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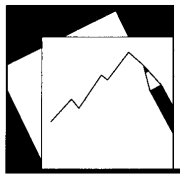

IMF Working Paper

Monetary Policy Implementation: Operational Issues for Countries with Evolving Monetary Policy Regimes

Nils Maehle

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Monetary Policy Implementation: Operational Issues for Countries with Evolving Monetary Policy Regimes

Prepared by Nils Maehle[1]

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Abstract

This paper discusses some key practical issues money targeting countries that want to reform their monetary policy regime need to consider. Consistent with past advanced country monetary targeting practice, it argues that short-term interest rates, not reserve money, should be the operational target for the daily liquidity operations also for countries that mainly relies on monetary aggregates for guiding policy formulations. The paper discusses how a monetary targeting based policy formulation framework can be combined with an interest rate focused operational framework; the use of momentary aggregates as information variables in guiding the setting of short term interest rates; the pro and cons of alternative liquidity management configurations; and the need for having an explicit and clearly communicated numerical inflation objective even when relying on monetary aggregates.

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Author's E-Mail Address: nmaehle@imf.org

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Contents Page

I. INTRODUCTION

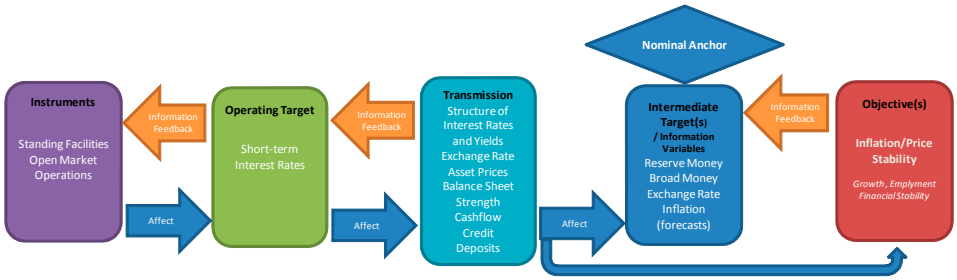
1. **Three critical aspects of effective modern monetary policy formulation and implementation concerns**:

- **Formulation of the policy stance and the determination of the level of the operating target** (interest rates and/or path of monetary aggregates) over the policy horizon deemed consistent with achieving the policy objective.
- **Day-to-day liquidity management** to ensure an effective transmission of policy actions and signals.
- **Policy communications and commitment** to anchor expectations and address the time inconsistency problem.

2. **Conventional monetary and inflation targeting regimes differ with respect to all of these three aspects.** In particular, monetary targeting regimes in low-income countries (LICs) typically have focused on controlling the quantity of liquidity and credit available to the economy both in the short run and over the medium term, while inflation targeting regimes have focused on controlling the price of liquidity and credit. In this regard, the monetary targeting practice in many LICs differs from the past advanced-country monetary targeting frameworks. In the latter group, short-term interest rates and not reserve money in most cases served as the de facto operational target for the daily operations while monetary aggregates, including reserve money and reserves, served as intermediate targets.[2] The practice of monetary and inflation targeting central banks typically also differ with regard to the analytical frameworks and intermediate targets used, and their public communication and commitment to achieving a particular numerical inflation target. However, both groups may have price stability as the stated overriding mandate, both may in practice derive their operating targets from an explicit and published numerical inflation target. That is, both money targeting and inflation targeting central banks may be ultimately targeting inflation.

[2] See in particular Bindseil (2004). See also Freedman (2000b), Friedman (2000), Axilrod (2000), Duesenberry (2000), Poole (2000), and Ireland (2000).

Figure 1. Instruments, Targets, Objectives, and Nominal Anchors



3. **Interim regimes, such as the Enhanced Monetary Targeting and Enhanced Monetary Policy Analysis frameworks,[3] rely to a varying degree on both price- and quantity-based targets and signals for each of the above three aspects of monetary policy formulation and implementation**. Most countries have found that controlling the quantity of liquidity and credit available to the economy has been effective in reducing inflation to moderate levels. However, increased reliance on interest-rate-based operating procedures would be needed to fine-tune inflation-control and inflation-stabilization further in a low to moderate inflation environment where exogenous shocks are relatively more important and the short-term trade-offs between price, output, and exchange rate stability more difficult. Interim monetary policy regimes aim *to improve the clarity, relevance, and consistency of policy signals and policy actions* in order to strengthen the transmission mechanism, while maintaining a role of monetary aggregates in guiding the medium term policy stance and as a disciplining tool to achieve the needed medium term monetary and fiscal restraint consistent with the inflation target. The challenge is how to do this in practice and to ensure that reforms to day-to-day operations, the formulation of the medium term policy stance, and to policy communications are mutually consistent, and consistent with the state of the country's financial sector and overall economic structure. The risk is that reforms to some aspects of the policy framework that are not sufficiently supported by corresponding reforms to other critical aspects of the policy formulation and implementations could undermine the credibility of the reform process and ultimately the policy framework.[4]

[3] See Laurens and others (2014).

[4] In particular, adoption of certain forms of central bank policy rates without having developed the capacity to properly operate the associated short-term liquidity management framework risk weakening the transmission mechanism and the central bank's ability to achieve its policy objectives. Moreover, a public announcement of having adopted an inflation targeting regime without having the ability to control inflation to a sufficient degree risk undermining the credibility of the policy regime and make it harder and more costly to achieve the policy objective.

4. **This paper elaborates on some of the key issues that countries that want to reform their monetary policy regime need to consider.** Section II discusses the pro and cons of alternative short-term liquidity management configurations, how the tradeoffs depend on country circumstances and configuration of the rest of the monetary policy framework. This is a critical aspect of monetary policy formulation and implementation that is often overlooked in LICs. Section III discusses some selected aspects of the choice of policy regime and how to determine the overall monetary policy stance in LICs, including the usefulness of simple money targeting rules in certain circumstances, and the information content in monetary aggregates more generally. Section IV brings the topics discussed in section II and III together and discusses how a monetary targeting based policy formulation framework can be combined with an interest rate focused operational framework. Finally, Section V discusses the associated policy communication and commitment strategy, noting the importance and usefulness of a clear communication of policy actions and objectives, including numerical inflation objectives, while stressing that commitments have to be achievable, and over the long run achieved, to be credible.

II. Short-term Liquidity Management: Some Considerations

5. **Day-to-day monetary policy operations must be aimed at stabilizing short-term interest rates, also for countries that mainly relies on monetary aggregates for guiding policy formulations**. Although the longer term development of market interest rates is endogenous under monetary targeting, focusing the daily operations on managing reserve money instead of reserve balances typically results in unwarranted day-to-day volatility in short-term interest rates that muddles the policy signal and hampers its transmission along the yield curve.[5] Excessive high-frequency interest rate volatility, and the associated high liquidity risk, may also result in hoarding of central bank balances and lower interbank trading, which reduces the relevance of interbank rates for commercial banks liquidity management.[6] This further hampers the monetary policy transmission mechanism. As a result, banks may instead base their pricing decisions on longer-dated t-bill rates from the primary auctions, which may be as much influenced by fiscal policies and other factors then by monetary policy actions.[7] Thus, containing the high-frequency (day-to-day) volatility of

[5] Stabilizing day-to-day movements in reserve money would require aiming OMO operations towards adjusting excess reserves to offset the day-to-day fluctuations in currency in circulation. Because banks demand for excess reserves generally seems to be fairly inelastic, and because there typically are significant high-frequency, but transitory, shocks to the interbank money market, the short-term volatility in excess reserves created by steering OMOs towards stabilizing reserve money can easily cause unwarranted short-term volatility in interest rates.

[6] It also may render central bank policy rates that mainly serve as targets for market rates and are not directly linked to central bank instruments largely irrelevant.

[7] High interest rate volatility and liquidity risk also tend to steepen the yield curve and increase interest rate margins.

short-term interest rates is essential for anchoring the yield curve, strengthening the transmission along the yield curve to other rates, and enhancing the monetary policy transmission more broadly (Appendix I). It also essential for fostering security market development and secondary market trading—reasonably stable and predictable short-term interest rates are a necessary input in the pricing of longer term instruments in the secondary market.

6. **A number of configurations for short-term liquidity management aimed at stabilizing short-term interest rates are possible, and in use**. Besides improving short-term liquidity forecasting in order to fine-tune their open market operations, central banks can use standing lending and deposit facilities[8] to form a corridor—or channel—f or the interbank rate to move within. Besides capping interbank rate volatility, interest corridors reduce the interest rate sensitivity of the commercial banks demand for central bank balances, and thus make the market less sensitive to liquidity forecasting errors (Box 1). Central banks can also use other tools such as reserve requirement averaging provisions (below) to flatten the demand for reserves.[9] The configuration of a country's liquidity management system generally should evolve over time as country circumstances changes—there's no "best configuration" that fit all.

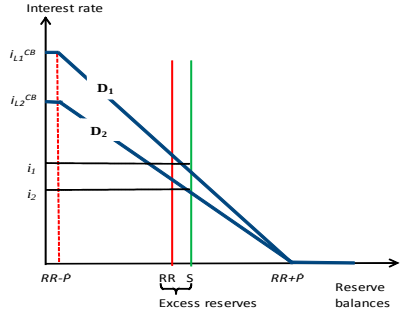
[8] Standing facilities are central bank lending and deposit facilities where the central bank stands ready to transact with banks on demand and in unlimited amounts provided certain conditions are met. These facilities have short maturities, usually overnight, and act as safety valves for the market's liquidity management. Well functioning lending facilities are also critical for the functioning of the payment system to prevent the risk of payment unwinding if some banks are short on liquidity at the end of the day. Access to the credit facility should for that reason be rule based and carry no stigma. Lending standing facilities should be distinguished from lender of last resort facilities.

[9] Additional tools to reduce interest rate volatility and flatten the demand for reserves include "daylight credit fees," and clearing bands (Appendix II).

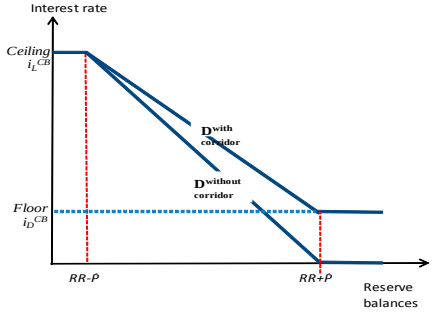
Box 1: Standing Facilities and the Demand for Reserve Balances

The central bank can impact the interbank interest rate on reserve balances both by changes its supply of those balances and by influencing the factors that determines banks demand for them. Besides reserve requirements, banks hold central bank reserve balances for a number of reasons, including for safeguarding against the risk of having to borrow from the central bank at a penalty rate; to meet unexpected after-close-of-the-interbank-market payments; and as a risk-free placement of assets, all of which may render their demand for reserves interest rate elastic. However, advanced-country empirical work finds little longer term correlation between interbank interest rates and the stock of reserve balances. This suggests that the demand for reserves is interest-*inelastic*, at least on a longer-term basis. It also point to the importance of the impact of central bank actions on the demand schedule as illustrated below, and the importance of measures to render the demand for reserves more interest-elastic on a day-to-day basis in order to reduce interest rate volatility.

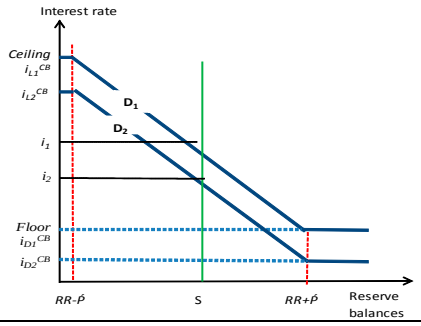
Changing the central bank lending rate tilts the demand curve and changes the interbank rate for a given supply of reserves



A corridor system help flattening the demand curve



Reducing central bank lending and deposit rates shifts the demand schedule downward and reduces the interbank rate for a given supply of reserves



D	Demand for reserves at the close of the market
RR	Required reserves
S	Supply of reserves
P	After close of market payment stocastic shock uniformly distributed within the interval [-Ṕ,Ṕ]
i	Interbank interest rate
i_L^{CB}	Central bank lending rate
i_D^{CB}	Central bank deposit rate

The figures are based on Ennis and Keister (2008), which provides a more indepth discussion of this. See amongh others also Whitsell (2006a, 2006b) for a more general non-linear model and Friedman and Kuttner (2010) for a discussion of the emperical literature.

A. Configuration of Interest Rate Corridors and Policy Rates

7. **There's a number of ways to operate an interest rate corridor system, both with and without the use of some form of a formal central bank policy rate**. The alternatives differ with regard to how well they are suited to different country circumstances, including their liquidity forecasting capabilities; the overall development of the country's financial markets and the functioning of the interbank market in particular; and the country's overall

monetary policy framework. In all corridor systems, a short-term (overnight) standing lending facility is combined with a standing deposit facility to providing a corridor for market rates. Central banks may also carry out open market operations (OMOs) to influence the level of the market rate within the corridor. Some of the critical issues to consider, include (i) how to choose the width of the corridor, (ii) whether, and when, to introduce a formal central bank policy rate to help strengthen policy signaling and guide interbank rates, and if so, how to configure the policy rate; (iii) the degree of reliance on the interbank market versus the standing facilities for facilitating intermediation of central bank balances.

