identifies transmission within the money supply only, not effects on prices, output, credit or the exchange rate, and the evidence is consistent with, rather than proof of the superiority of, the move to an interest rate corridor in July 2023.

Keywords: reserve money; money multiplier; money supply; monetary transmission; vector autoregression; Bangladesh

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1. Introduction

Bangladesh has sustained rapid output growth since the early 2000s alongside recurrent inflationary, exchange rate and financial sector pressures[1,2]. Monetary aggregates have occupied a central place in the policy framework throughout this period: Bangladesh Bank has operated a loose form of monetary targeting, setting a path for the monetary base and using broad money as the intermediate target for price stability[3,4]. Whether that framework could work depends on a link that is usually assumed and seldom tested, namely that

changes in the monetary base are reliably followed by changes in the broader aggregates. A stricter test asks whether those responses last beyond the first few months of adjustment.

There is no reason to expect the link between the base and broader money to be mechanical. Textbook multiplier models imply a fairly stable mapping from reserve money to deposits. Endogenous money accounts put bank lending, credit demand and reserve management at the centre of deposit creation instead. Recent evidence questions the interpretation of the multiplier as a stable technological coefficient and points instead to the behavioural role of banks and borrowers[5–7]. If that view is right, how far a base money instrument reaches has to be established country by country[8].

Bangladesh offers a revealing setting for this question. Its monetary operations are closely bound up with fiscal financing, foreign exchange intervention and support for the banking sector. The World Bank[9] points to special bonds issued at below-market rates as a route to de facto deficit monetisation, one able to offset a contractionary stance. The International Monetary Fund[10] reports that a cumulative tightening of 350 basis points between September 2023 and October 2024 was later undermined by large liquidity injections to weak banks. Episodes of this kind help in reading the monetary data. The time series design used here cannot identify their causal effects, however, so they are treated as background and not as exogenous drivers of the estimated coefficients.

Nor has the switch to an interest rate corridor in July 2023 made the question irrelevant. The reserve money programme governed monetary policy for more than twenty of the twenty-two years in the sample, and an assessment of how its instrument transmitted is needed to interpret why the framework was abandoned[11,12]. Reserve money also remains the variable through which liquidity operations act under the corridor. The episode recorded by the International Monetary Fund[13], in which liquidity support to weak banks offset a tightening of the policy rate, shows that its movements continue to bear on policy outcomes.

Existing work on Bangladesh has examined transmission through policy rates, bank lending, the exchange rate, prices and output. Ahmed and Islam[14], Afrin[15], Younus[16], Hossain and Ibon[17] and Huh and Lee[18] provide evidence that monetary conditions affect macroeconomic outcomes, while several of these studies emphasise attenuation associated with financial and institutional frictions. Comparatively little attention has been given to transmission within the money supply itself, from reserve money to narrow and broad money at monthly frequency. This paper addresses that narrower question.

The contribution is threefold. First, the paper estimates monthly transmission from reserve money to narrow and broad money over a long post-2003 sample using a specification that contains only the non-redundant aggregates, reports level as well as growth responses, and tests whether the results survive the July 2023 change of operating framework. Second, it separates the behavioural interpretation of the money multiplier from the accounting identity that links it to broad money and reserve money, and shows why the multiplier cannot be entered as an endogenous variable alongside its own components. Third, it interprets the persistence of transmission within the institutional setting of Bangladesh without treating contextual

institutional evidence as causal identification. Section 2 reviews the literature and states two hypotheses. Section 3 describes the data and the estimation strategy, Section 4 presents the results, Section 5 discusses them, and Section 6 concludes.

2. Literature review and hypothesis development

2.1. Money creation, the monetary base and the multiplier

Two views of how money is created matter here, and they predict different things. Under the fractional reserve view, the central bank sets the base and banks multiply it into deposits at a ratio fixed by reserve and currency preferences; broad money then follows reserve money in a predictable way. Under the credit creation view, banks lend in response to credit demand and create deposits as they do so. Reserves adjust to meet the settlement needs that follow, and they do not limit lending.

Most recent evidence favours the second view. Werner[19] offers direct evidence that an individual bank creates a new deposit when it lends, instead of lending out reserves it already holds, a result at odds with both the intermediation and the fractional reserve views. Grishchenko et al.[20] put the three competing theories to a test on Russian monthly data with a vector autoregression. The credit theory fits best, and lending turns out to be limited mainly by credit demand. For the United States, Ryan and Whelan[21] show that the lower multipliers seen after quantitative easing persisted because banks genuinely wanted more reserves, not because they absorbed them passively. Dunaev[22] treats the credit multiplier of the banking system as a tool for regulating economic growth and studies it together with interest rates, inflation and the velocity of money.

The choice between these views affects how the model is specified, not only how its results are read. A multiplier shaped by behaviour says something about banks' portfolio choices. That does not make it an independent endogenous variable that can sit in a model next to the aggregates it is built from. Section 2.3 explains why, and Section 3.1 sets the argument out formally.

2.2. Empirical evidence on reserve money transmission

Studies of developing economies disagree about how strongly base money is transmitted, and the pattern of disagreement is itself informative.

Some studies find that transmission works. Younus[23] estimates a five-variable vector autoregression for Bangladesh and finds significant effects of the money supply and policy rates on output and prices. Afrin[24] concludes that the aggregates targeting framework still influences prices, although the exchange rate channel is weakened by intervention in the foreign exchange market. Hossain and Ibon[25] use a structural vector autoregression on monthly data for 1989–2018. Positive broad money innovations raise prices and bank credit in their results, but only in the short run, a limit they attribute to structural weaknesses in the financial system.

A second strand reports weak or absent transmission from the base. Ahmed and Islam[26] find only weak evidence of bank lending and exchange rate channels in Bangladesh. Ofoi and Sharma[27] find that the multiplier does not hold in Papua New Guinea and that the central bank's provision of loanable funds does not

enhance private sector credit. In Poland, Bachurewicz[28] finds no Granger causality from the multiplier to broad money, and finds that loans cause deposits, not the other way round. Khan[29] applies panel FMOLS, DOLS and ARDL estimators to ten developing Asian economies; there, bank lending and income determine the money supply.

These findings can be reconciled. Predicting the aggregates in the short run is one thing, and controlling them over time is another. Reserve money may still carry information about later movements in narrow and broad money even when financial frictions, weak credit demand or offsetting moves in the base stop the first expansion from taking hold. For that reason the analysis looks at how the non-redundant aggregates respond over time and how long the responses last, not just at their size on impact.

H1: *A positive reserve money innovation is followed by statistically significant increases in narrow and broad money at short horizons, and these increases do not persist over the medium term.*

2.3. The money multiplier as a derived ratio

The money multiplier is simply broad money divided by reserve money. In logarithms it equals log broad money minus log reserve money, and its growth rate equals the growth of broad money minus the growth of reserve money. This is an accounting identity, not an estimated relationship. Put reserve money, broad money and the multiplier into one system and it is singular by construction. The residual covariance matrix loses full rank, the Cholesky factorisation degenerates, and no orthogonalised innovation can be separately identified for the multiplier. The identity also guarantees that a Johansen test on such a system rejects the null of no cointegration whatever the data say, since the identity is itself a trivially stationary linear combination.