8. **Some of the main alternative interest rate corridor and policy rate configurations include**: [10]

- **A corridor with no official central bank policy rate**. The central bank may, or may not, have an internal target for the interbank rate.
- **A floor system** where the rate on the central bank deposit facility that constitutes the floor of the corridor both serves as the target for the interbank rate and as the official central bank policy rate.
- **A mid-rate corridor system** where the policy rate either is an announced target for the interbank rate—and a central bank commitment to use OMOs to steer interbank rates to the target—or the rate the central bank uses to transact with its counterparts (the "OMO rate").[11] Typically, the policy rate is positioned in the middle of the corridor with the standing facility rates that constitutes the floor and ceiling of the

[10] In principle it is also possible to have a ceiling system where the rate on the central bank lending facility that constitutes the ceiling of the corridor both serve as the target for the interbank rate and as the official central bank policy rate, somewhat similar to the "classical system" where the central bank discount rate, or Bank Rate, combined with OMOs were used to steer short-term market rates somewhat below the Bank Rate (see Bindseil, 2004, and Tucker, 2004). Ceiling systems are not common anymore. They may in practice be less useful than the alternatives, including because of a heightened risk of losing control over unsecured short-term interest rates and of banks risk not being able to carry out their payment obligations if they do not have the needed collateral to borrow from the central bank or the reputational cost of doing so is too high.

[11] Examples of the latter include the European Central Bank (ECB) whose pre-crisis policy rate was the minimum bid rate for its short-term open market lending operations (it would during the same period occasionally also conduct liquidity absorption operations at the policy rate), Bank of England who pre-crisis conducted fixed-quantity open market operations at the policy rate, the current ECB fixed-rate full-allotment liquidity providing tenders, and the National Bank of Moldova fixed-rate full-allotment auctions of certificates of deposits.

corridor set at a fixed margin above and below the policy rate so that they move in tandem with changes in the policy rate.[12]

9. **A corridor system with no formal policy rate may fit countries that rely heavily on reserve money as a near to medium-term operational target but want to start transitioning towards an interest-rate based framework.** While there's no formal point policy rate under this approach, the corridor would serve as a de facto policy range. This configuration provides no signal to the market on where in the corridor the central bank would like to see the interbank rate, which is both its strength and weakness. The lack of a (credible) point policy rate to anchor market expectations may make it harder to stabilize the interbank rate within the corridor.[13] However, this configuration also provides more flexibility for reserve-money-targeting central banks to calibrate their day-to-day liquidity operations to ensure that they are consistent with its longer-term reserve money targets. This is because by not committing to a particular positioning of the interbank rate within the corridor, the interbank rate can be allowed to drift from one side to the other side of the corridor without being inconsistent with the stated (money-based) policy stance. Such persistent drifts should, however, under strict reserve money targeting trigger a shift of the corridor in the same direction and under flexible monetary targeting a reassessment of the targeted longer term reserve and/or broad money path.

10. **The corridor may be set relatively wide initially to provide the central bank with the added flexibility to meet its reserve money target and to reduce the need for frequent repositioning of the corridor.** However, it should, as the central bank gains experience and improves its liquidity forecasting capacity, subsequently be narrowed in order to better stabilize the interbank rate and strengthen the price signal. The narrower corridor may over time start functioning as the *de facto* policy rate. It is critical to ensure that changes in the central bank lending and deposit standing facility rates that form the corridor are followed by corresponding adjustments to the liquidity operations, as needed, in order to avoid a situation where the interbank market rate ends up moving in the opposite direction. Such an inconsistency between the changes in the standing facility rates and the market rates would send conflicting signals to the market about the intended change in the policy stance and undermine the credibility of the central bank's policy framework. Having an internal target for the interbank rate to guide the open market operations may be helpful to avoid this mistake, and to gain experience with how to operate a system with an official policy rate.

[12] Theoretical studies suggest that the market's aggregate demand for (excess) reserves would be less impacted by shocks with symmetric opportunity costs and thus that the central bank would not have to re-estimate the daily demand for reserves as frequently in this case (see Whitesell (2006) for a further discussion of this point).

[13] It may increase the importance of the standing facilities for short-term intermediation of reserve balances.

11. **Adoption of an official point policy rate can help stabilize short-term interest rates within the corridor, and strengthen the transmission of price signals to longer-term rates, if well implemented**. An official policy rate may help anchor market expectations and help stabilize interest rates if the central bank can successfully demonstrate its ability and willingness to use its tools, including OMOs, to consistently steer the interbank money market rate close to the policy rate, and through that ensure the market that they will be able, when needed, to trade at rates close to the policy rate. Failure to do this may, however, increase uncertainty and market volatility. More importantly, if market rates are allowed to persistently drift away from the policy rate, the market risk losing its trust in the overall policy framework, which would not only render the policy rate irrelevant, but possibly harmful.[14] Tying the policy rate to the rate of one of the central bank policy instruments such as one of the standing facilities or to the minimum bidding rate for the fixed quantity repo (liquidity injection) operations and/or to the maximum bidding rate for the reverse repo (liquidity draining) operations may help reduce the risk of this.

12. **The use of a policy rate to stabilize short-term interest rates can be combined with use of monetary targets for guiding the medium to longer term interest rate development**. Although the short-run supply of reserve balances will have to be geared towards steering market rates close to the policy rate (and thus be endogenous), prolonged deviations of broad money growth from predetermined targets could trigger periodic changes in the policy rate aimed at adjusting the pace of broad money growth back to what is considered consistent with meeting the ultimate policy objective (inflation)—that is, broad money can still serve as the intermediate target.

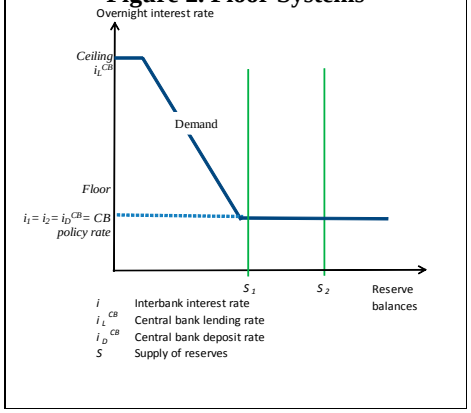
13. **A floor system, where the rate on the central bank deposit facility also serves as the official central bank policy rate, may be the simplest and most robust policy rate configuration**.[15] The central bank under a floor system needs to provide banks with sufficient liquidity to ensure that the overnight interbank money market rate stay close to the policy rate, but could increase the supply of liquidity further without the risk of pushing short-term interbank rates below the target—that is, price and quantity becomes "decoupled (Figure 1). This has several advantages:

[14] There's a number of examples of countries that have prematurely introduced policy rates that have largely been irrelevant in guiding the market, or even been misleading the market about the authorities de facto policy stance.

[15] Floor systems were, prior to the global financial crisis (GFC), common in number of emerging market countries, including India, Russia, and most MENA countries. They were also used in a few advance economy countries, notably Norway (since the mid 1990s) and New Zealand (since 2006), and have become more common in advanced economies following the use of unconventional monetary policy tools in response to the GFC with the US, Canada, ECB, and the U.K. among others *de facto* operating floor systems.

- ***It reduces the need for fine-tuned day-to-day liquidity operations*** in order to keep market rates close to the policy rate[16]—the deposit facility will automatically drain the excess if more reserves than what's needed is provided—which may make it particularly attractive for countries with less sophisticated liquidity forecasting frameworks and/or with structural liquidity surpluses that otherwise would have to be drained through OMOs.

Figure 2. Floor Systems



- ***It allows the central bank to control both interest rates and interbank liquidity.*** In particular, it allows the central bank to provide whatever liquidity may be need to ensure that all banks remain liquid and do not have to unwind payments or radically curtail lending in crisis situation where the interbank market stops functioning properly. It also allows central banks to engage in "quantitative easing." Both of these features of floor systems can be critical in time of financial distress or when rates are pushing against the zero lower bound.

- ***It makes it easier to align banks within-day liquidity needs with the overnight balances that is consistent with the overnight interbank money market interest rate target.*** Banks need reserve balances to make interbank payments and settling a vast array of transactions, including most retail bank payments. The value of interbank payments carried out through the day can easily exceed banks overnight balances. Thus, to ensure a smooth working of the payment system, central banks my have to increasing the supply of reserves during the day—that is, provide *daylight reserves* or *daylight credit*.[17] Under a floor system, at the end of the day the central bank may not have to shrink the supply of reserves all the way back to achieve the targeted overnight market rate. This should help reduce any tensions between the central bank's payment system and monetary policy objectives.

- **It may help reduce banking costs and interest rate spreads, and increase the central bank's control over short term rates**. The abundance of costless, safe reserves would reduce liquidity risk and could displace costly and risky private credit

[16] Including because the demand for reserves tend to be more elastic at the floor (and at the ceiling) of the corridor than in the middle of the corridor (see Whitesell (2006) for a formal model of this).

[17] And more so as they are replacing end-of-day netting procedures with real-time gross settlement systems.

in the banking system and thereby reduce banking costs, while paying interest on excess reserves would reduce the "reserve tax," and paying interest in both excess reserves and required reserves would eliminate the reserve tax. As a result, lending rates may be reduced and deposit rates increased. Reducing or eliminating the reserve tax would also reduce or eliminate banks incentives for substituting away from central bank reserve balances for payment services and thereby increase the central bank's control over short term interest rates.[18]

14. **However, floor systems also provide fewer incentives for banks to engage in interbank trading.** By reducing liquidity risk, banks have fewer incentives to invest scare resources on liquidity management systems and developing trading relationships to intermediate reserve balances.[19] As a result, a substantial part of the bank-to-bank intermediation of reserve balances may not take place in the market but through the central bank. The resulting lack of established interbank trading relationships may increase the risk of large spikes in interbank rates at times of less flush liquidity conditions, unless the corridor is kept sufficiently narrow.[20] This tendency of floor systems to reduce the incentive for interbank trading can be mitigated somewhat by (i) not supplying more reserves than what's strictly needed to keep interbank rates close to the floor;[21] and (ii) by having a tiered rate structure for the deposit facility where deposits above a pre-determined amount are remunerated at a lower rate to encourage banks that are particularly long to lend to the market.[22]

15. **Providing incentives for interbank trading may, however, be of secondary importance in countries with significant structural impediments to interbank trading**

[18] See Goodfriend (2011).

[19] The savings from this can be substantial. Active commercial bank liquidity management can be costly as it requires monitoring and accurate forecasting of liquidity inflows and outflows, and analysts, traders, back office staff, managers etc. to undertake both the monitoring and forecasting and the needed trading (see also Bindseil and Nyborg, 2007).

[20] It is sometimes also argued that active interbank trading may help financial stability through increased incentives and scope for peer-monitoring of individual bank solvency risks. Others have argued, however, that because interbank trading is very short-term, there is little focus on the long-term solvency of the borrowing bank (see Bernhardsen and Kloster, 2010). Moreover, active interbank markets did not prevent the recent financial crisis (much of which was bank-sourced).

[21] That is, in Figure 1 by keeping the supply of reserves close to S_1 and not S_s.

[22] For this reason, New Zealand has been operating a floor system with a tiered rate structure since 2007 and Norway has done the same since late 2011. See also the discussion of this in Appendix II.

that may dominate the trading incentive issue.[23] Floor systems with a sufficiently narrow corridor may for these countries provide better anchored, less volatile, and more predictable short-term interest rates—that is a *clearer policy signal*—than the alternative policy rate configurations. Moreover, while under a floor system the interbank market (and the interbank rate per se) may be less relevant for banks liquidity management, the easy access to standing facilities with stable rates may in fact enhance the banks' ability for short-term liquidity management and thus, compared to the alternative configurations for countries with significant structural impediments to interbank trading, *improve the relevance of the policy rate.*

16. **Thus, monetary transmission could be stronger under a floor system than a mid-rate corridor system when there are significant structural impediments to interbank trading.** Some have argued that the persistently higher level of excess reserves under floor system would reduce competition for bank deposits and thus weaken the policy transmission to commercial bank deposit rates. However, it is not clear that this argument is correct as banks holdings of excess reserves earn the overnight market rate under a floor system. Banks should have the same incentive in either system to mobilize deposits as long as the costs of attracting additional deposits (by bidding up deposit rates, or offering deposit facilities to unbanked customers) is lower than the interbank rate.

17. **The better anchoring of short-term rates under a floor system should, furthermore, help develop the capital market.** It should help with the pricing of longer-term securities, which is essential for the development of the secondary market and ultimately for the development of longer-term commercial bank, and nonbank, lending product. This should also help lowering government borrowing costs.

18. **Mid-rate corridor systems are more demanding to operate than floor systems, but have some advantages.** They do require better liquidity forecasting frameworks, more fine-tuned and more frequent OMOs, and supporting measures such as reserve requirements with reserve averaging to properly steer interbank rates and contain volatility. However, they also provide stronger incentives for interbank trading, which as noted above provide a number of advantages for countries with no, or few, structural impediments to interbank trading. Mid-corridor systems may be the natural configuration for countries with a structural liquidity shortage that require the central bank inject liquidity instead of predominantly absorb excess reserves.[24] For this reason, a number of emerging economy central banks

[23] Examples of such impediments include high trading costs and significant counterparty risks, including because of lack of a proper trading platform and cumbersome collateral handling, and a perception that interbank trading entail aiding its competitors.

[24] For countries with structural liquidity shortages, mid-corridor systems require banks to provide the central bank with less collateral, which is costly, may reduce the secondary market liquidity of securities accepted as collateral, and may constrain the banks' ability to engage in other trading activities.

shifted from a floor system to a mid-corridor system as structural surpluses were drained trough foreign exchange sales and retail deposit growth that left the banking system with a structural central bank reserve shortage.

B. Determining the Width of the Interest Rate Corridor[25]

19. **Setting the interest rate corridor too wide may hamper both market development and the transmission of policy signals, and lead to reserve hoarding**. It is common to argue that the standing facility rates should be "penal," hence that the corridor needs to be fairly wide to discourage reserve intermediation via the central bank and create sufficient incentives for banks to deal among themselves in the overnight interbank market. However, a wide corridor could also result in relatively high day-to-day interbank rate volatility that could muddle the policy signal and increase trading risks, and particularly so when risk concerns and structural factors render the interbank market less functional. For example, with a 200 basis point corridor—which, while wide for advanced country standard is much narrower than the corridors found in may developing countries (Table 1)—the day-to-day swings in the interbank rate could easily become much larger than the 25 basis points advanced countries change their policy rate with when they want to signal a change in the policy stance. However, if settlement costs are high and trading volumes low, even such large deviations between the policy rate and deposit facility rates may not be sufficient to make it profitable for banks with excess reserves to lend to the market.[26] Moreover, high interbank rate volatility also complicates banks liquidity management and makes it riskier to rely on the market to fine tune their reserve holdings.[27] Thus, if the marginal cost of accessing the central bank lending facility is too high, credit and liquidity risks are material, and settlement costs high relative to the size of the standard trades, it would be rational for banks to increase their liquidity buffers instead of engaging in overnight interbank trade.[28]

20. **Setting the corridor on the narrow side so that the market has no incentive for short-term trading may be less of a concern**. As argued above, short-term market trading, while generally advantageous, may be of secondary importance from an immediate policy perspective—the short-term rates controlled by the central bank may still be the relevant ones for banks liquidity management and transmit to the longer rates. For this reason, since 2007,

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[25] See among other Gray and others (2013) for a discussion of this.

[26] For example, if an overnight trade yields a gain of 25bp on US$1 million, the bank will only earn US$6.85, which may not cover the fixed costs (Gray and others, 2013).

[27] For instance, a pick-up of 50bp from interbank overnight lending every day of the week would be more than offset if the lending bank had to access a credit SF at 300bp over the policy rate once a week (Gray and others, 2013).

[28] Consistent with this, interbank market volatility was pre-crisis typically fairly low in advanced countries with the most active interbank markets.

a number of advanced country central banks have reduced the width of their interest rate corridors to reduce short-term rate volatility from heightened levels in the aftermath of the financial crisis.

Table 1. Interest Rate Corridors in Selected Countries

50bp	Australia, Canada, Chile, Israel, Malaysia	Symmetrical
100bp	Egypt, Tunisia, New Zealand, Singapore, South Africa, Sweden, Switzerland, Thailand	Not all symmetrical
200bp (pre-crisis for ECB, Bank of England)	Bahrain, Jordan, Morocco, Oman, Czech Republic, ECB, Bank of England,[54] Hungary, India, Korea	Mostly symmetrical
More than 200bp	Iraq, Qatar, Bolivia, Poland, Azerbaijan, Brazil	

Source: IMF ISIMP database.

C. Reserve Requirement Averaging

21. **Reserve averaging may help reduce interbank market volatility and the need for frequent OMOs.** In a system with a reserve averaging, banks are not required to hold a particular quantity of reserves each day. Rather, each bank is required to hold a certain *average* level of reserves over a period (the "maintenance period" or MP). Reserve averaging gives banks flexibility in determining when they hold reserves to meet their requirement. In general, banks will try to hold more reserves on days they expect the market interest rate to be lower and fewer reserves on days when they expect the rate to be higher. By allowing such flexibility, commercial banks' demand for reserve balances becomes more interest rate sensitive and the interbank market rate less sensitive to shocks to the demand for and supply of reserves.[29, 30]

22. **However, this requires that the expected interbank interest rate for the final day of the reserve maintenance period is properly anchored**. Inter-temporal arbitrage would tend to keep overnight rates in the earlier part of the MP in line with the expected rate on the last day of the MP (the "settlement day"). However, it also means that any uncertainty about what the interbank market rate would be on the final day of the MP would transmit to the earlier days of the MP. Unfortunately, the "flattening" of the demand curve caused by reserve

[29] Advanced-country empirical work suggest that, while demand for reserves may be highly interest-*inelastic* on a longer-term basis, with reserve averaging the demand for reserves may at the same time be highly interest-*elastic* within the maintenance period (see Friedman and Kuttner, 2011, for an extensive discussion of this). As a result, overnight interbank interest rates may react strongly to announced changes in the central bank target for the interbank rate, or market expectations about such changes, that are properly backed by a strong commitment to adjust OMO operations, as needed, to steer interbank rates close to the target. Among other for this reason, even without the advantage of a corridor system, advanced country central banks often may not have to adjust the supply of reserves by much to achieve the targeted change in interbank rate.

[30] Reserve averaging will also lower the pre-cautionary demand for reserves during the MP, but not at the end of the MP.

averaging disappear on the settlement day, which causes interest rates to be more volatile on those days and on the days leading up to the settlement day.[31, 32] The risk that the central bank may change its policy rate before the end of the MP add further uncertainty and make it harder for the central bank to keep the rate on target in the period before any expected policy change is made. To avoid these sources of volatility, some central banks:

- Schedule their policy committee meetings to the beginning of the MP (e.g., ECB, BoE) to ensure that liquidity management by the banks is not affected by speculation about future rate changes.[33]
- Align the maturity of their OMO operation instruments to the MP to ensure that they do not overlap the timing of policy decisions.
- Position the settlement day at the middle of the working week—preferably Wednesdays—to avoid market volatility and distortions caused by weekend and holiday effects—liquidity is easier to forecasting for a midweek day than the day before or after a weekend.[34]
- Conduct a fine–tuning OMO on the final day of the MP to correct for possible errors in aggregate liquidity supply in the earlier part of the MP (UK).
- Narrow the interest rate corridor on the last day of the MP (UK).[35]
- Allow a certain percentage of reserve deficiencies or excess reserves to be carried over to the next period (US).
- Use clearing, or penalty-free, bands where small settlement day reserve shortfalls are not penalized and small excesses earn an interest (appendix II).

23. **Reserve averaging can be particularly useful for reducing interbank rate volatility for countries that rely heavily on reserve money as a near to medium term target.** For these, the flexibility provided by averaging for banks to manage day-to-day

[31] See Bartolini, Bertola, and Prati (2002) for a theoretical model of this phenomenon.

[32] It also causes banks to tend to hold larger reserves on settlement days (Bartolini, Bertola, and Prati, 2000).

[33] The Euro system and the Bank of England set the MPs to run between the dates on which monetary policy decision meetings are held, and in addition they use a 7 day maturity for OMO conducted at the policy rate.

[34] See Gray (2011) for a further elaboration of this.

[35] In the system operational from May 2006 until the global financial crisis the corridor was narrowed from ±100bp during the RMP to ±25bp on the last day of the RMP (Gray and others, 2013).

variations in reserve balances can substantially help reduce the tension between the day-to-day liquidity operations needed to stabilize short-term rates and the liquidity operations consistent with over time meeting their reserve money target.

24. **Reserve averaging may also help increase interbank trading**. Besides the benefits for interbank trading and capital market development provided by lower interbank rate volatility, the short–term buffer provided by averaging means that banks may be more relaxed about making interbank loans since they should be more confident of their ability to manage short–term liquidity shocks (Gray, 2011).

25. **The maintenance period need to be sufficiently long for banks to be able to fully benefit from reserve averaging.** For this reason, the RR calculations should also be fully lagged,[36] as any overlap of the calculation and the maintenance periods—that is contemporaneous or semi-contemporaneous calculations—reduced the effective length of the maintenance period. According to Gray (2011), most central banks find that, in practice, at least a 14 day MP is needed for banks to be able to benefit from averaging, and one-month MPs appears to have worked well. Besides the added flexibility provided to banks, averaging over a full month MP period may make it easier for the central bank to forecast the need for liquidity within the MP as many transactions have a monthly cycle.[37, 38] Moreover, a lot of economic statistics are available with a monthly frequency, including monetary statistics. For these reasons, monthly MPs may be particularly helpful for monetary targeting central banks to reduce the tension between liquidity operations aimed at stabilizing short-term rates and liquidity operations aimed at meeting the monetary target(s).[39]

[36] A fully lagged calculation period also helps the central bank managing liquidity by giving it advanced information about the aggregate demand for reserves over the maintenance period—banks demand for excess reserves—while volatile on a day-to-day basis—do typically not vary much over the longer run in well managed systems.

[37] Including government and other salary payments, pension payments, and a number of tax flows.

[38] Averaging over a full month MP combined with a relatively high reserve requirement may provide banks with the needed flexibility to buffer against market imperfections without a need to hold additional—"excess"—reserves except for on the last day of the MP. It would then generally be sufficient for the central bank besides fine-tuning operations and the other measures to address the end-of-MP issue discussed above, to simply supply the predetermined reserve balances needed for the banking system to meet the reserve requirement during the MP.

[39] To achieve this, and the above benefits of a midweek settlement day, the MP may be set to end on the first Wednesday of the each month. Depending on the calendar, the length of the MP will then vary between four and five weeks throughout the year.

Table 2. Maintenance Periods

	Total				% of Total			
	2008		2013		2008		2013	
	Total	Averaging	Total	Averaging	Total	Averaging	Total	Averaging
No MP	9		10		9.2		8.0	
Between 1-7 days	23	17	25	14	23.5	24.6	20.0	15.1
Between 8-15 days	17	15	30	23	17.3	21.7	24.0	24.7
> 15 days	46	35	56	52	46.9	50.7	44.8	55.9
Varies	3	2	4	4	3.1	2.9	3.2	4.3
	98	69	125	93	100	100	100	100

Source: IMF survey of central banks.

D. Other Issues

Targeting the overnight interbank rate or longer term interbank rates?

26. **Most central banks target the overnight interbank rate, but some are targeting longer term rates with apparent success.** In particular, the Swiss central bank targets the three-month labor rate while bank of Uganda is targeting the 7-day interbank rate. In both cases, the main reason for this choice was that these were the more developed and liquid money-market segments at the time of shifting from using reserve money to using an interest rate as the operational target.[40] However, while the longer-term rates may be more relevant for economic activity, they are harder for the central bank to control. Moreover, targeting the longer-term rates could cause extreme movements at the short end of the yield curve in response to expectations of future changes in the longer-term target. Moreover, because the targeted maturity may span the dates of rate decisions, the market rate would be a function of both the current and expected future monetary policy stance. As a consequence, in order to steer market rates close to the operational target, the central bank may have to commit to a certain path of future decisions.[41]

Implications for Central Bank Costs

27. **Increased efforts to better control short-term interest rates may initially increase central bank costs in cases of particular large excess reserves**. Banks have strong incentives to hoard reserve balances when liquidity risks are particular high because of a non-functioning interbank market, excessive high-frequency interbank rate volatility and low market liquidity, large spreads between central bank lending rates and market rates, and/or

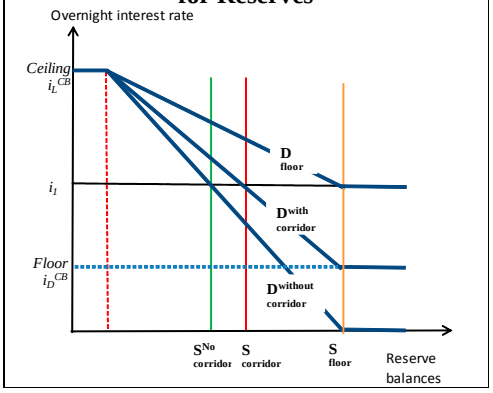
[40] According to Amstad and Martin (2011) for Switzerland and Laurens and others (2013) for Uganda.

[41] See Bindseil (2004, 2007) for a further elaboration of this.

constraints on access to central bank lending facilities. In such a situation, banks may need to hold substantially larger excess reserve balances than what they would need in a better functioning system. Consequently, there may be a need for fairly large and costly mopping up operations to keep market rates close to the target as the operating framework is improved. Increasing unremunerated reserve requirements,[42] shifting government accounts from commercial banks to the central bank, and/or increased issuance of government debt with the proceeds placed in a locked government account at the central bank could be used to more permanently mop up this structural excess liquidity and reduce the costs to the central bank of operating a better functioning monetary policy framework.

28. **Paying interest on excess reserves may be less costly for low-income central banks with structural liquidity surpluses than feared, and may be self-financing for central banks with a structural liquidity deficit**. The standard models for commercial bank demand for reserve balances imply that introducing an overnight deposit facility for excess reserves, and moving to a corridor or floor system, should result in an outward swing in banks demand for reserve balances (Figure 2). Consequently, in the case of a structural liquidity surplus that needs to be mopped up, the targeted interest rate level can be achieved with smaller, or in the case of the floor system no, open market operations. Most OMO instruments have a longer-than-one-day-maturity and, with an upward sloping yield curve, and interest rates that are higher than both the central bank deposit rate and target overnight rate. Thus, the interest savings from the reduced size of the needed mopping up operations would help offset a (possibly large) part of the interest payment on excess reserves placed in the overnight deposit facility. In the case of a structural liquidity deficit, the central bank would be injecting into the market the additional liquidity banks want to hold by engaging in repo operations or second market purchases of longer-term government securities. In this case, the central bank would be earning difference between the interest it earns on those longer maturity instruments and the interest it pays on the increased deposits. This net interest

Figure 3. Deposit Facilities and Demand for Reserves



[42] Unremunerated required reserves do, however, represent a tax on deposits, which causes deadweight losses, including by reducing banks incentives for deposit mobilization and increasing interest rate spreads. For this reason, many advanced country central banks have started to remunerate required reserves. However, the need to hold large unremunerated excess reserves because of poorly functioning central liquidity management system also causes deadweight losses that can easily be larger than those caused by high unremunerated required reserves.

earned by expanding the central bank's balance sheet may be sufficient to pay for all, or most, of the interest it would have to pay on preexisting excess reserves when, as is the case in most advanced countries, preexisting excess reserves are relatively small. [43,44]

III. Determining the Policy Stance and the Role of Monetary Aggregates

A. Introduction

29. **Although short-term interest rates should be the operational target, and monetary policy actions mainly transmit via interest rates, there may still be a role for monetary aggregates in determining the policy stance**. The optimal use of monetary aggregates in the monetary policy making process depends on a number of country specific circumstances. This section discusses some of issues that should be considered in this regard regarding (i) the reliance on simple money targeting rules versus more flexible approaches (including a reliance on advanced modeling frameworks),[45] and (ii) the information content of money and interest rate data.