Handled this way, the multiplier still has economic meaning. Its growth is the gap between the broad money and reserve money responses. If it falls after a positive base money innovation, reserve money has risen faster than broad money at that horizon, and the injection has not been turned into deposits one for one. This provides an empirical basis for examining the relative response of the two aggregates. What it measures, though, is how the two aggregates move relative to each other; it does not reveal the mechanism. Banks holding on to reserves, weak credit demand and offsetting balance sheet operations would all produce the same movement.

H2: *After a positive reserve money innovation the derived money multiplier falls, which means that broad money responds less than proportionately to the change in the monetary base.*

2.4. Institutional context

The institutions within which monetary operations take place help explain why transmission might or might not last. Work on time inconsistency shows that a monetary authority that cannot commit is tempted to deliver surprise expansions, so that credibility suffers and average inflation rises[30,31]. Rogoff[32] builds the case for delegation on this result. Cukierman et al.[33] provided the indices that made these ideas testable, and Alesina and Summers[34] showed that countries with more legally independent central banks tend to have lower inflation. Klomp and de Haan[35], meta-analysing fifty-nine studies, find a genuine negative effect alongside

significant publication bias, while Garriga and Rodriguez[36] confirm the association across 118 developing countries. Paul[37] identifies the money supply as the channel through which independence reduces inflation in developing economies, which places aggregates of the kind studied here on the relevant path.

Legal autonomy is nonetheless an imperfect guide to conduct. Strong[38] finds for thirty-one African countries that governor turnover, a de facto measure, is associated with higher inflation where statutory autonomy is not, and Gavin and Manger[39] show that governments can bring nominally independent central banks to heel without altering their legal status. In Bangladesh, a World Bank assessment[40] identifies operational independence as a precondition for financial stability rather than an accomplished fact, and documents non-performing loans of approximately thirty-six per cent of total loans by September 2025 alongside system-wide capital ratios below half the regulatory minimum.

This literature is used here as interpretive context and not as an identification strategy. The specification estimated below contains no measure of central bank independence, no fiscal variable and no electoral indicator, and it therefore cannot attribute the observed dynamics to any of these mechanisms. **Table 1** summarises the empirical studies against which the present question is positioned.

3. Data and methodology

3.1. Data, variable construction and monetary accounting

The data are monthly and run from January 2003 to April 2025, which gives 268 level observations before any differencing. The start date coincides roughly with the move to a managed float. Every series comes from Bangladesh Bank's *Economic Trends* and its official statistical database, with levels in millions of Bangladeshi taka. Definitions, transformations and sources are listed in **Table 2**.

Table 1. Selected empirical evidence on reserve money transmission and the money multiplier.

Study	Economy and period	Data and method	Principal finding
Ahmed and Islam[41]	Bangladesh, 1979–2005	Quarterly; unrestricted VAR	Only weak evidence of lending and exchange rate channels
Afrin[42]	Bangladesh, post-2003 float	Quarterly; SVAR	Aggregate targeting still affects prices; lending channel non-trivial
Younus[43]	Bangladesh, 2004–2016	Quarterly; five-variable VAR	Money supply and policy rates affect output and prices
Hossain and Ibon[44]	Bangladesh, 1989M1–2018M12	Monthly; SVAR	Broad money raises prices and credit, but only in the short run
Bachurewicz[45]	Poland, 2001–2016	Monthly; VECM, VAR, Granger	Loans cause deposits; multiplier does not cause broad money
Ofoi and Sharma[46]	Papua New Guinea, 1980Q1–2017Q4	Quarterly; six-variable VAR	Multiplier does not hold; transmission to credit weak
Grishchenko et al.[47]	Russia, 2005–2019	Monthly; VAR	Credit theory fits best; lending limited by demand
Ryan and Whelan[48]	United States, post-2008	Micro-simulation of aggregates	Lower multiplier reflects genuine reserve demand, not passivity
Khan[49]	10 developing Asian economies	Panel FMOLS, DOLS, ARDL	Money supply driven by bank lending and income; supports endogeneity
Garriga and Rodriguez[50]	118 developing countries, 1980–2013	Panel	Inflation lower with legal independence, more so in democracies
Strong[51]	31 African countries, 1980–2009	Panel; de facto index	Higher inflation with governor turnover; legal autonomy not enough

Note: Selected studies only. The table positions the research question and does not attempt a full survey.

One problem in the compiled series had to be fixed first. From February 2023 the observations are recorded in crore taka, not millions, so each is a tenth of the size it should be relative to earlier months. Left uncorrected, the error shows up as a one-month fall in reserve money of 230.95 log points and as a sudden collapse at the end of the plotted levels. Every observation from February 2023 is therefore multiplied by ten (one crore is ten million). After the correction, reserve money changes by −0.70 per cent in February 2023. The multiplier needs no adjustment, since both of its components are in the same unit. None of the series is seasonally adjusted at source; seasonality is modelled in the estimation (Section 3.3).

The monetary accounting is central to the design and is therefore stated explicitly. Reserve money (RM) comprises currency issued by the central bank and the deposits of scheduled banks held at Bangladesh Bank. Narrow money (M1) comprises currency held outside banks plus demand deposits; it is not reserve money plus demand deposits, since bank reserves are not part of the money held by the public. Broad money (M2) extends M1 by time and other quasi-money deposits. The money multiplier (MM) is defined in Equation (1).

$$MM_t = \frac{M2_t}{RM_t} \tag{1}$$

Bangladesh Bank influences reserve money through open market operations in treasury bills and repurchase agreements, through the cash reserve and statutory liquidity ratios, through foreign exchange intervention, and through changes in its balance sheet claims on government and other counterparties. Reserve money movements may therefore reflect both deliberate policy operations and endogenous balance sheet adjustment. The empirical identification accordingly treats the reserve money innovation as an orthogonalised

innovation under an explicit recursive ordering, and not as an exogenously imposed policy shock.

Reserve money, narrow money and broad money enter in natural logarithms, multiplied by 100 so that responses can be read as percentages. They are modelled in levels, for the reasons given in Section 3.2. The multiplier is calculated from the levels and is kept out of the system as an endogenous variable. Equations (2) and (3) establish why.

$$ln\, MM_t = ln\, M2_t - ln\, RM_t \quad (2)$$

$$\Delta\, ln\, MM_t = \Delta\, ln\, M2_t - \Delta\, ln\, RM_t \quad (3)$$

Equation (3) shows that the growth rate of the multiplier is an exact linear combination of the growth rates of broad money and reserve money. A system containing all four series would therefore be singular, its residual covariance matrix would be rank deficient, and no separate orthogonalised innovation could be attributed to the multiplier. Excluding it removes redundant information while preserving the economic interpretation of the multiplier as the relative response of broad money to reserve money, which is recovered from Equation (2) at each horizon as the difference between the broad money and reserve money level responses.

Table 2. Variable definitions, measurement and sources.

Variable	Definition	Measurement in estimation	Source
RM	Reserve money: currency issued plus scheduled bank deposits held with Bangladesh Bank	Natural logarithm × 100	Bangladesh Bank, *Economic Trends*
M1	Narrow money: currency outside banks plus demand deposits	Natural logarithm × 100	Bangladesh Bank, *Economic Trends*
M2	Broad money: M1 plus time and other quasi-money deposits	Natural logarithm × 100	Bangladesh Bank, *Economic Trends*
MM	Money multiplier, defined as M2 divided by RM	Derived from Equation (2); not separately estimated	Authors' calculation

Note: All levels are in millions of Bangladeshi taka at monthly frequency, January 2003 to April 2025. MM is a pure ratio. Observations from February 2023 are converted from crore to million taka (Section 3.1). The series are not seasonally adjusted.