B. Money Targeting Rules versus Flexibility

30. **The optimal degree of flexibility, and the reliance on monetary versus interest rate rules, in determining the level of interest rates and/or path of monetary aggregates to steer towards in order to achieve the inflation objective, depends on the specific country circumstances**. Some of the important factors include the overall level of inflation; the type, relative size, frequency, and duration of shocks to the economy; availability of high-frequency, reliable, and timely data on the state of the economy; the central bank's analytical (including modeling) capacity; and the usefulness of monetary aggregates as a disciplining device and a device to deflect political pressure to keep interest rates too low.[46]

31. **A simple money targeting rule may be preferable when inflation is relatively high; particularly if central bank capacity is low, the risk of fiscal shocks are high, or there's political constraints on increasing interest rates.** Simple money targeting

[43] See Goodfriend (2002) for a discussion of this in the case of the US.

[44] Note that it is possible to only pay interest on excess reserves and not required reserves. It is also possible to have a tiered rate structure where excess reserves above a pre-determined level are remunerated at a lower rate (see Appendix II for a discussion of this).

[45] See Laurens and others (2014) for a further comprehensive discussion of this issue and the related Enhanced Monetary Targeting and Enhanced Monetary Policy Analysis frameworks.

[46] Several authors have been arguing that this may be one of the main reasons for the shift in the 1920s in the US and other countries to reserve targeting as the publically stated, but not necessarily the de facto, operational framework (see in particular Bindseil (2004) and the references in that paper for an extensive discussion of this.

frameworks that keep broad money growth over the medium term under reasonable control has proven effective in reducing inflation from high to more moderate levels, and at the same time supported financial stability (including output and exchange rate stability) and growth. Under monetary targeting, broad money, which is not directly controllable by the central bank, serves as an intermediate target, from which the central bank would derive an operational target to guide monetary policy implementation. The operational target that the central bank in low-income countries would use its instruments to achieve has typically been the path of reserve money, derived from the targeted broad money path by projecting the components of the money multiplier. However, it is also feasible to use the interbank money market interest rate as the operational target in a monetary targeting policy framework as discussed in section IV below.[47]

32. **The choice of monetary policy framework becomes more difficult in a low inflation environment, however.** With lower inflation, exogenous shocks become relatively more important, and the short-term trade-offs between price, output, and exchange rate stability become more difficult. Consequently, while the use of broad money as an intermediate target to guide policy implementation may still be helpful in keeping inflation under control, more flexible, activist, and forward looking frameworks could help reducing inflation volatility and better anchoring inflation expectations under the right circumstances.

33. **Reaping the potential fine-tuning benefits of an activist monetary policy is demanding, including for advanced country central banks, though**. It does require having the capacity to properly indentifying the type, strength, and duration of the shocks experienced, as the appropriate policy response very much depends on what shock the country is facing, and their impact on future inflation, the output gap, market interest rates, risk premiums, and the exchange rate. Forward-looking structural analytical models may be helpful in this regard. However, they are demanding to use, in particular in low income countries with serious data gaps and data timeliness and reliability issues, and where the economic structure, and policy and shock transmission, may differ from the advanced countries that most of these models have been tested on. Shocks to potential output, demand, and inflation typically are both larger and longer lasting in developing countries than in advanced countries, and the monetary transmission mechanism less understood, and more rapidly changing.

34. **Real time estimates of potential output, and the natural rates of unemployment and interest, is subject to considerable uncertainty even in advanced countries, which can render activist monetary policy risky.** As documented in a series of papers by

[47] See Bindseil (2004) for a comprehensive discussion of the rise and fall of the reserve position doctrine and the use of interest rates as the operational target also under the money targeting era.

Orphanides and coauthores,[48] real time output and unemployment gap measures in the US at times differed substantially from subsequent the ex post measures both because of unreliable real time estimates of current output and misperceptions about potential output and the natural rate of unemployment, and activist policies that relied heavily on these measures may have increased economic instability.[49] Real time estimates of potential output and the natural rates of unemployment and interest is of course many times harder in low income countries both because of their more frequent, larger, and larger lasting shocks, and because of their much weaker statistical systems—current unemployment and output may not even be known, or only with a substantial delay and large measurement uncertainty. Moreover, the natural rate of interest is likely much less stable, and thus harder to estimate, in low income countries, including because of frequent fiscal shocks and their developing financial sectors and financial markets.[50]

35. **Reaping the potential fine-tuning benefits of an activist monetary policy also requires having a good understanding of the transmission mechanism, which likely is evolving.** Without it, it becomes hard to properly caliber the timing and strength of the policy response. Failure to properly do so could risk adding to the shocks instead of abating their impact on inflation, growth, and financial stability. However, determining the strength and lags of the monetary policy transmission becomes inherently harder in a low inflation environment where unobserved shocks may dominate. Econometric results can be highly unreliable, or even misleading under such circumstances, unless the researcher is able to properly identify all shocks the country has faced over the sample. For example, assume that monetary policy is highly effective and the central bank has been successful in adjusting interest rates (or money growth) to largely offset any exogenous shocks to inflation. As a result, inflation may have been fairly stable, while interest rates (or money growth) may not only have been volatile, but could even have been positively (negatively in the case of money growth) correlated with inflation. Consequently, if the unobserved shocks are not properly indentified, which is hard to do, it is easy to conclude that the particular form of monetary

[48] See among others Orphanides (2001, 2002, and 2003a, b), Orphanides and Nord (2002), and Orphanides and Williams (2002, 2005a, b, and 2007).

[49] According to Orphanides and coauthors, this may be the main explanation for the “Great Inflation” of the 1970s.

[50] See among others McCulley (2008) and Krugman (2014) on the changing natural rate of interest in advanced countries during, and as a consequence of, the global financial crises and associated structural changes in those countries. See also Laubach and Williams (2001) for estimates of time varying natural rate of interest for the U.S.

policy studied is not effective (and that interest rates, or money, do not matter) in controlling inflation, or may even have the opposite effect on inflation than theory suggest.[51]

36. **Because of the above, it is generally preferable to rely on a number of tools and indicators to determine the level of interest rate and/or path of monetary aggregates to target.** Modeling, short- and medium-term inflation forecasts incorporating expert judgment, and analysis of available high frequency indicators (including the details of the monetary and price statistics, and the trend-cycle, seasonal, and irregular components of the monetary and price statistics time series), may help a monetary targeting central bank determine whether the assumptions underpinning the monetary program remain valid, or whether the program should be revised. Similarly, for a central bank that primarily relies on model-based inflation forecasts to determine the policy stance, monetary aggregates and other timely high-frequency data may provide both useful inputs into the forecasting exercise and cross checks of the forecasts.

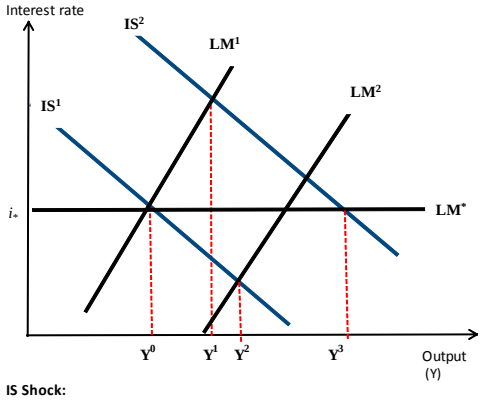
C. Money and Interest Rate Rules, and the Information Content of Monetary and Interest Rate Data

37. **Money and interest rates are linked.** Thus, it is possible, at least in principle, ex ante to derive simultaneously —but not independently—a target for both money and interest rates. However, because of economic shocks, this ex ante equivalence between the money and interest rate targets will not hold ex post, and the authorities must decide before knowing current state of affairs and the shocks that will hit the economy over the next period whether to adhere to the ex ante interest rate target or the ex ante money aggregate target. This basic insight has given rise a long-standing literature on the optimal choice of monetary policy instrument—or rather, the operational target—and the optimal adherence to money versus interest rate targets following the seminal paper by Poole (1970). Although, as argued in Section II above, the day-to-day monetary operations should focus on managing short-term interest rates, the basic insight from the Poole literature remains relevant, both for the use of monetary aggregates as intermediate targets, including when to adhere to them in a world of incomplete information, and for the interpretation of developments in monetary aggregates and interest rates more generally.

[51] See among others King (2002) for experiments based on model generated data that demonstrate this risk of drawing the wrong conclusion from econometric studies when unobserved shocks are important.

38. **Shocks to money demand can lead to excessive inflation and output volatility under strict monetary targeting, but so can demand shocks under interest rate targeting**. The original Poole analysis was cast in the static IS-LM model (as in Figure 3) focusing on the impact of two alternative policy rules—targeting the money stock or the level of interest rates—on output variability, not inflation, but the logic of his arguments and his conclusions apply equally well to the inflation control issue that's at the center of modern monetary policy analysis. More recent studies, using the current New-Keynesian workhorse model framework,[52] have reached similar conclusions to Poole's that whether to rely on a monetary or interest rate (intermediate) target depends on the relative volatility of money demand and real shocks, the interest rate elasticity of money demand, and the degree of noise in the relationship between short term money market rates controlled by the central bank and the longer term rates that matter for private sector behavior and money demand. That is:

Figure 4. Shocks, and Interest Rate versus Monetary Targeting



IS Shock:
Under interest rate targeting: Output shift from Y^0 to Y^3
Under monetary targeting: Output shift from Y^0 to Y^1

Money Demand Shock:
Under interest rate targeting: No shift in output
Under monetary targeting: Output shift from Y^0 to Y^2

- An **interest rate targeting rule** would work better than a money target rule when money demand volatility is high relative to the volatility of the IS curve, the LM curve is relatively steep (money demand is un-elastic) and the IS curve is relatively flat, and money market interest rates are closely correlated with longer-term securities rates and lending and deposit rates.

- A **money targeting rule** would work better than an interest rate target rule when money demand volatility is low relative to the volatility of the IS curve, the LM curve is relatively steep (money demand is un-elastic) and the IS curve is relatively steep,

[52] Berg, Portillo, and Unsal (2010). Bhattacharaya and Singh (2007) reach similar conclusions using a different modeling framework. See also Walsh (2003) for a discussion of the Poole analysis, Collard and Dellas (2005), and Singh and Subramanian (2008, 2009).

and money market rates are less closely correlated with longer term securities rates and lending and deposit rates.

39. **Thus, a money targeting rule may be more robust than an interest rate rule when the economy is subject to large aggregate demand shocks, including in particular fiscal shocks**.[53] A positive demand shocks would both add pressure to inflation and increase money demand, which under a monetary targeting regime should result in an automatic increase in interest rates. Moreover, this increase in interest rates would satisfy the Taylor principle that an increase in inflation requires an increase in real interest rates for inflation to be stabilized if money demand is relatively interest rate inelastic. A similarly passive interest rate rule would, on the other hand, result in price indeterminacy and instability. A feedback rule, like the Taylor rule—$i_t = \pi_{t-1} + \bar{r}_t + a_\pi(\pi_{t-1} - \bar{\pi}_{t-1}) + a_\pi(y_{t-?} - \hat{y}_{t-?})$[54]—where interest rates are adjusted in response to deviations of observed inflation from target and (possibly) the estimated output gap, although satisfying the Taylor principle if the coefficient on the inflation gap is positive, could also be destabilizing as it in practice would be backward looking,[55] reacting to past, not current, or future inflation. Committing to partly correcting for past inflation target misses, rather than conducting policy in a purely forward looking fashion, may be appropriate and needed to properly anchoring long term inflation expectations,[56] but strictly following a purely backward looking Taylor rule may overly emphasize past inflation, and with a possible unnecessary delay—because of the lags in the transmission of demand shocks to inflation, a money targeting rule may result in an earlier and more timely interest rate adjustment.[57]

40. **A money targeting rule may also be more robust than an interest rate rule when the economy is subject to credit supply shocks.** The experience of Zambia on 2009-10 is

[53] And this particularly so if there's also limited capacity to timely identify such shocks, or political constraints to increase interest rates as needed to contain inflation pressure.

[54] Where i_t is the target short-term nominal interest rate, π_t is the observed rate of inflation, $\bar{\pi}_t$ is the inflation target, $\bar{r}_t$ is the assumed natural real interest rate (or alternatively the equilibrium, flexible price, full employment stable price interest rate), y_t is the log of constant price GDP, and $\hat{y}_t$ is the log of potential output.

[55] Inflation as measured by the consumer price index is typically observed monthly with a one month lag in most countries, while estimates of GDP in many low income countries may only be available with a substantial lag on an annual basis, and subject to large measurement errors.

[56] See Woodford (2007) for why, contrary to what's often emphasized in the literature on interest rate rules, it may not be appropriate to let current, and past, inflation bygones be bygones. See also the work of Orphanides and Williams (2005b, 2007, and 2008) on learning and expectation formation for arguments in favor of a more aggressive response to current inflation.

[57] Several studies have found that money growth lead inflation peaks by as much as a year (see among others Batini and Nelson, 2001, Nelson, 2003, and Reynard, 2007), and thus may contain forward-looking information.

interesting in this regard. Following the global financial crisis, Zambia experienced a massive negative external trade shock and associated rise in the country's external risk premium as the price of its dominant export copper collapsed. This, and a related sharp rise on nonperforming loans in the banking sector, triggered a sharp reduction in banks risk appetite. Banks increased their lending rates, reduced sharply their lending to the domestic private sector, and increased their demand for government securities. After an initial slowdown in reserve money supply amid stable short term interest rates,[58] the central bank increased money supply broadly in line with projected increase in nominal GDP and change in velocity, despite an explosion in excess reserves and a collapse in the yields on short term government securities—the yield on 91-day t-bills declined by almost 1400 basis points between October 2009 and April 2010—which in retrospect appears to have been appropriate.[59] It is hard to imagine an interest rate targeting central bank loosening the policy stance this aggressively.