3.2. Integration order and the choice between VAR and VECM

Monetary aggregates typically contain stochastic trends, and regression among such series without prior testing risks spurious inference[52]. Stationarity is assessed for reserve money, narrow money and broad money, after removing deterministic monthly seasonality, using the Augmented Dickey-Fuller test[53], the Phillips-Perron test[54] and the KPSS test[55]. The ADF augmentation lag is chosen by the Akaike criterion from a maximum of twelve, the Phillips-Perron test uses a Newey-West bandwidth, and the KPSS test takes stationarity as its null hypothesis. Levels are tested with an intercept and a linear trend and first differences with an intercept; p-values for the first two tests follow MacKinnon[56]. The multiplier is not subjected to a separate integration order decision, since Equation (2) makes it an exact transformation of two series that are tested directly. Its logarithm is nonetheless tested, because stationarity of that difference would imply that broad money and reserve money are cointegrated with a unit coefficient.

Cointegration among the three aggregates is assessed by the Johansen[57] procedure. The multiplier is excluded from the cointegration system for the reason set out in Section 2.3: Equation (2) is itself a stationary linear combination, so its inclusion would generate a cointegrating vector by construction and render the rank test uninformative. The test is applied with an intercept and one lagged difference, matching the two-lag levels specification, and critical values are taken from MacKinnon, Haug and Michelis[58]. Both the trace and the maximum eigenvalue statistics reject the null of no cointegrating vector, so the aggregates are not suitably modelled by a vector autoregression in first differences, which omits the error correction terms that cointegration implies[59,60]. The estimated rank, however, shifts with the deterministic specification (Section 4.2), so the baseline is a vector autoregression in log levels. Least squares estimates of such a model are consistent whatever the number of unit roots and cointegrating relations[61], so impulse responses at fixed horizons are estimated consistently without conditioning on a pretest. A vector error correction model and a vector autoregression in first differences are reported as robustness checks. The specification is therefore dictated by the test outcome rather than adopted by preference.

3.3. Lag order selection and the VAR specification

Lag length is selected by comparing the Akaike[62], Schwarz[63] and Hannan-Quinn[64] information criteria over orders one to twelve for the levels system with an intercept and eleven monthly dummies. The Schwarz and Hannan-Quinn criteria both select two lags and the Akaike criterion selects nine. Without the dummies the Akaike criterion selects twelve, the signature of unmodelled annual seasonality in series that are not seasonally adjusted at source. Two lags are used, the order on which both consistent criteria agree, and four and nine lags serve as robustness checks.

Let $\mathbf{y}_t$ denote the vector of the logarithms, multiplied by 100, of reserve money, narrow money and broad money. The vector autoregression of order p is given by Equation (4).

$$\boldsymbol{y}_t = \boldsymbol{c} + \boldsymbol{A}_1\boldsymbol{y}_{t-1} + \boldsymbol{A}_2\boldsymbol{y}_{t-2} + \cdots + \boldsymbol{A}_p\boldsymbol{y}_{t-p} + \boldsymbol{\Gamma}\boldsymbol{d}_t + \boldsymbol{\varepsilon}_t \tag{4}$$

Here $\mathbf{c}$ holds the intercepts and the $\mathbf{A}_i$ are coefficient matrices; $\mathbf{d}_t$ contains eleven monthly seasonal dummies, with coefficients in $\boldsymbol{\Gamma}$; and $\boldsymbol{\varepsilon}_t$ collects the reduced-form innovations, whose covariance matrix is $\boldsymbol{\Sigma}$. Treating all three variables as endogenous avoids exogeneity restrictions for which the institutional setting gives no grounds[65]. Each equation is estimated by ordinary least squares, which is both consistent and efficient when every equation has the same lagged regressors[66,67]. Single coefficients in such a system say little on their own. As is usual, the dynamics are summarised through impulse responses[68], and the results below are reported in that form.

3.4. Identification and dynamic analysis

The reduced-form innovations are correlated within the month, so an identifying scheme is needed before any response can be given an economic reading. The scheme used here is a Cholesky decomposition with the ordering [RM, M1, M2], which factorises the covariance matrix as in Equation (5).

$$\boldsymbol{\Sigma} = \boldsymbol{P}\boldsymbol{P}' \tag{5}$$

Under this ordering, reserve money does not react within the month to narrow or broad money, whereas both aggregates can react within the month to a reserve money innovation. This is the standard recursive assumption in monetary transmission work[69]. Two points are relevant to putting reserve money first. Bangladesh Bank conducts its balance sheet operations continuously within the month, whereas the monthly aggregates are compiled with a lag, so it is plausible that the base does not respond to the current month's aggregates. Against this, reserve money and narrow money share a large common component in currency, and an ordering with reserve money first attributes common currency-demand disturbances to the reserve money innovation. The ordering is an identifying assumption, not evidence that reserve money is exogenous to the institutional setting. For that reason the alternative ordering [M1, RM, M2], under which the reserve money innovation is the component of the base orthogonal to current narrow money, is reported in full in Section 4.6.

Dynamic interactions are summarised by impulse response functions, which trace the effect of an identified reserve money innovation over subsequent months[70]. Confidence bands are obtained by a residual-based moving-block bootstrap[71] with 2,000 replications and blocks of twelve months. Residual vectors are resampled jointly, which preserves their contemporaneous correlation, and in consecutive blocks, which preserves the serial dependence and conditional heteroskedasticity detected in Section 4.3. In each replication the system is regenerated recursively from the observed initial values and re-estimated, and the bands are the 2.5th and 97.5th percentiles of the resulting responses. The derived multiplier response is not separately estimated: within each replication it is computed from Equation (2) as the difference between the broad money and reserve money responses, so its band reflects the joint sampling variation of the two. Residuals are examined with the adjusted multivariate portmanteau test[72], the Jarque-Bera test[73] and equation-by-equation ARCH-LM tests[74], and dynamic stability with the moduli of the roots of the characteristic polynomial. To check whether the parameters survived the July 2023 change of operating framework, each equation is put through a Chow breakpoint test, a Chow predictive-failure test covering the twenty-two months after the change[75], and the OLS-CUSUM test[76].

4. Empirical results

4.1. Descriptive properties

Descriptive statistics are in **Table 3**. Over the sample, reserve money, narrow money and broad money each grew roughly eighteen- to twentyfold. Their standard deviations are of the same order as their means, a sign of steady trend growth and not of short-run volatility. The multiplier averaged 5.155 and stayed between 4.490 and 5.628; throughout the period, each taka of base money supported about five taka of broad money. In levels, the aggregates are correlated above 0.99. Shared trends account for this, and the correlations say nothing about a stable structural link. The multiplier is left out of the correlation panel, since it is built from two of the series it would be correlated with. For short-run dynamics it is growth rates that matter, and Panels B and C give the same statistics for monthly growth. Average monthly growth is close to 1.1 per cent for all three aggregates, but reserve money growth is almost four times as volatile as broad money growth (standard

deviations of 4.15 and 1.12 percentage points). The growth-rate correlations, between 0.70 and 0.86, are well below those in levels.