41. **Monetary aggregates may convey information about the monetary conditions that are not fully captured by short-term interest rates.** Although the various transmission channels discussed in the literature all effectively work through interest rates (and the exchange rate), it is not clear that they in practice can be adequately summarized by developments in short-term market rates only. As also stressed in Appendix I, monetary policy impacts the economy, and inflation, through its impact, over time and with various lags, on the full spectrum of interest rates, asset prices, and explicit and implicit yields, as well as on the strength of banks' and bank borrowers' balance sheet and risk appetites. Short-term market rates may provide an adequate summary proxy for this complex process under normal circumstances in advanced countries with fully developed, deep, and liquate financial markets that allow for a fast and complete transmission from changes in short term rates to the full set of yields. However, short-term market rates likely do not provide an adequate summary proxy in times of stress and in countries with severely underdeveloped and segmented financial markets or important non-market-determined rates. As also stressed in the monetarist literature, monetary aggregates may serve as an index of the fuller spectrum of rates and better capture the full set of transmission channels under these circumstances. [60]

[58] This slow down in reserve money was likely due to a number of factors, including a decline in the demand for currency, concerns about a higher-than-targeted money growth in 2008, higher-than-targeted food and nonfood inflation, and a sharp increase in excess reserves related to a decline in deposits and credit to the private sector.

[59] See Baldini and others (2012) for an ex post model-based analysis of Zambia's monetary policy during this period.

[60] See in particular Nelson (2003) for a further discussion of this, and the difference between the monetarist and Keynesian views of the monetary policy transmission mechanism. See also Nelson (2003) and Reynard (2007) for a discussion of equilibrium changes in velocity—including from the Fisher effect in the case of protracted disinflation—that if not properly corrected for may blur the money-inflation relationship and bias econometric

(continued)

42. **Money and credit aggregates may also convey early forward–looking information about the real economy and demand conditions that could provide early warnings about future inflation and financial stability risks.** Many have found a close longer-term correlation between narrow money and growth and between broad money and inflation, and, in line with Friedman and Schwartz pioneering original work, that money growth may lead inflation peaks by as much as a year.[61] While this does not necessarily imply a causal role for money in the transmission mechanism,[62] it does imply that money and credit aggregates may contain useful coinciding and/or forward-looking information. Excessive credit growth has been shown to be useful and leading indicator of future financial stress. It may contain additional forward looking information, including because besides interest rates, credit growth is driven among other by expectations about future growth, risk perceptions, and the degree of optimism or pessimism in the economy, which again influence spending , economic activity, and eventually inflation. These factors may also affect the slope of the yield curve, and longer term interest rates and yields more generally, as well as broad money growth. Banks create deposits, and thus broad, or commercial bank, money, when they lend, but the broader set of interest rates and asset yields may (have to) adjust to ensure that the public what to hold these deposits and not seek to exchange then for higher yielding assets. This is one of the reasons why broad money may both contain forward looking information about demand conditions and future inflation pressures, as well as about monetary conditions that are not fully captured by short-term interest rates, as discussed above.

43. **The prevalence of large, semi-persistent, price level shocks pose particular challenges to monetary policy in many low income countries.** Domestic food supply shocks, in particular, caused by weather related shocks to the harvest tend to cause large and semi-persistent swings in both food price levels and the conventional 12-month-rate-of-change measure of inflation around their longer term trends, and opposite swings in actual and potential output.[63] Monetary policy using simple backward looking policy rules based only on observed deviations from the inflation target would tend to amplify these swings. While both money and interest rate rules could be subject to this problem, money rules

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results of the significance of money growth for shorter term inflation dynamics. See also Goodhart (2007) on the usefulness of paying attention to monetary and credit aggregates.

[61] See among others Batini and Nelson, (2001), Nelson, (2002, 2003), King 2002), Hauser and Brigden (2002), and Reynard (2007)

[62] As stressed in Appendix I, monetary policy mainly work its impact on interest rates, explicit and implicit yields, and the exchange rate, and their impact on credit growth, and the resulting deposit and broad money creation, both directly and via a number of amplifying channels.

[63] Periodic adjustments in administrative prices will also, because of the "base effect," give rise to semi-persistent swings in official inflation rates as conventionally measured by the 12-month change in the CPI.

should be less so—with inflation above trend and output below trend, the impact on nominal GDP and money demand of a negative shock domestic harvest may be more muted. To properly respond to the challenge posed by these domestic food supply shocks, the policy framework needs to be both appropriately flexible so as to allow a more muted response to the current inflation shocks as it is caused by exogenous factors that when eventually reversed will cause a new shock in the opposite direction. Moreover, because of the long duration of these shocks, the policy framework would need to be anchored on a longer forward-looking horizon than what's common in countries that experience less persistent shocks. Use of forward-looking Taylor rules—$i_t = \pi^e_{t+1} + \bar{r}_t + a_\pi(\pi^e_{t+1} - \bar{\pi}_{t+1}) + a_\pi(y^e_{t+1} - \hat{y}_{t+1})$—could help achieve this, but would require a sophisticated model-based framework, strong analytical capacity, and a comprehensive set of high-quality high-frequency statistics that most low income countries are lacking.

44. **Flexible policy rules that rely in multiple indicators may provide some advantages and be more robust.** Money targeting central banks can usefully use developments in interest rates relative to their ex ante targets/assumptions to adjust their monetary targets. Similarly, model-based interest rate targeting central banks can usefully use the developments in money and credit aggregates relative to their ex ante assumptions to adjust their interest rate targets. In practice, monetary policy decisions are taken amid substantial uncertainty about the state of the economy and the shocks hitting it. This is particularly so in low-income countries where shocks, including to potential output, typically are larger, real time economic information is both more limited and of poorer quality, and analytical capacity weaker than in advanced countries. Several studies have found that money market indicators, including monetary aggregates, can help improve the central bank's "nowcast" of the economic situation and inflation and output forecasts,[64] and help safeguard policy against the risk of persistent misperceptions regarding the unobservable equilibrium real interest rate, potential output, and the natural rate of unemployment.[65]

IV. Flexible Monetary Targeting: Bridging Short-and Long-Term Liquidity Management

45. **A monetary-targeting based policy formulation framework can be combined with an interest rate focused daily implementation—or operational—framework**. Broad money demand is a function of the alternative cost of holding money, which again depends on the spread between yields on longer-term instruments and deposit rates. Thus, the central bank could alternatively back out the level of interest rates implied by the broad money target and its forecast of the other variables that determine broad money demand. This implied level

[64] See among others Berg, Portillo, and Unsal (2010), Andrle and others (2013b), Coenen and others (2005), Reynard (2007), and Beck and Wieland (2007).

[65] Beck and Wieland (2007).

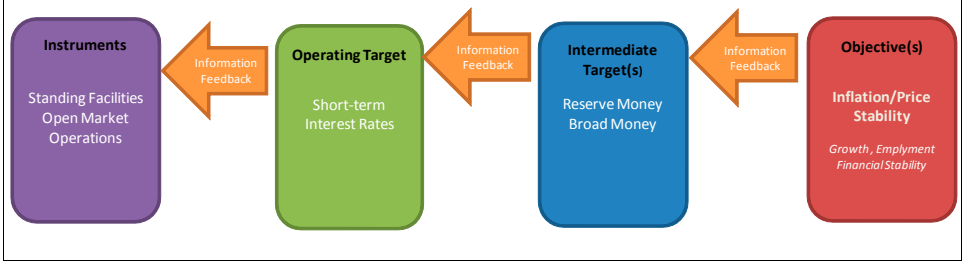
(and structure) of market interest rates could alternatively (or complementary) be used to derive a short-term money market interest rate as the operational target for the daily monetary policy implementation. This would be similar to how may many advanced country central banks de facto conducted monetary policy when they formally were targeting money.

46. **The precise role of the monetary target(s) within the policy framework would have to change somewhat, though**. To provide sufficient flexibility to shift the focus of the day-to-day operations towards managing liquidity in a manner that is consistent with a smooth development of short-term interest rates, the monetary targets should serve more as longer-term targets that do not dictate, but guide, the longer term evolution of the daily operations. Two broad options are feasible:

- Reserve money as a longer-term operational target that serve as a constraint over time on the average liquidity operations. Short term interest rates would move within an interest rate corridor.
- Sole focus on broad money as the intermediate target to guide interest rate setting, with no reserve money target. This would allow further flexibility for the day-to-day liquidity management to steer the overnight towards a point policy rate, preferably within a floor or mid-point corridor system.

Under either option, periodic reviews of the monetary program to incorporate inputs from economic analysis and modeling would allow assessing the need for adjusting the monetary targets, and/or the positioning of the interest rate corridor.

Figure 5: Flexible Monetary Targeting



A. Reserve Money Targeting with Interest Rate Focused Operations

47. **Reserve money targeting can be combined with an interest rate focused daily operational framework by**:

- Setting the reserve money targets on a longer term (quarterly) average basis, and possibly within a band**.**

- Lengthening the horizon of the high-frequency liquidity forecasting to one month, or better a full quarter, on a two-week rolling basis to help steering liquidity towards the reserve money target.
- Allowing short-term money market interest rates to over time drift within an interest rate corridor in response to longer term persistent changes in the liquidity conditions.
- Not having a point policy rate.

48. **Setting the reserve money targets on longer term average basis would provide added flexibility to let reserve money—and by implication—excess reserves vary from day-to-day as needed to keep the short-term market interest rates reasonably stable**. Lengthening the horizon of the high-frequency liquidity forecasting exercise should help to gradually adjust liquidity conditions to ensure that reserve money over time evolve in line with the longer-term reserve money target. The central bank would use short term open market operations combined with reserve averaging provisions, as discussed above, to counter short-term liquidity shocks. A persistent positioning of the interbank market rate close to the floor (ceiling) of the corridor would signal to the central bank that is should move the corridor down (up). This could also serve as a signal to the market that the policy stance is being loosened (tightened)—the corridor would serve as the de facto policy rate and thereby help improve transparency and communication of the policy stance. Effectively the monetary program and the reserve money target would serve as a tool to back out in an indirect way the approximate overnight interest rate level that would be consistent with achieving the policy objective.

49. **The default under this "flexible reserve money targeting" option would be to strive to adhere to the average reserve money target and move the interest rate corridor as needed within the target period to meet it.** However, less frequent periodic reviews of the key parameters and assumptions of the monetary program, possibly also incorporating inputs from economic analysis and modeling, would allow assessing the need for adjusting the targeted path of reserve money as well. This option would allow for retaining reserve money as a formal target both for external communication purposes and for IMF conditionality—that is, the default would be a strict adherence to the longer term average reserve money target. However, a looser adherence to the target, effectively using reserve money as a second intermediate target derived from the primary secondary target, broad money, would provide added flexibility to ensure well-behaved short term interest rates and improve the clarity of the policy signals.

50. **The width of the corridor under this option would have to be chosen with some care.** A narrow corridor would help keep the high-frequency interest rate reasonably stable and thereby help improve the clarity of the policy signal. However, a narrow corridor would also require a more frequent re-positioning of the corridor to ensure that reserve money over time evolves as targeted. It would also increase the likelihood that earlier corridor shifts may have to be reversed, which could muddle the policy signal and undermine the market's confidence in the policy framework.

51. **Reserve money targeting would generally not be compatible with having a point policy rate though.** A central bank point policy rate represent a central bank commitment to use OMO operations as needed to steer the short-term interbank rate close to the target. This would generally require more flexibility to with regard to both the daily and longer term liquidity management than the even flexible reserve money targeting would generally allow. Moreover, failure to steer interbank rates close to the point policy rate risk threatening the central bank's credibility and rendering the policy rate irrelevant. Interest rates need to be relevant for banks short-term liquidity management to serve as a benchmark for other rates—that is, they have to be traded at. In situations with high interbank interest rate volatility, or structural weaknesses that hamper interbank market trade, T-bills and the standing facility rates typically will serve as benchmark rates.[66]

B. Broad Money Targeting

52. **Dropping the reserve money target all together and relying entirely on broad money as the intermediate target would provide the flexibility in the day-to-day liquidity management needed for having a point policy rate**. The use of a point-policy rate should, as discussed, help stabilize short-term interest rates within the corridor, and strengthen the transmission of price signals to longer term rates. However, it also may make it harder to determine the level of the overnight interbank interest rate to target. The basic idea would be to periodically review the broad money program and the reasons for any deviations between the actual and desired value of broad money and the main aggregates of the broad money program and based on that assess the need for either (i) a change in the policy stance as expressed by the policy rate and interest rate corridor in order to bring the monetary program back on back, or (ii) update the monetary program's underlying assumptions. Reliance on a multiple set of tools and indicators, including modeling, would be useful in this.

V. Policy Communications and Commitment

53. **Proper communications of policy actions and objectives to the public at large can help anchor expectations and make it easier to achieve the central bank's policy objective**. Clarity on price stability as the overriding mandate of the central bank combined with measures to ensure the public's trust in the central bank's commitment to, and willingness/ability to act in accordance with that mandate is critical irrespective of the particular policy framework adopted. Clarity on the specific inflation outcome the central bank expect/target—including numerical projections and/or targets—and clear communication to the public how its policy actions are consistent with achieving that target

[66] Interbank rates can serve as benchmark rates instead of T-bill rates in pure corridor systems without a point policy rate if the interbank market is sufficiently well developed and the full transmission to longer rates, including T-bill rates, through arbitrage is not impaired.

is also crucial for anchoring expectations under any regime. This may be more challenging in a quantity-based framework, as market participants tend to understand interest rates better than quantitative targets, but no less important.