Figure 1 shows the three aggregates together with the derived multiplier. All three aggregates rise steadily. The multiplier, by contrast, moves within a fairly narrow range around a gently declining path. Because the figure uses the corrected series, the sudden fall at the end of the sample caused by the unit error is gone. The dashed vertical line marks July 2023, when the interest rate corridor was adopted. Trends in levels and short-run dynamics in growth rates are clearly different things, and the analysis keeps them apart.

4.2. Integration order and cointegration

Table 4 reports the unit root and stationarity tests. In levels, neither the ADF nor the Phillips-Perron test rejects a unit root for any aggregate, and the KPSS test rejects stationarity at the 1 per cent level in each case. In first differences, the ADF and Phillips-Perron tests reject a unit root for reserve money and narrow money. For broad money the Phillips-Perron test rejects decisively ($p < 0.001$), whereas the ADF test does not ($p = 0.684$) and the KPSS test rejects stationarity. That combination is consistent with the gradual decline in average broad money growth over the sample, which a constant-mean test reads as non-stationarity. The aggregates are therefore treated as integrated of order one, with less certainty for broad money growth than for the other two series, which is a further reason to prefer a specification that does not require the order of integration to be settled. The evidence on the log multiplier is mixed: the Phillips-Perron test rejects a unit root strongly, the KPSS test rejects stationarity at 5 but not at 1 per cent, and the ADF test does not reject.

Table 3. Descriptive statistics and correlations.

Panel A: Levels				
Variable	**Mean**	**Std. dev.**	**Minimum**	**Maximum**
RM	1,588,678	1,189,652	203,920	4,136,470
M1	1,832,290	1,430,890	246,623	5,009,268
M2	8,107,464	6,058,197	1,061,854	21,150,920
MM	5.155	0.229	4.490	5.628
Panel B: Monthly growth rates (per cent)				
ΔRM	1.10	4.15	−9.60	13.70
ΔM1	1.11	3.68	−7.59	15.86
ΔM2	1.12	1.12	−1.52	4.94
ΔMM	0.02	3.46	−10.61	8.17
Panel C: Correlations of monthly growth rates				
	ΔRM	ΔM1	ΔM2	
ΔRM	1.000			
ΔM1	0.857	1.000		
ΔM2	0.702	0.827	1.000	

Note: Levels in millions of taka after the unit correction described in Section 3.1; MM is a pure ratio. Growth rates are 100 times the first difference of the natural logarithm, 267 observations. ΔMM equals ΔM2 minus ΔRM by Equation (3). Correlations among the levels of RM, M1 and M2 lie between 0.994 and 0.997. Estimation uses natural logarithms × 100.

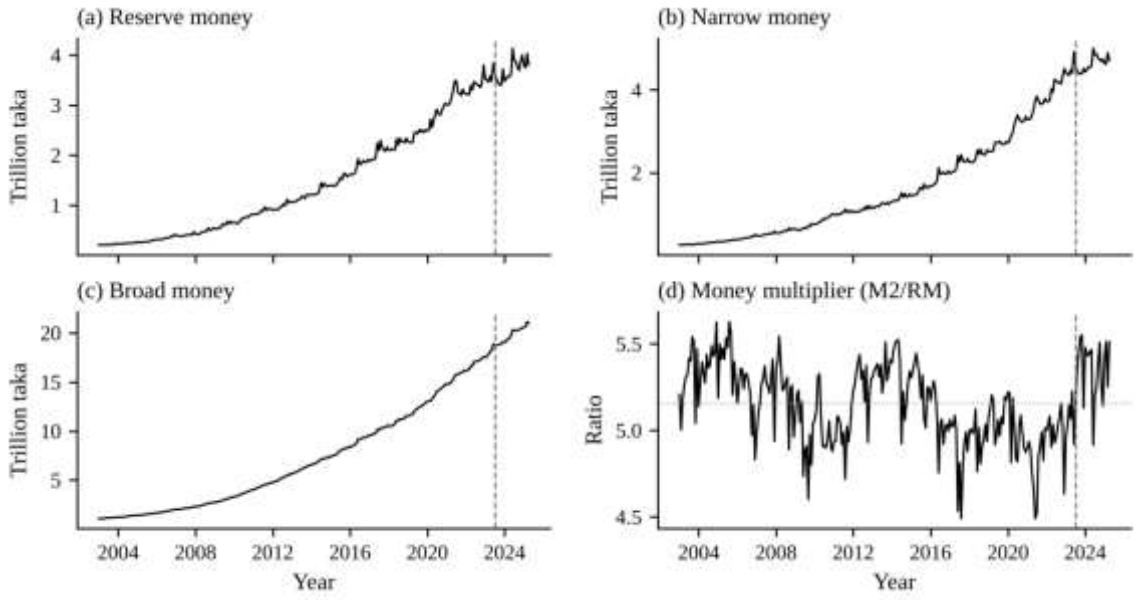


Figure 1. Reserve money, narrow money, broad money and the derived money multiplier, 2003M1–2025M4.

Source: Bangladesh Bank, *Economic Trends*; authors' presentation. Observations from February 2023 converted from crore to million taka. Dashed line: adoption of the interest rate corridor, July 2023. Dotted line in panel (d): sample mean of the multiplier.

Table 4. Unit root and stationarity tests.

Series	Deterministic terms	ADF (lags)	p-value	PP	p-value	KPSS	p-value
ln RM	Intercept, trend	0.207 (12)	0.996	−0.990	0.946	0.578	<0.01
Δ ln RM	Intercept	−3.859 (11)	0.002	−29.284	<0.001	0.606	0.022
ln M1	Intercept, trend	−1.246 (12)	0.901	−2.271	0.450	0.471	<0.01
Δ ln M1	Intercept	−3.308 (11)	0.015	−27.987	<0.001	0.357	0.094
ln M2	Intercept, trend	−0.461 (12)	0.985	1.041	1.000	0.623	<0.01
Δ ln M2	Intercept	−1.175 (11)	0.684	−21.041	<0.001	2.011	<0.01
ln MM	Intercept	−2.211 (12)	0.202	−8.257	<0.001	0.584	0.025

Note: Series in natural logarithms with deterministic monthly seasonality removed; 268 observations in levels. ADF: Augmented Dickey-Fuller, lag selected by the Akaike criterion from a maximum of 12. PP: Phillips-Perron with Newey-West bandwidth. ADF and PP null: unit root; p-values from MacKinnon[77]. KPSS null: stationarity; p-values below 0.01 are reported as <0.01.

Table 5 reports the Johansen tests. In the main specification both the trace and the maximum eigenvalue statistics reject the hypotheses of zero and of at most one cointegrating vector and do not reject at most two, indicating two cointegrating relations and a single common stochastic trend. The estimated rank is sensitive to the specification. With a linear trend both statistics indicate one cointegrating relation; with three lagged differences the trace statistic indicates two while the maximum eigenvalue statistic narrowly fails to reject the null of none (21.07 against a critical value of 21.13). Every specification provides evidence of at least one cointegrating relation by at least one statistic. A vector error correction model of rank two normalises the first relation as RM − 1.041 M2, close to the unit coefficient implied by a stationary multiplier. The adjustment coefficient on this relation is −0.206 (t = −4.07) in the reserve money equation and −0.002 (t = −0.18) in the broad money equation, so deviations from the long-run relation are corrected by movements in reserve money rather than in broad money.