54. **Changes in interest rates can be used to signal changes in the policy stance, also for countries that primarily rely on monetary aggregates for determining the policy stance.** As stressed, in section II above, the day-to-day monetary policy operations should be interest rate focused also for countries that mainly relies on monetary aggregates for guiding policy formulations. Under the "flexible reserve money targeting" framework discussed in Section IV A, periodic repositioning of the interest rate corridor would imply a change in the policy stance, and should be used as the main-or sole, signal to communicate a change in the policy stance. A point policy rate would serve as both the main operation target and signaling device under the flexible broad money targeting framework discussed in section IV B.

55. **Strengthening the central bank's public communications is a prerequisite transitioning towards monetary policy frameworks with less rigid policy rules and more allowance for "constrained-flexibility."** A commitment to transparency will provide an incentive to clearly articulate the objectives of monetary policy and the adopted measures, and to explain to the public the achieved results, including the reasons for any deviations from stated objectives. Ultimately, it will enhance the credibility of the central bank, but also protect its independence as it will support accountability and be a deterrent to pressures from the government or pressure groups, which is of particular importance when transitioning towards a less rule-based policy regime.

56. **Clear central bank's public communications is also essential for an effective policy transmission.** As stressed by Woodford (2003), successful monetary policy is as much about shaping market expectations of how interest rates, inflation, and income is likely to evolve over the near to medium terms as it is about effective control over today's overnight interest rate in the interbank money market. Some of the key elements of a best practice communication strategy include:

- **Pre-determined and published Monetary Policy Committee Meeting Schedule**. The MPC meetings could be scheduled on an annual rolling basis, and the meeting calendar should be published in advance to avoid any uncertainty related to the timing of monetary policy decisions, including possible changes to the operating framework. The timing of the MPC meetings could usefully be tied to the release of key high-frequency statistics—conducting the MPC meetings a few days after the release of the CPI may be effective in reducing market speculations.

- **A clear, but brief, communication to the public of the policy committee decisions**—the Monetary Policy Statement—that focus only on monetary policy issues; and with a clear emphasis on the inflation outlook. It could usefully include signals of possible future monetary policy movements conditional on particular

anticipated outcomes, particularly if the MPC meetings are conducted more frequently than the issuance of comprehensive forward-looking Inflation Reports.

- **Issuance of regular Inflation Reports** that are comprehensive, forward looking, and analytical. These reports could typically be issued on a quarterly basis, and with a fixed release schedule—no publication delays should be allowed. The reports could/should include near- to medium-term inflation projections that assume that the central bank's planned policy actions over the policy horizon are implemented.[67] Some central banks also publish the planned policy actions—their planned or internal forecast of future policy rates—that underpins the projections. The report should also discuss risks to this inflation outlook, and could usefully discuss how the central bank plans to adjust policy if those risks materialize.

- **Outreach activities to explain the policy framework and central bank take on the inflation relevant developments,** including workshops, seminars, conferences, speeches by key officials; off the record meetings with journalists, economists, and other key opinion influencers; on-the record interviews; and regular publication; dissemination of staff working papers; and posting centrally on the central bank web site of key monetary policy rated material.

57. **Consistent policy implementation is critical for the credibility of the central bank actions and communications**. Credibility can easily be lost if the market perceives the central bank's actions to be inconsistent with the stated policy framework and the achievement of the stated policy objective. Examples of such policy inconsistencies include:

- Changing central bank interest rates in one direction—standing facility rates and/or policy rates—while undertaking liquidity operations that move short-term market rates in the opposite direction.

- Taking actions that move market interest rates in a direction that the public perceive as inconsistent with, or insufficient to, achieving the stated policy objective.

Eventually, such events contribute to sending confusing signals to market participants regarding the policy stance, which in turn can undermine the anchoring of inflation expectations or the credibility of the central bank.

58. **Commitments have to be achievable—and over the long run achieved—to be credible.** Frequent misses of publically committed targets risk resulting in a loss of hard won

[67] One implication of this is, of course, that the inflation projection over the policy horizon will always converge towards the inflation target. The main purpose then of the projections is to show how the inflation target is expected to be met—that is, the inflation path towards the target and policy actions need to achieve that.

credibility and making meeting the inflation target harder than it would have been without making the commitment in the first place. For this reason, it is generally advisable to hold off publically announce the adoption of a formal inflation targeting regime until the central bank, over a sufficiently long time, has consistently demonstrated that it can keep inflation reasonably close to the target. Developing and emerging market countries typically may have a weaker and more rapidly changing policy transmission mechanism that makes it harder to engage in any fine tuning of the inflation developments. They may also experience larger, more persistent, and more frequent supply shocks to inflation—including in particular because of fiscal shocks and more limited options for offsetting the price impact of swings in the harvest—that may make fine-tuned inflation stabilization not only harder but also less desirable. These factors not only challenge the central bank's communication efforts, but may make switching to a full-fledge inflation regime risky and premature.

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Appendix I. Monetary Policy Transmission Channels

A. Introduction

59. **Monetary policy mainly works through its impact on interest rates, explicit and implicit yields, and the exchange rate.** This doesn't mean that what is commonly referred to as the (narrow) "interest rate channel" dominates or is particularly strong, nor does it imply that "money does not matter" or that targeting the money aggregates may not be a viable policy strategy.[68] It simply summarizes what appears to be the consensus in the literature. All, or almost all, of the transmission channels discussed in the literature—including the credit, bank lending, wealth, and bank capital channels—work through the impact of monetary policy on interest rates, the exchange rate, and explicit or implicit asset yields, or by amplifying the effect of changes in these on demand through their impact on asset prices and credit risk, and the impact on these on demand (Figure 5), and not by rationing the means of payment. This again reflects the consensus that consumption and investment demand mainly is a function of income, interest rates, wealth and (because some households and firms are credit constraint) the availability of credit, and not money balances. Although money-in-utility models that does not assume that the utility function is separable gives a structural, or causal role, for real money balances in determining demand, the consensus seems to be that this effect would be quantitatively small and largely irrelevant.[69]

Comment [NM1]: Look again at credit rationing, liquidity constraint consumers, and cash in advance models. There could be more of a role for money in those cases.

60. **However, modern central banks do not directly control the retail rates, assets prices, and yields that ultimately determine economic behavior.** What they do control is the supply of "central bank money,"[70] of which only their control over one part, reserve balances, is used as a policy tool.[71] However, these balances can be tiny compared to the size of the daily payment flows and the financial market, at least in countries with no reserve requirements. Moreover, they can only be used for interbank transactions. Thus, to fully understand the monetary policy transmission mechanism, it is essential to understand how the central bank's actions with regard to the volume and terms of their supply of these

[68] It does, however, imply a rejection of the old textbook quantity-of-reserves and money-multiplier story as a description of causality and of how the monetary transmission mechanism works in a modern credit-money economy. The old quantity theory and money-multiplier story was based on, and fit, a pure commodity-money or fiat-money economy, and not one dominated by credit money.

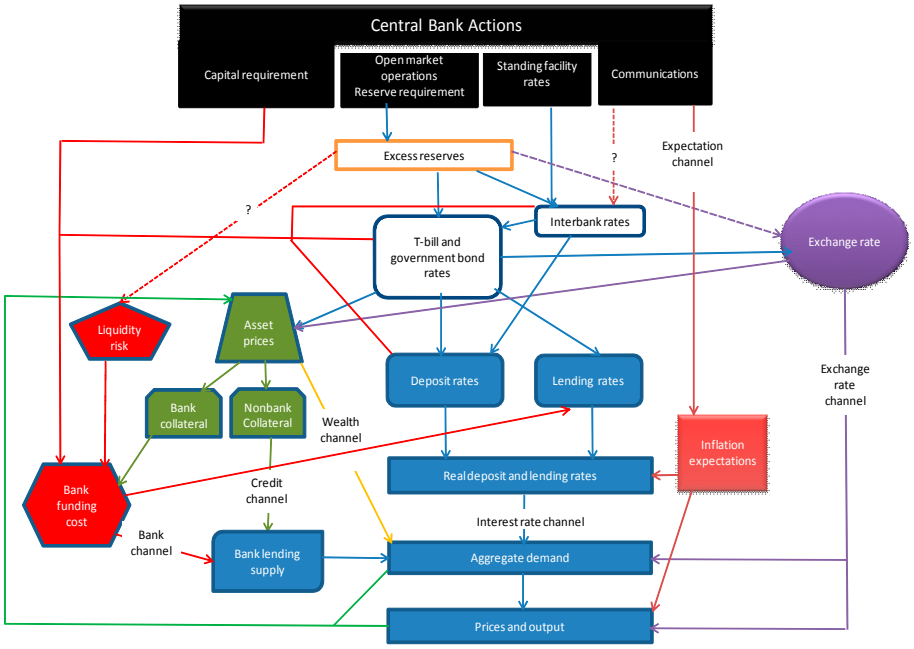
[69] See among others Nelson (2002, 2003), Ireland (2004), Berger and others (2008), Andrés and others (2009) and Zanetti (2012).

[70] Equal to currency in circulation and commercial banks' deposits at the central bank (reserve balances for short).

[71] Modern central banks do not use their currency-issuance monopoly as a policy tool. They always supply the full amount demanded, which typically only constitute a moderate, non-dominant, share of the total money supply, as not doing so would impair the payment flows.

balances impact bank behavior and how these actions transmit, through arbitrage, to the wider set of set of market interest rates, assets prices, and yields. That is, how monetary policy actions through the (direct) interest rate channel, the exchange rate, expectations, and a number of other channels that "amplifies and propagate conventional interest rate effects" (Bernanke and Gertler, 1995) impact demand, growth, and inflation.

Figure 6: Monetary Policy Transmission Channels



B. Reserve Balances, the Payment System, and the Interbank Money Market—the First Stage of the Monetary Policy Transmission Mechanism

61. **Commercial banks use their deposits at the central bank—their reserve balances—for interbank transactions, including in particular to settling payments they undertake on behalf of their customers.**[72] These deposits, as all deposits, constitute a closed system. Banks cannot unilaterally change the total amount of reserve balances in the

[72] For instance, when Bank A transfer money on behalf of a customer from the customer's deposit account in bank A to someone else's deposit accounts in Bank B, Bank A would have to either transfer an asset to Bank B—the economically most effective way to do so would be transfers of reserve balances through the central bank's settlement system—or obtain a credit from Bank B.

system, nor can they transfer or lend them to individuals or institutions that do not have an account at the central bank. They can only use them to transact with the central bank or other central bank account holders (that is, other banks and the government) to (i) settle interbank payments; (ii) purchase or sell foreign exchange or government securities, and (iii) lend to the other account holders. Most of these transactions just moves reserve balances from the account of one account holder to the account of another account holder without changing the total stock of reserves. The total stock of reserve balances in the system can only change through transactions between the non-government account holders and the central bank for policy or autonomous reasons.[73]

Comment [NM2]: 1. Sixth, banks do not lend out their reserves, nor do they need to. They do not because non-banks cannot hold accounts at the central bank. They need not because they can create loans on their own. Moreover, banks cannot reduce their aggregate reserves. The central bank can do so by selling assets. The public can do so by shifting from deposits into cash, the only form of central bank money the public is able to hold.

62. **Thus, banks demand for reserve balances are closely linked to the working of the payment system and the central bank's liquidity management framework**, as illustrated in Box 1**.** Banks receive, and make, a large number of interbank payments during each day. To be able to carry out these interbank payments, they would need to have some assets that can easily be transferred, or be able to obtain credit from and willing to provide credit, to the counter-party banks. While the net of these intraday payment inflows and outflows may be close to zero, there is always a risk of becoming short and not being able to carry out payments or not meeting reserve requirements. This can be very costly, but so can holding large unremunerated balances at the central bank. Banks' demand for reserve balances is a function of these two risk or cost factors, as well as the reserve requirement regime in place. The risk, and associated costs, of becoming short or long again is a function of:

(1) The timing and coordination of bank settlement, including gross versus net settlement and real time versus lagged settlement.
(2) The risk of large imbalances between the payment inflows and outflows during the day and at the end of the day.
(3) The ease and cost of bank's access to intraday, or daylight, central bank credit and interbank credit lines to meet settlement needs during the day.
(4) The timing of the closure of the payment system and the interbank market, and the risk of having to make (receive) payments after the closure of the interbank market.
(5) The ease and cost, including risks, of access to the overnight and longer term interbank money market to meet shortfalls or lend excess reserve balances.
(6) The ease and cost of their access to central bank lending facilities to meet an unexpected end of-day shortfall;
(7) The ease of access and degree of remuneration of commercial bank overnight deposits in central bank.

63. **It is possible to operate the system with a close to zero aggregate overnight reserve balance target, and some central banks at times have.** The Reserve Bank of New

[73] The latter includes payments the central bank undertake to settle its own expenses, foreign exchange interventions, and transactions it undertake on behalf of the government.

Zealand for a time operated with a constant overnight reserve target of only US$20 million. Similarly, Bank of England for a time operated with a constant overnight reserve target of only £45 million at a time when the daily interbank payment flows were over £150 billion, while Bank of Canada for a short time operated with a zero targeted, and subsequently with a small positive target, for overnight settlement balances in their Large Value Settlement system.[74] Operating with a close to zero target of overnight balances do require, however, a narrow interest rate corridor, solid liquidity forecasting and frequent OMOs, a well functioning interbank market, well coordinated payment settlements, proper coordination between the payment system and the interbank market, effective collateral handing, and ample access to central bank and interbank intraday and inter-day credit facilities in order to keep payment risks to a minimum.[75]

64. **Monetary policy works by changing the explicit or implicit (shadow) price on banks' short term liquidity—this is the first stage of the transmission mechanism**.[76] In systems with a well-developed interbank market, there would be an explicit market price—the interest rate on short term interbank credit—that reflects the banks short term liquidity risk, while in systems with no, or poorly functioning interbank markets, there would be a similar implicit shadow price on liquidity. Both prices are determined by the risk and cost factors discussed above that determine banks demand schedule for reserve balances.[77]

65. **Banks do not need to hold large reserve balances for the central bank to be able to steer the interbank rate**. What is critical is that banks have full access to a central bank provided alternative to interbank credit for settling payments or placing any excess balances if need be, not that they are actively using these facilities. Moreover, as illustrated in Box 1, the central bank does not necessarily have to change the aggregate supply of reserves to change the interbank rate. Under a corridor (and under a floor) system, it would be sufficient to change the rates on the central bank deposit and lending facilities, which would the cause the demand schedule for reserve balances to shift.