Table 5. Johansen cointegration tests for RM, M1 and M2.

Specification	H_0	Eigenvalue	Trace	5% critical value	Max-eigenvalue	5% critical value
Main: intercept, 1 lagged difference	r = 0	0.1006	54.69	29.80	28.21	21.13
	r ≤ 1	0.0825	26.48	15.49	22.89	14.26
	r ≤ 2	0.0134	3.59	3.84	3.59	3.84
Linear trend, 1 lagged difference	r = 0	0.1115	44.49	35.01	31.43	24.25
	r ≤ 1	0.0449	13.05	18.40	12.21	17.15
	r ≤ 2	0.0031	0.84	3.84	0.84	3.84
Intercept, 3 lagged differences	r = 0	0.0767	37.78	29.80	21.07	21.13
	r ≤ 1	0.0496	16.72	15.49	13.44	14.26
	r ≤ 2	0.0123	3.27	3.84	3.27	3.84
Intercept, 1 lagged difference, unadjusted	r = 0	0.0949	51.99	29.80	26.53	21.13
	r ≤ 1	0.0799	25.46	15.49	22.15	14.26
	r ≤ 2	0.0124	3.31	3.84	3.31	3.84

Note: Natural logarithms of RM, M1 and M2, 268 monthly observations. Seasonality is removed from the series in the first three specifications but not in the last. Critical values from MacKinnon, Haug and Michelis[78]. Implied rank at 5 per cent (trace / maximum eigenvalue): main 2/2; linear trend 1/1; three lagged differences 2/0; unadjusted 2/2.

4.3. Lag order, diagnostics and parameter stability

Table 6 reports the information criteria for the levels system with an intercept and monthly dummies, computed on a common estimation sample. The Schwarz criterion is minimised at 2.782 and the Hannan-Quinn criterion at 2.335, both with two lags, and the Akaike criterion at 1.998 with nine. The criteria are expressed for the variables in logarithms multiplied by 100, the units used throughout the estimation.

Table 6. Lag order selection criteria.

Lag	AIC	SBIC	HQIC	Lag	AIC	SBIC	HQIC
1	2.309	2.932	2.560	7	2.017	3.388	2.568
2	2.035	**2.782**	**2.335**	8	2.032	3.528	2.633
3	2.034	2.907	2.385	9	**1.998**	3.618	2.650
4	2.081	3.078	2.482	10	2.027	3.772	2.729
5	2.106	3.228	2.558	11	2.047	3.917	2.799
6	2.133	3.380	2.635	12	2.009	4.003	2.811

Note: Bold entries mark the minimum of each criterion. AIC is the Akaike criterion, SBIC the Schwarz Bayesian criterion and HQIC the Hannan-Quinn criterion. Levels VAR in 100 × natural logarithms with an intercept and eleven monthly dummies, estimated on a common sample, 2004M1–2025M4.

Table 7 reports diagnostics for the VAR(2). The largest root of the characteristic polynomial has modulus 0.9973, and all roots lie inside the unit circle, so the system is stable; the root closest to unity reflects the common stochastic trend. At 12 and 24 lags the portmanteau statistics reject the null of no residual

autocorrelation. Normality is rejected by the Jarque-Bera test. The ARCH-LM tests find conditional heteroskedasticity in the reserve money and narrow money equations, though not in the broad money equation. Adding lags does not remove the autocorrelation, which points to calendar irregularities in the monthly data more than to missing dynamics. The moving-block bootstrap of Section 3.4 is built to cope with both problems, and the lag-length checks in Section 4.6 show that the responses do not depend on the lag order chosen.

Table 7. Residual diagnostics and stability of the VAR(2).

Test	Statistic	df	p-value	Conclusion at 5%
Portmanteau, 12 lags (adjusted)	259.67	90	<0.001	Residual autocorrelation
Portmanteau, 24 lags (adjusted)	495.73	198	<0.001	Residual autocorrelation
Jarque-Bera (multivariate)	66.71	6	<0.001	Non-normal residuals
ARCH-LM, 12 lags, RM equation	30.83	12	0.002	ARCH effects
ARCH-LM, 12 lags, M1 equation	47.62	12	<0.001	ARCH effects
ARCH-LM, 12 lags, M2 equation	15.79	12	0.201	No ARCH effects
Largest root modulus	0.9973			Stable (all roots < 1)

Table 8 reports the parameter stability tests at July 2023, the month in which the interest rate corridor was adopted, with 22 post-change observations. The Chow breakpoint test rejects stability in the reserve money equation ($F = 3.27$, $p = 0.002$) but not, at the 5 per cent level, in the narrow and broad money equations. The predictive-failure test gives the same pattern ($p = 0.033$ for reserve money). The OLS-CUSUM test detects no instability in any equation. The change of operating framework therefore altered the behaviour of the base itself, which is consistent with the liquidity operations documented by the International Monetary Fund[79], while leaving the equations for the broader aggregates broadly unchanged. Section 4.6 shows that the impulse responses survive excluding the post-change months.

Table 8. Parameter stability tests at July 2023.

Equation	Chow breakpoint F	p-value	Chow predictive F	p-value	OLS-CUSUM	p-value
RM	3.27	0.002	1.68	0.033	0.713	0.690
M1	1.81	0.087	0.82	0.704	0.740	0.645
M2	1.74	0.099	1.12	0.331	1.011	0.258

Note: Each equation of the VAR(2) with intercept and monthly dummies. Breakpoint test: all lag coefficients and the intercept allowed to change from July 2023, $F(7, 241)$. Predictive-failure test for the 22 post-change months, $F(22, 226)$. OLS-CUSUM: Ploberger and Krämer[80].

4.4. Impulse responses

Figure 2 reports the level responses of the three aggregates to a one-standard-deviation reserve money innovation, which raises reserve money by 3.25 per cent on impact, and **Table 9** reports the responses and their 95 per cent bands at selected horizons. Broad money rises by 0.43 per cent on impact, an elasticity of about 0.13 with respect to the base; its response settles at about a quarter of a per cent and is statistically distinguishable from zero only through month 11. Narrow money rises by 2.16 per cent on impact, and its response decays more slowly, retaining 0.59 per cent, about 27 per cent of the impact effect, after two years and remaining significant through month 33. The injection itself does not persist. The reserve money response falls to 0.49 per cent after twelve months, about 15 per cent of its impact value, and to 0.19 per cent after twenty-four; it cannot be distinguished from zero after month 11. The evidence therefore supports H1 for broad money, whose response is small and not persistent, but not for narrow money under this ordering; Section 4.6 shows that the narrow money result depends on the recursive ordering.