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[74] See among other Frazer (2005) for a discussion of the earlier liquidity management framework New Zealand before they moved to the current floor system with a tiered deposit facility, Tucker (2004) for a discussion of the earlier BOE framework, and Clinton (1997), Howard (1998 with subsequent updates) for a description of the earlier Bank of Canada framework.

[75] Both New Zealand and Bank of Canada during this period operated with a +/-25 bps interest rate corridor. Both do now operate a version of the floor system with large reserve balances.

[76] That is, the risk and associated cost of becoming too short or too long with respect to reserve balances.

[77] Except for the case of pure floor (ceiling) systems where the liquidity-risk price would be equal to the central bank deposit (lending) rate.

C. Reserve Balances and Bank Lending: the Interest rate, Credit, Bank Lending, and Bank Capital Transmission Channels

Introduction

66. **Banks do not strictly need reserve balances at the central bank to lend in a modern credit economy.** And, contrary to the presentation in many elementary textbooks, they do not need deposits to lend. First, deposits are not an assets that banks can on-lend, it is a bank liability—an "I-Owe-You" (IOU). Second, deposits, and by implication broad money, or "commercial bank money," are created when banks engage in lending.[78] When banks lend "money" to their customers, the first thing that happens is that they simultaneously create a claim on the customer and a claim on the bank in the form of a deposit (an IOU). In that sense, the lending is self-financed and banks do "print money" (although not without limits as explained in Tobin (1963)).[79] Moreover, although the borrower would likely shortly thereafter use the new deposit-money created by the loan to purchase something from someone, the bank may not need any reserve balances to settle this payment if (i) the transaction is with another account holder in the same bank; (ii) all banks expand their businesses as the same pace so that each banks increased payment outflows are matched by increased payment inflows; or (iii) the bank can draw on existing interbank credit lines.[80] In this case, as in the case of interest-rate-targeting central banks that would provide the system with whatever reserve balances needed to keep interbank rates close to the policy rate, the supply of loans and the associated supply of deposit-money in the banking system would be determined primarily by interest rates and credit demand, as argued by the post-Keynesian endogenous money school.[81]

67. **However, banks do in practice need to hold reserves and other highly liquid "defensive" assets to manage their liquidity risks.** Banks always face the risk of particular large payment outflows on some days that may not be fully matched by simultaneous payment inflows, as well as the risk of larger deposit withdrawals. To insure against the risk that such events result in payment defaults or the need for costly liquidation of loans or other non-liquid assets, banks do need, and often are required, to hold (borrowed, as well as non-borrowed) defensive assets—mainly reserves and government securities—that could either directly be used for settling interbank payments, quickly exchanged for payment means

[78] See among others McLeay, Radia, and Thomas (2014) for a recent discussion of money creation in the modern economy.

[79] Similarly, when bank customers reduce their deposits to repay loans or buy financial assets such as securities and equity instruments from the banks, "commercial bank money" is destroyed.

[80] This is very much in line with Wicksell's (1898) pure credit economy (see Boianovsky and Trautwein, 2006).

[81] See among others Moore (1988), Palley (2002, 2013), Bindseil and König (2013), Culham and King (2013).

("liquidated") at relatively low costs, or used as collateral for central bank or interbank market borrowing. For the same reason, banks would typically try to lock in part of the liability side of their balance sheet, including by offering higher earning time deposits, or issuing longer maturity (tradable as well as non-tradable) debt obligations. In this sense, banks do need funding to lend.

The Direct Interest Rate Channel

68. **The direct interest rate channel is often weak in developing countries.** The strength of the channel depends on both the degree of pass-through from monetary policy actions to lending, deposit, and securities rates, and the interest rate sensitivity of investment and consumer spending decisions. Unclear policy signals and high risks may weaken the pass-through and low financial inclusion—low credit-to-GDP ratios, low deposit-to-GDP ratios and large share of the population without bank accounts—may reduce the relevance of bank lending and deposit facilities for investment financing and consumption smoothing.

69. **There should be a strong link between monetary policy actions and lending, deposit, and security rates in a low risk environment with well developed financial markets and clear and relevant policy signals:**

- ***Lending rates should be closely linked to the central bank's policy rate, or standing facility rates, in such an environment.*** Banks generally lend whatever amounts that are demanded as long as the expected net return on new lending is positive. The expected net return would be positive as long as lending rates, adjusted for perceived credit risks, are higher than the banks marginal (opportunity) cost of providing the loan.[82] The latter should be close to the central bank's policy rate in systems with an explicit and relevant policy rate. When expanding their lending, banks can choose to settle the expected additional interbank payment outflow by (i) drawing down their reserve balance at the central bank,[83] (ii) borrow from other banks in the interbank market, or (iii) attracting new deposits by offering better terms.[84] The full (opportunity) cost of either option should in equilibrium be equal and equal to the policy rate/interbank rate.

- ***Deposit rates should for the same reason also be both closely linked to both lending rates and the central bank's policy rate(s), but also aligned with security rates in***

Comment [NM3]: This is all a story of monetary policy working via its impact on loan supply. That it, it is all a form of a Banking Lending Channel—shift in the loan supply schedule channel.

There may be a loan demand effect in economies with significant capital markets where increases in bond rates induce borrowers to shift to bank financing, which would push up lending rates if the loan supply schedule is upward sloping for some reason.

[82] See Tobin (1982), Bertocco (2006), and Palley (2013) for some simple, and very similar, models of this.

[83] Or liquidate some other defensive assets, which in either case would leave the size of their balance sheet unchanged.

[84] And thereby requiring other banks to transfer reserves or borrow from them in order the settle the deposit transfer.

this environment. Although banks create deposits when they lend, and thus "print money," the public would need to be willing to hold the additional liquidity created. The public can, as noted, on its own reduce the stock of deposits, and thus broad money, by repaying loans or buy higher yielding, but less liquid, financial assets from the banks.[85] Thus, deposit rates and the rates on the public's alternative placements of their financial assets needs to be properly aligned.

- ***Commercial banks' own demand for government securities should further strengthen the link between monetary policy actions and security yields***. While banks cannot lend out their reserve balances, they can use them to buy government securities either directly from the government (with the central bank acting as an agent for the fiscal authorities), or from each other. Moreover, because government securities in most cases can be used obtain short-term [86]funding from the central bank or the interbank market, they are a close substitute to reserve balances as bank "defensive" assets. For these reason, interbank rates and short term government security yields typically are closely correlated.

- ***The existence of well developed capital markets would further strengthen the link between security yields and bank lending and deposit rates***. This, by offering larger entities an alternative to bank loans for funding investments, by offering banks an alternative funding source, and by offering the public with an alternative to deposits for placement of their financial assets.

70. **However, the link between monetary policy actions and lending, deposit, and security rates can be fairly weak in a high risk environment with underdeveloped financial markets, and unclear monetary policy signals and operations, including because:**

- ***Banks may rely more on relationships, collateral, and other non-price factors for determining lending, and as a result be slower to pass on changes in the policy stance, in such an environment.*** While they should still want to lend whatever amounts that are demanded as long as the expected net return on new lending is positive, credit risk and the cost of building trustworthy relationships, and not interest rates or funding costs, may be the dominant factors in determining the expected return on lending in a high lending risk environment. This, not at least because relying purely on price factors in allocating credit in an environment where real interest rates

[85] Because of this and the above credit-demand driven supply of deposit-money, deposits and thus broad money would in the end be endogenously determined by the interplay of money demand and the supply of commercial bank money created through bank lending as argued by the structuralist camp within the Post-Keynesian School.

[86] Through repurchase arrangements or collateralized loans.

typically already are fairly high would subject the lender to an adverse selection bias with only the higher-risk borrowers being willing to borrow at the terms offered. Moreover, although banks may lend against collateral, it may be hard to collect on the collateral. For these reasons, banks may base a substantial part of their lending decisions on their knowledge of their customers, and banks and borrowers may spend substantial time and resources on establishing close relationships and obtaining client-specific information. As a result, banks may be reluctant to pass on an increase in the policy rate or their funding costs to existing borrowers because of the risk that that could sever their relationship or could cause the borrower to have difficulties serving the loan. This, in particular if the increase in funding cost, because of a high level of interest rate volatility, is not perceived as being sustained. Similarly, banks may be able to not pass on a decline in policy rates to their existing borrowers because they have few short term alternatives.[87]

- ***Unclear monetary policy signals and inappropriate operational frameworks increase risks, fragment markets, reduce bank competition, and slow the pass through of changes in the policy stance*.** Banks liquidity situation and liquidity risks and thus their marginal (opportunity) cost of providing a loan may differ substantially if there's no facility in place—such as a functioning interbank market or easy access to central bank lending and deposit standing facilities with rates that are fairly close—for short term placement of excess liquidity or short term borrowing. Big differences in banks marginal opportunity costs would tend to weaken the effective bank competition and fragment the markets, and particularly so in an environment with high credit risks. Unclear monetary policy signals because of high interbank rate volatility, or the lack of an explicit price on short term liquidity that is predictably controlled by monetary policy actions, further muddles the link between policy actions and banks marginal opportunity costs.

- ***Depositors may have fewer alternatives to deposits for placing their financial assets***. While they can still use the deposits created when banks lend to repay loans and thereby on their own reduce the stock of deposits and broad money in the economy there may be less possibilities for most to use the deposit created to buy higher yielding securities as there's little or no second market security trading and not well established second market security pricing. This may weaken the link between deposit rates and securities rates. However, in many of these countries pension funds and other large institutional investors may be large, or even the dominant, depositors in the domestic banking system. They may at the same time be able to participate directly in the primary government security auctions. Thus, they may be able to quickly shift from deposits to securities depending on relative interest rates. This

[87] See among others Aksoy, Basso, and Coto-Martinez (2013) on this.

would tend to generate both a strong link between certain time deposit and government security rates.

71. **There may still be a strong link between monetary policy actions and government security yields in such a high risk, unclear policy environment.** Banks, and sometimes insurance companies and pensions funds, typically are the dominant players in the government securities market in these economies. With a lack of an active secondary market, these instruments may be fairly illiquid for most, except banks that still can use then as collateral for obtaining short-term funding from the central bank or the interbank market. Thus, and because banks can use their reserve holdings to buy government securities from the government at the primary auctions or from each other, they can still serve as a close substitute to reserve balances in the banks' portfolio of "defensive" assets. government security yields often serve as the formal, or de facto, pricing base for bank loans and deposits instead of interbank rates in countries with no policy rate and no or highly volatile interbank rates.

Monetary Policy, Lending Risk, Asset Prices, and the Wealth and Credit Channels

72. **Changes in interest rates affect household and businesses cash-flow and cause asset prices to change, both of which may affect the demand for credit and banks willingness to lend.**[88] As is well documented, persistent changes in asset prices, including housing prices and the price of other real assets, do impact consumption, saving, and investment decisions, including through the "wealth effect" on household consumption and the Tobin's Q. Changes in asset prices would also change the overall strength of borrowers balance sheet and the value of any collateral they may pledge, which would impact on the actual, or perceived, risk banks are taking on, their willingness to lend, and the risk or external finance premium they would require. Interest rate changes also affect borrowers' cash-flow position and through that their creditworthiness and the risk premium banks would require in order to be willing to lend. Changes in households and businesses cash-flows may, in addition, directly affect the real economy by changing liquidity (or credit) constraint households' consumption demand and liquidity constraint small businesses ability to expand their operations. Interest rate changes would also affect the cost of businesses working capital and thus their operating costs. Finally, the changes in the overall economic environment and outlook caused by a change in the monetary policy stance would also impact banks perceived riskiness of lending and thus their willingness to lend. These effects would amplify the impact of monetary policy actions on the real economy, but could also give rise to destabilizing asset bubbles.

[88] See among others Bernanke and Gertler (1995), Bernake, Gertler, and Gilchrist (1996), and Bernanke (2007).

Monetary Policy and the Risk Channel

73. **Interest rate changes may directly impact banks risk appetite, risk perception, and willingness to lend and thereby help further amplify the impact of monetary policy actions on the real economy through:**

- ***Credit rationing in a high interest rate environment***. As noted in the discussed of the direct interest rate channel above, high interest rates may give rise to an adverse selection effect. High interest rates may crowd out low-risk investment projects from the credit market that typically also have lower expected returns. High interest rates may also give rise to moral hazard and induce borrowers to turn to more risky investment projects. Thus, rather than raising interest rates, banks may thus prefer to curtail credit instead. While this may weaken the direct interest rate channel, it would act as an amplifier of monetary policy impulses to the real economy.

- ***Search for yields and higher risk appetite in a low interest rate environment.*** Low returns on lending projects may increase the incentives for lenders to take on more risk to boost profit.[89] This tendency would act as an amplifier of monetary policy impulses to the real economy in a low interest rate environment, but also as a source of potential financial risk and instability.

- ***Observed volatility and measures of risk***. A change in the policy rate that impact asset and collateral values, may in turn modify bank estimates of the probabilities of default, loss-given-default and volatility. For example, low interest rates and increasing asset prices tend to reduce asset price volatility and thus risk perception.

Comment [NM4]: Add explanations from literature. Find literature, and add references

Comment [NM5]: Find reference to this empirical claim.

Bank Capital Requirement and the Bank Lending Channel

74. **Monetary policy may also affect bank lending and lending rates through its impact on the strength of banks balance sheets**.[90] Banks, for prudential reasons, are subject to capital requirements and thus may have to raise additional capital in order to expand lend and the asset side of their balance sheet in order to meet those capital-to-asset ratio requirements. In the same way as asset prices and the strength of nonbank' balance sheet may affect their risk premiums and borrowing costs, the strength of banks' balance sheet can affect their ability to, and/or the cost of, raising capital (both in the form of equity and borrowed capital), as well as their access to, and the cost of, short term uninsured market

[89] See among others the findings of Dell'Ariccia, Laeven, and Suarez (2013) and Jiménez and others (2014).

[90] See among other Van den Heuvel (2002), Gambacorta andMistrulli (2004), Honda (2004), Kishan and Opiela (2006), Disyatat (2011), Kapan, and Minoiu (2013) for a discussion of this. See also Bernanke (2007) for recognition that "fundamentally, the bank-lending channel is based on the quality of bank balance sheets…"

funding. Because of this, bank capital, and bank capital requirements, may affect the monetary policy transmission by:[91]

- ***Hampering weaker banks ability to expand their lending in response to a monetary policy loosening.*** This because costs of raising additional capital (both in the form of equity and borrowed capital) may be prohibitively high.
- ***Causing weaker banks to more sharply contract lending in response to a monetary tightening***.
- ***Changing the strength of banks balance sheet and through that their funding costs.*** This effect may be stronger in well-developed financial systems where banks may rely more on uninsured market funding than in developing countries.[92]

This effect of monetary policy via its impact on the banks financial health could work both by amplifying the effect of changes in short-term interest rates on lending rates (effectively and amplification of the interest rate channel) or by changing banks lending standards and their use of non-price measures for granting loans.

Comment [NM6]: Cost difference between insured and noninsured bank liabilities and link to reservable and nonreservable liabilities.

75. **Note that this bank capital version of the "Bank Lending Channel" differs from the conceptualization of the bank lending channel discussed in the older literature**. There are two versions of the older conceptualization of the bank lending channel:

- ***The first, following Bernanke and Blinder (1988) was based on the money multiplier story***. It assumed that because of reserve requirements central banks can directly manipulate the level of "reservable" deposits in the system through their control over bank reserves and thereby control banks ability to lend, and thus that is a quantity-based direct link from central bank reserve management to bank lending. There're a number of problems with this quantity-of-reserves based conceptualization of the bank lending channel. First, as argued above, the direction of causality typically is the opposite.[93] Moreover, banks in most cases want and need to hold excess reserves as a cushion against liquidity shocks and to ensure that they will be able to carry out their payment obligations. Any effort by the central bank to reduce reserves in the system to a degree where it would directly force banks to somehow reduce reservable deposits would cause possible widespread payment failures and

[91] See in particular Kishan and Opiela (2006) for evidence of the impact of bank capital shortages on banks response to monetary policy changes and the asymmetric response of capital weak banks to expansionary versus contractionary policy changes.

[92] See Disyatat (2011) on this.

[93] That is lending creates deposits and banks' demand for reserves, and policy actions change interest rates that affect lending.

short-term interest rates and yields on government securities to skyrocket.[9495] Finally, banks in a liberalized environment typically react to a monetary tightening—including one generated by causing a relative shortage of non-borrowed reserves—not by reducing deposits but by biding up interest rates on deposits in order to protect their reserve holdings.[96] The quantity-based conceptualization of the bank lending channel implies that banks would do the opposite. However, banks can only unilaterally reduce their stock of reservable deposits by either offering sufficiently poor terms that cause depositors to move to another bank, which would worsen the banks reserve shortage and not reduce the total stock of reservable deposits in the system, or induce depositors to place some of their deposits in no-reservable unsecured instruments like certificates of deposits offering sufficiently good terms on those.

- ***The second, newer version, assumes that banks might respond to a reduction in the supply of reserves by replacing reservable (and insured) deposits by more costly non-reservable (and uninsured) liabilities.*** This strand of the literature also takes as a starting point that a reduction to stock of reserves in the system would force banks to reduce the stock of reservable deposits.[97] Thus, all the issues with this story noted above apply to this version as well. However, in an environment where banks because of regulations are prevented from paying interest on reservable deposits or increase the interest rate offered, as was the case in the US under regulation Q,[98] a monetary tightening that increased non-regulated interest rates could induce depositors to withdraw their funds and place them in higher yielding securities.[99]

[94] It would also subsequently cause banks to sharply increase their demand for excess reserves.

[95] See also Gray (2011) for a similar discussion if the money multiplier and the fact that using reserve money to guide credit growth in a credit money economy practice is an indirect way of using interest rates.

[96] Or to attract additional reserves by either attracting new depositors or encouraging the public to shift from holding government securities to deposits.

[97] See among others Kishan and Opiela (2000) Kashyap and Stein (2000), and Ehrmann and others (2001).

[98] See the discussion in Bernanke (2007) and Boivin, Kiley, Mishkin (2010) on this.

[99] Banks would react to the tighter liquidity situation by trying to reduce their holdings of government securities and thereby push up security yields, which would induce some depositors to shift from deposits to securities and force the banks to increase their reliance on the more expensive uninsured market funding. This would again push up lending rates, which would cause a reduction in new lending and, as a consequence, the creation of new deposits.

The Exchange Rate Channel

76. **The strength of the exchange rate channel depends mainly on the link between policy actions and the exchange rate and the degree of pass-through from the exchange rate to inflation and the wider economy.** While many low and middle income countries are small and open, and partly for that reason the exchange rate pass-through may be strong, the link between monetary policy actions and the exchange rate can be weak. Besides expectations effects, there need to be sufficient foreign exchange flows that are sensitive to relative changes in interest rates for there to be a strong link between monetary policy and the exchange rate, which may not always be the case. Interest rate sensitive cross-border capital flows are fairly limited in many low income countries. There may, however, be sizable foreign currency deposits in the local banking system that may be sensitive to relative changes in the interest rates offered by the domestic banking system on foreign and local currency deposits, which could generate a strong link between monetary policy and the exchange rate if there's a sufficient link between deposit rates and monetary policy actions.

77. **Commercial bank behavior can generate both a price- and a quantity-based link between monetary policy actions and the exchange rate, but prudential regulations cap this link.** Banks can use their reserve holdings to buy foreign exchange from the central bank or other central bank account holders. Limits on banks net open foreign exchange positions would, however, limit banks ability to do this on their own account.

D. Reserve Requirements and the Transmission Mechanism

78. **Reserve requirements are not strictly needed for monetary policy purposes and a number of countries have for some time been operation without them.**[100] The origin of reserve requirements was as a prudential measure to ensure that banks hold sufficient gold in their vaults or with another bank as a backing for deposits received or notes issued, including to ensuring that other banks accepted their bank notes. This prudential role of reserves is now in most countries covered by other measures. Today, for monetary policy purposes, the main role of reserve requirements is to help reduce interbank interest rate volatility through reserve averaging (as discussed in Section II.C). They also, if unremunerated, provide for the central bank a less costly way to immobilize any surplus excess reserves so that the liquidity in the interbank market is consistent with the central bank's formal, or internal, interest rate target.[101] Unremunerated reserve requirements (URR) do act as a tax on deposits that

[100] See Gray (2011) for a comprehensive discussion of reserve requirements.

[101] Reserve requirements of course also create a close correlation between reserve balances and (reservable) deposits (and a more predictable money multiplier) and make reserve money targeting a viable policy strategy to indirectly set interest rates by creating a feedback loop from shocks that impact the credit and deposit creation process, or the demand for foreign exchange, back to short term interest rates.

increases the cost to banks of holding deposits relative to any alternative funding sources.[102] They therefore would tend to push down the rates on reservable deposits relative to non-reservable instruments. To the extent that this induces depositors to shift some of their funds out of deposits and into higher yielding instruments, UURs would also increase banks overall funding costs and their lending rates. Because URRs affect the lending-deposit rate spread, and the wider interest rate structure, they could potentially be used as a supplementary policy tool to for example push up lending rates to contain credit growth without at the same time increasing capital inflows.[103]

[102] Reserve averaging, which allows required reserves to be used for payment settlement within the maintenance period and thus reduce the need for holding excess reserves to settle interbank payments, reduce the effective rate of this URR tax.

[103] See Gray (2011) for a discussion of this and some of the complications involved. See also, Cordella, Vegh, and Vuetin (2013) for indications that some countries may on occasion have actively used reserve requirements as a macro prudential policy tool in this manner, and Glocker and Towbin (2012) and Walsh (2012) for a DSGE model that incorporates such effects. See also Lim and others (2011), and IMF (2012a, 2012b).

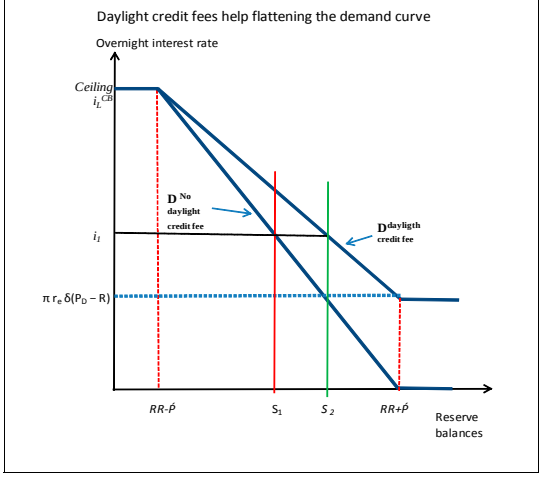
Appendix II. Daylight Credit Fees and Clearing Bands

Daylight Credit Fees

79. **The terms on central bank within-day—or daylight—credit facilities also impact the interest rate elasticity of banks demand for overnight balances**. To ensure a smooth working of the payment system, central banks my have to increasing the supply of reserves during the day—that is, provide *daylight reserves* or *daylight credit to banks*. These may be provided free of charge, or at a charge, and with, or without, posting of collateral. Interbank payment flows throughout the trading day can be large, lumpy, and volatile. This creates a risk that banks could at some points during the day be short of reserves and not able to carry out an interbank payment, or would have to delay it until after they have received expected incoming payments. This, problem could in particular occur with real-time gross settlement systems, and where required reserves are small relative to the size of the daily interbank transactions. To avoid such distortions, [many/some/all] central banks offer daylight credit, or overdrafts. Access to such daylight credit facilities would reduce banks need for holding large amounts of excess reserves, and thus help reduce interest rate spreads.

80. **Banks expected costs of daylight credit could provide a floor for the interbank market rate and help flatten the demand for overnight reserves**.[104] Consider a simple case of only two payment flows during the day, and let P_D denote a daytime payment, R the bank's reserve holdings, π the probability that a bank sends the outgoing payment before receiving the incoming one, δ the time period between the two payment flows during the day, and r_e the interest charge on daylight credit. Then the bank's expected cost of daylight credit would then be $\pi\, r_e\, \delta(P_D - R)$. Figure 6 illustrates the change in banks demand for overnight reserves of $r_e > 0$ compared to the case of $r_e = 0$ in the case with no interest paying standing deposit facility.

Figure 7. Fees on daylight Credit and Demand for Overnight Reserves

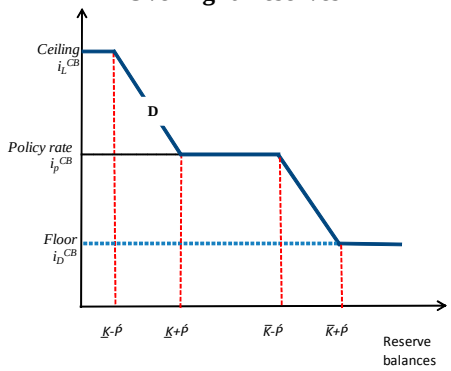


[104] See Ennis and Keister (2008), and Ennis and Weinberg (2007), which this section is drawing heavily on, for a fuller discussion of this.

Clearing Bands

81. **Clearing bands is effectively a truncated floor system.** In a system with clearing bands, the central bank pays interest on a bank's reserve holdings at the target rate policy rate as long as those holdings fall within a pre-specified band**.** If a banks reserve holdings fall below the lower end of the band at the close of the day (or with averaging, the MP), the bank would have to borrow the shortfall from the central bank at the lending rate, and if it exceeds the upper end of the band at the close of the day (or MP) it will receive only a lower interest rate on the excess (Figure 2).[105]

Figure 8. Clearing Bands and Demand for Overnight Reserves



D	Demand for reserves at the close of the market
$\underline{K}$	Lower end of the clearing band
$\bar{K}$	Upper end of the clearing band
P	After close of market payment stocastic shock uniformly distributed within the interval [-$\acute{P}$,$\acute{P}$]
i	Interbank interest rate
i_L^{CB}	Central bank lending rate
i_P^{CB}	Central bank (target) policy rate
i_D^{CB}	Central bank deposit rate

Source: Ennis and Keister (2008).

82. **A truncated floor system would provide stronger incentives for interbank trading, but would also require tighter liquidity management compared to a traditional floor system.** By penalizing banks that are excessively long in reserves, such a system provides incentives for these banks to lend to those that are short. This should boost activity in the shortest segment of the money market and reduce the total amount of reserves the central bank would have to supply in order to ensure that the payment system works smoothly and short term rates stay close to the policy rate.[106] However, it would also require a more active central bank liquidity management to contain the aggregate supply of reserves and ensure that market rates does not fall below the policy rate.

[105] New Zealand changed in late 2007from a conventional floor system to such a truncated floor system with a tiered central bank deposit rate structure where deposits up to a predetermined amount would be remunerated at the policy rate and deposits in excess of that would earn 100 basis points less. New Zealand does not have a reserve requirement.

[106] Norway changed from a standard floor system to a truncated floor system in later 2011 for this reason. Under the new system, a predefined volume of bank deposits in Norges Bank (a quota) are remunerated at the policy rate (the sight deposit rate) while deposits in excess of this quota are remunerated at 100 basis point less. Norway does not have a reserve requirement.