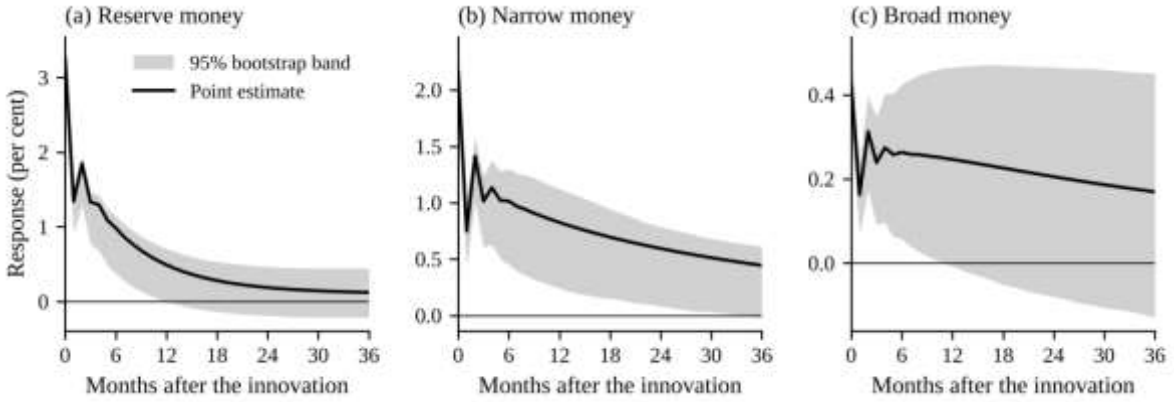


Figure 2. Responses of reserve money, narrow money and broad money to a reserve money innovation.

Source: Authors' calculations from Bangladesh Bank, *Economic Trends*. Responses in per cent (100 × natural logarithm) to a one-standard-deviation reserve money innovation; baseline VAR(2) in levels, Cholesky ordering [RM, M1, M2]. Shaded areas: 95 per cent moving-block bootstrap bands, 2,000 replications.

4.5. The derived multiplier response

Because the multiplier is defined by Equation (1), its response is implied mechanically by the relative responses of broad money and reserve money rather than estimated as an independent structural outcome. Applying Equation (2) to the responses in **Figure 2** yields the multiplier response in **Figure 3** and the last column of **Table 9**. The multiplier falls by 2.83 per cent on impact, about 0.14 on its sample mean of 5.155; the decline narrows to 0.72 per cent after six months, cannot be distinguished from zero after month 9, and has disappeared by month 24. Reserve money therefore rises more than broad money over the first year, after which the long-run relation between them is restored, mainly through the reversal of the base identified by the adjustment coefficients in Section 4.2. That is the outcome anticipated by H2. The finding is a statement about the relative magnitude of two responses and does not by itself distinguish among reserve retention by banks, weak credit demand and offsetting balance sheet operations, each of which would generate the same observed

movement. **Figure 3** also shows why the cumulated responses of a first-difference VAR, which omits the error correction terms, would mislead on persistence: cumulating its growth responses implies a permanent fall in the multiplier of 1.63 per cent, which is incompatible with the cointegration evidence.

Table 9. Impulse responses to a reserve money innovation at selected horizons.

Months	Reserve money	Narrow money	Broad money	Money multiplier
0	3.25 [2.88, 3.36]	2.16 [1.84, 2.35]	0.43 [0.31, 0.51]	−2.83 [−2.92, −2.51]
1	1.34 [0.91, 1.52]	0.75 [0.43, 1.00]	0.16 [0.07, 0.24]	−1.18 [−1.31, −0.80]
3	1.33 [0.77, 1.46]	1.01 [0.60, 1.23]	0.24 [0.09, 0.35]	−1.09 [−1.19, −0.62]
6	0.98 [0.38, 1.15]	1.01 [0.45, 1.30]	0.26 [0.06, 0.42]	−0.72 [−0.83, −0.25]
12	0.49 [−0.00, 0.71]	0.82 [0.24, 1.12]	0.25 [−0.01, 0.46]	−0.25 [−0.34, 0.07]
24	0.19 [−0.19, 0.47]	0.59 [0.08, 0.78]	0.21 [−0.08, 0.47]	0.02 [−0.06, 0.18]
36	0.12 [−0.21, 0.45]	0.44 [−0.02, 0.61]	0.17 [−0.13, 0.45]	0.05 [−0.02, 0.13]

Note: Point estimates with 95 per cent moving-block bootstrap intervals in brackets, per cent. The multiplier response is the broad money response minus the reserve money response, computed within each bootstrap replication.

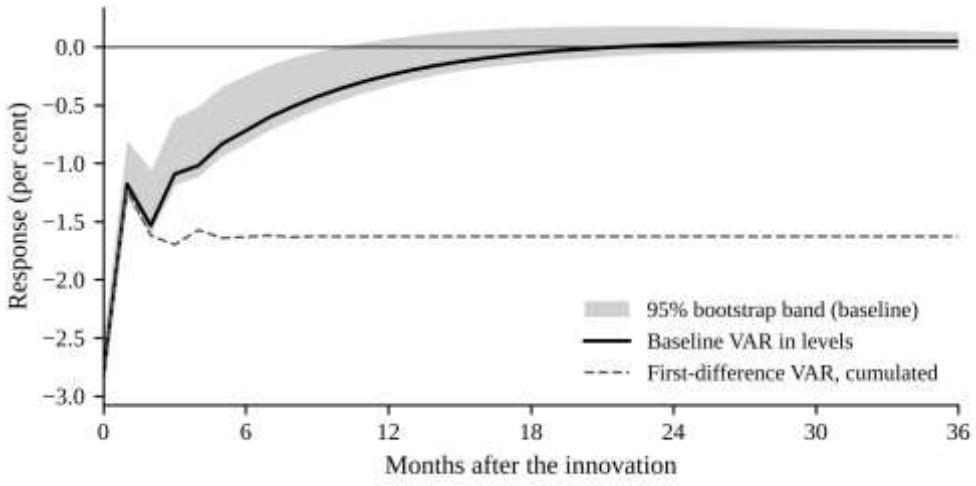


Figure 3. Response of the derived money multiplier to a reserve money innovation.

Source: Authors' calculations from Bangladesh Bank, *Economic Trends*. Response in per cent, computed from Equation (2) as the broad money response minus the reserve money response. Shaded area: 95 per cent moving-block bootstrap band for the baseline. Dashed line: cumulated growth responses from a VAR(2) in first differences with monthly dummies.

4.6. Robustness

Table 10 reports the main responses under nine alternative specifications. The decline in the multiplier on impact is the most robust result: it lies between 1.96 and 2.93 per cent in every specification and is significant wherever bands are computed. The response of broad money on impact never exceeds 0.73 per cent, about a fifth or less of the change in the base.

The ordering matters for the size of transmission to the aggregates. Under the ordering [M1, RM, M2], the

reserve money innovation is the part of the base that is orthogonal to current narrow money. On impact it lifts reserve money by 1.97 per cent and cuts the multiplier by 1.96 per cent, and the fall stays significant through month 16. It raises neither narrow nor broad money at any horizon, and narrow money falls briefly in months 1 and 3. So the baseline narrow money response comes from the currency that reserve money and narrow money have in common, not from reserves turning into deposits. The failure of reserves to reach broad money, on the other hand, holds under either ordering.

The results are not driven by the corridor period. Estimated on 2003M1–2023M6 only (246 observations), the responses are close to the baseline. Reserve money rises by 3.16 per cent on impact and broad money by 0.42 per cent, significant through month 6, while the multiplier falls by 2.74 per cent and recovers within a year. Adding a dummy for the corridor period, omitting the seasonal dummies, or using four lags leaves the pattern unchanged, although without seasonal dummies the broad money response remains significant through month 18. With nine lags the base and the multiplier responses are more persistent at twelve months but are not significant at twenty-four.

The treatment of long-run dynamics matters for the base but not for the multiplier on impact. With a vector error correction model of rank two, the baseline is reproduced almost exactly. Under rank one, which is indicated only when a linear trend is allowed, the base injection persists (2.42 per cent at twenty-four months) and broad money rises gradually to 0.94 per cent. The multiplier then recovers only slowly and remains 1.47 per cent below its pre-innovation level after two years. The first-difference VAR shows why cumulative responses are needed to assess persistence. Its growth responses are significant only through month 3, yet cumulating them, as in the accumulated responses reported by Jones and Bowman[81], implies permanent level shifts of 1.96 per cent in reserve money, 1.44 per cent in narrow money, 0.33 per cent in broad money and −1.63 per cent in the multiplier. Those permanent effects arise because the specification omits the error correction terms, and they are not supported once cointegration is allowed for. Bands from an independent and identically distributed residual bootstrap differ little from the moving-block bands and extend the significance of the broad money response by two months.

Table 10. Robustness of the responses to a reserve money innovation.

Specification	Reserve money			Narrow money		Broad money			Multiplier		
	0	12	24	0	24	0	12	24	0	12	24
Baseline: levels VAR(2), seasonal dummies	3.25*	0.49	0.19	2.16*	0.59*	0.43*	0.25	0.21	−2.83*	−0.25	0.02
Ordering [M1, RM, M2]	1.97*	0.33	0.17	0.00	−0.13	0.01	0.06	0.09	−1.96*	−0.27*	−0.09
Sample 2003M1–2023M6	3.16*	0.37*	0.23	2.20*	0.60*	0.42*	0.19	0.18	−2.74*	−0.18	−0.05
Corridor-period dummy	3.20*	0.31*	0.20	2.13*	0.52*	0.42*	0.17	0.16	−2.78*	−0.14	−0.04
No seasonal dummies	3.66*	0.52*	0.24	2.82*	0.58*	0.73*	0.32*	0.26	−2.93*	−0.20	0.02
Four lags	3.24*	0.67	0.33	2.21*	0.54	0.42*	0.29	0.27	−2.82*	−0.38	−0.06
Nine lags	3.19*	1.04*	0.69	2.11*	1.02*	0.43*	0.32	0.37	−2.77*	−0.72*	−0.32
VECM, rank 2	3.15	0.51	0.23	2.10	0.79	0.41	0.24	0.21	−2.73	−0.26	−0.02
VECM, rank 1	3.26	2.31	2.42	2.12	1.73	0.42	0.63	0.94	−2.84	−1.68	−1.47
First-difference VAR(2), cumulated	3.28*	1.96*	1.96*	2.21*	1.44*	0.43*	0.33*	0.33*	−2.85*	−1.63*	−1.63*

Note: Responses in per cent at 0, 12 and 24 months (0 and 24 for narrow money) to a one-standard-deviation reserve money innovation. * 95 per cent moving-block bootstrap interval (2,000 replications) excludes zero. VECM responses are point estimates. Under the alternative ordering the impact response of narrow money is zero by construction.

5. Discussion

5.1. Transmission without persistence

The central result is a contrast between two properties of the same responses. Reserve money innovations move both narrow and broad money, and the bootstrapped bands exclude zero in the opening months, so the transmission is real rather than an artefact of estimation noise. Yet the broad money response is small. On impact it is about 13 per cent of the change in the base, it cannot be told apart from zero after the first year, and over the same year most of the injection to the base is itself reversed. A base money instrument that produces a detectable but short-lived movement in the aggregates is doing something quite different from what a monetary targeting framework assumes it does. Narrow money does respond for longer under the baseline ordering. Once the reserve money innovation is stripped of its comovement with current narrow money, though, that response vanishes, which suggests that it reflects the currency the two aggregates share and not a flow from reserves into deposits.

Two features of the estimated system make that contrast intelligible. The first concerns the base itself. In Bangladesh, reserve money is far from a clean policy instrument. Open market operations, changes in reserve requirements, foreign exchange intervention and shifts in central bank claims on government all feed into it, and these pieces need not move together, either in direction or in timing. A shock to such a series mixes several disturbances, and some of it is routinely undone the next month by operations that serve another purpose. The estimates fit this picture. The reserve money response drops from 3.25 to 1.34 per cent within a month, and the adjustment coefficients show that it is the base, not broad money, that moves to restore the long-run relation between them. The second feature has to do with where the money is meant to end up. Most of broad money consists of time and quasi-money deposits. Their growth depends on credit demand and on banks' lending decisions, and neither adjusts to a change in reserves from one month to the next. With a mixed instrument at one end and a slow-moving target at the other, a short-lived response is what one should expect. It is not an anomaly.

5.2. The derived multiplier and its candidate mechanisms

The multiplier result is arithmetic, a by-product of the two responses, but that does not make it empty. Broad money rising by less than reserve money at short horizons means that, over those months, banks do not turn a liquidity injection into deposits one for one. A fixed multiplier would rule exactly this out. In the long run, though, the multiplier is stable. Most of its decline is undone within about a year, and the cointegration evidence links broad money to reserve money with a coefficient near one. It is better thought of as a ratio that is stable over long horizons and unstable over short ones than as a technological constant.

Why the conversion is incomplete is a question the design cannot answer. At least three mechanisms would produce the same movement. First, banks may hold on to the extra reserves as a precaution. Ryan and Whelan[82] favour this reading for the United States, where the lower multipliers after the crisis reflected a real rise in the demand for reserves and not passive absorption. Second, credit demand may be too weak to take up the liquidity, the mechanism that Grishchenko et al.[83] find dominant in Russia and that Khan[84] identifies across developing Asian economies. Third, the central bank may withdraw the injection itself, through offsetting operations, before any deposits are created; the multiplier would then be tracking policy, not bank behaviour. Telling these apart would take bank-level data on reserves and lending, or a breakdown of reserve money by balance sheet source. Neither type of data is available at monthly frequency. The alternative ordering does add one useful fact. Reserves unrelated to current currency demand are not converted into deposits at any horizon, a pattern that all three mechanisms predict and that a conventional multiplier rules out. So the aggregate evidence shows that conversion is incomplete and narrows the list of possible explanations, but it cannot choose between them.

Still, the Bangladeshi context makes the precautionary channel hard to rule out. A World Bank assessment[85] puts non-performing loans at about thirty-six per cent of total loans by September 2025, with system-wide capital ratios at less than half the regulatory minimum. Under distress of that magnitude, a bank receiving reserves has strong incentives to hold them against liquidity and solvency risk. That lends some

support to one candidate mechanism. It does not, however, discriminate between that mechanism and the others.

5.3. Comparison with the existing evidence

These findings fit the endogenous money literature better than the fractional reserve account, and they agree with what comparable designs have found elsewhere. In Papua New Guinea, Ofoi and Sharma[86] find that the multiplier does not hold and that loanable funds supplied by the central bank do not raise private sector credit. Bachurewicz[87] shows for Poland that causality runs from loans to deposits. Grishchenko et al.[88], using monthly data and a vector autoregression close in construction to the one applied here, find the credit theory of money best supported for Russia. Four economies with quite different financial systems point the same way, which suggests that weak and short-lived transmission from the base is common to monetary aggregates generally and is not peculiar to Bangladesh.

Nor do the results contradict the domestic literature; they sharpen it. Afrin[89] and Younus[90] report effects of monetary conditions on prices and output, and Hossain[91] finds a stable demand function for broad money along with causality from money growth to inflation. None of this needs reserve money to drive the aggregates durably. It needs money to matter for prices, and that is a separate claim. The nearest domestic study is Hossain and Ibon[92]. Their structural vector autoregression on monthly data shows broad money innovations raising prices and credit, but they stress that the effect is short-lived and attribute it to structural weaknesses in the financial system and slow adjustment of policy rates. The present results find the same limitation one link earlier in the chain. The effect is already fading as it passes from the base to the aggregates, before the question of how money affects prices even comes up.

5.4. Institutional context and the limits of inference

It is tempting to explain the lack of persistence in institutional terms, but that explanation needs care. The model includes no measure of central bank independence and no fiscal or electoral variable, and none of its shocks is independently identified as policy. So it cannot show that fiscal pressure, political incentives or interventions in the banking sector caused what is observed.

What can be said is that the pattern is consistent with the mechanism that literature describes. Two documented episodes fit that description: the special bonds issued below market rates, which the World Bank[93] regards as de facto deficit monetisation able to offset a contractionary stance, and the large liquidity injections to weak banks that, according to the International Monetary Fund[94], undermined a cumulative 350 basis point tightening between September 2023 and October 2024. Where the base expands and contracts for fiscal and financial stability reasons on a horizon shorter than that on which deposits adjust, transmission of the kind estimated here is what one would expect to observe. The wider literature explains why this matters. Klomp and de Haan[95] and Garriga and Rodriguez[96] link central bank independence to inflation outcomes; Paul[97] traces that link through the money supply; and Strong[98] and Gavin and Manger[99] show that legal autonomy says little about conduct when de facto constraints bind. Consistency of this sort falls short of identification, and it is

offered here only as consistency.

A further caveat concerns the demand for credit. How much banks lend, and so how many deposits they create, depends on borrowers' production plans and on interest rates, inflation and prices. The same determinants are central to the credit-multiplier analysis of Dunaev[100]. None of them is in the present system, so the model records the reversal of the base and the weak broad money response without explaining them in these terms. What the results describe is what reserve money operations achieved within the money supply, and not why credit demand behaved as it did.

5.5. Implications for the operating framework

The results speak directly to the choice of operating framework, and the sample happens to include a change of framework against which to judge them. In July 2023 Bangladesh Bank dropped monetary targeting for an interest rate corridor. The repurchase rate became the policy rate, standing lending and deposit facilities formed a symmetric band around it, and the stated reason was that targeting monetary aggregates had lost its effectiveness[101]. The transition followed technical assistance from the International Monetary Fund[102], which recommended weekly open market operations at the policy rate, averaging of the cash reserve requirement, automatic access to standing facilities, and amendment of the Bangladesh Bank Order to prioritise price stability, strengthen autonomy and end directed central bank lending.

The evidence here is consistent with the diagnosis behind that reform. When reserve money innovations move the aggregates only briefly, a framework that targets an aggregate is tied to a variable its instrument cannot control for long. That strengthens the case for an operating target the central bank can steer continuously. It does not show that the corridor is the better framework. Such a comparison would need a model with policy rates, inflation, output, credit and the exchange rate, and an identification strategy able to separate policy innovations from endogenous responses.

The second implication is about sequencing. Central bank liquidity becomes deposits and credit only by passing through bank balance sheets, so no framework can work better than those balance sheets allow. Reforming the operating target and repairing asset quality and capital adequacy therefore go together, and one does not replace the other. On this evidence, the second limits what the first can achieve.

5.6. Scope conditions and what would overturn the result

Three caveats limit how far the results can be pushed. The first comes from inside the sample: its last twenty-two months belong to the corridor framework, not to the reserve money programme. At that date the Chow tests in Table 8 pick up a change in the reserve money equation. Responses estimated on the pre-change sample alone (**Table 10**), however, are close to the baseline, so mixing the two regimes is not what drives the results. There are not yet enough post-2023 observations to estimate the corridor regime on its own.

The second caveat is identification. Under the Cholesky ordering, reserve money is assumed not to respond within the month to the broader aggregates, which is the usual recursive assumption[103]. Changing the order does not affect the reversal of the base or the fall and recovery of the multiplier, but it does eliminate the

narrow and broad money responses. How much transmission reaches the aggregates therefore depends on the identifying assumption; its short life does not. Sign restrictions, or a narrative account of policy episodes, would put the reserve money innovation on firmer ground.

The third caveat has to do with how the long-run dynamics are specified. The aggregates are cointegrated, and the results are reported from a levels specification that does not impose a particular cointegrating rank. Under a vector error correction model of rank two the responses are almost identical to the baseline; under rank one, which is indicated only when a linear trend is allowed, the base injection persists and broad money rises gradually, although the multiplier still falls and recovers slowly. The finding that the base injection is reversed is therefore conditional on the rank indicated by the main specification of the Johansen test, whereas the less than proportionate response of broad money, and hence the fall in the multiplier, holds in every specification examined.

6. Conclusion and policy implications

This paper has examined the transmission of reserve money innovations to narrow and broad money using monthly Bangladeshi data from January 2003 to April 2025. The specification estimates reserve money, narrow money and broad money as the non-redundant endogenous variables in a VAR(2) in log levels with monthly seasonal dummies, chosen because the aggregates are cointegrated, and treats the money multiplier as the derived ratio defined in Equation (1) rather than as a separate endogenous variable. The main finding is that, after a reserve money innovation, broad money rises on impact by only about 13 per cent of the change in the base. This response cannot be distinguished from zero after the first year, and the injection to the base is itself largely reversed within that period. A second result follows from the accounting identity. Since broad money responds less than proportionately, the derived multiplier falls by about 2.8 per cent on impact; the fall is no longer significant after month 9. Narrow money reacts for longer under the baseline ordering, though not once the reserve money innovation is cleared of its comovement with current narrow money.

The policy lessons should not go beyond this evidence. Reserve money still has a clear job in liquidity management, even though its transmission to the broader aggregates is incomplete. Given how briefly its effects last, though, it cannot serve on its own as the instrument of monetary control. Central bank liquidity turns into deposits and credit only through financial intermediation, so monetary operations are best judged alongside the state of bank balance sheets. Stronger asset quality, better capital adequacy and more credible monetary operations may improve transmission, but the present model does not estimate those institutional effects.

The evidence has four limits. First, policy rates, prices, output, credit and the exchange rate are all outside the system, which therefore identifies transmission within the money supply and says nothing about the effect of monetary policy on the real economy. Second, the Cholesky ordering is an identifying assumption, not proof of institutional exogeneity, and the narrow and broad money responses change with it. Third, with no direct measure of central bank independence, fiscal dominance or electoral timing, the analysis cannot attribute the

observed dynamics to any of these mechanisms. Fourth, longer lags do not remove the serial correlation and conditional heteroskedasticity left in the residuals; the moving-block bootstrap allows for both, but the bands are still approximations. Each limit suggests further work: extending the system to prices, output and the policy rate; identifying policy innovations with sign or narrative restrictions; adding loans and deposits, as the credit-multiplier approach of Dunaev[104] suggests; and examining the microeconomic basis of the multiplier directly with bank-level data on reserves and lending.

Conflict of interest

The authors declare that they have no conflict of interest.

Data availability

The monthly series are compiled from Bangladesh Bank's *Economic Trends*. The corrected dataset and the estimation code are available from the corresponding author on reasonable request.

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