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Sophie Claeys

Optimal regulatory design for the Central Bank of Russia

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Optimal regulatory design for the Central Bank of Russia

Tiivistelmä

Venäjän keskuspankilla on useita sellaisia tehtäviä, jotka eivät yleensä ole kuuluneet keskuspankeille. Sen lisäksi, että Venäjän keskuspankki toteuttaa rahapolitiikkaa, se toimii pankkivalvojana, hallinnoi Venäjän talletussuojajärjestelmää ja on pääomistaja Venäjän suurimmassa liikepankissa. Tutkimuksessa käsitellään ensin sitä, kuinka taloustieteellinen tutkimus käsittelee keskuspankkien optimaalisia tehtäviä ja miten Venäjän keskuspankin nykyiset tehtävät poikkeavat tästä optimista. Tämän jälkeen testataan empiirisesti, miten pankkivalvonnan säilyttäminen keskuspankissa vaikuttaa rahapolitiikkaan. Yksinkertaisen estimoidun Taylor-säännön avulla pystytään selvittämään, että Venäjän keskuspankki ei ole ilmeisesti käyttänyt pankkivalvonnasta saamiaan tietoja koko rahoitusjärjestelmän vakauden parantamiseen, vaan pikemminkin suurten, julkisessa omistuksessa olevien pankkien etujen mukaisesti.

Asiasanat: keskuspankki, pankkivalvonta, rahapolitiikan säännöt, Venäjä

Optimal Regulatory Design for the Central Bank of Russia*

Sophie Claeys[†]

May 2005

Abstract

The Central Bank of Russia (CBR) assumes a wide range of functions not traditional to a central bank. In addition to the daily conduct of monetary policy, it acts as a regulator and supervisor of the banking sector, is responsible for the implementation of a deposit insurance scheme and is the main owner of Russia's largest commercial bank, Sberbank. I review how the current design of the CBR deviates from the optimal allocation of regulatory powers prescribed in the literature and generates scope for conflicts within the CBR policy objective function. I then empirically investigate the need for a supervisory body within the CBR. Using a simple Taylor rule framework I find that the CBR does not use its "hands-on" supervisory information to maintain financial stability, but rather to accomodate state-owned banks' balances.

Keywords: Central Bank, Prudential Regulation and Supervision, Monetary Policy Rules, Russia.

JEL-Classification: G21, G28.

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1 Introduction

When discussing the optimal conduct of monetary policy, many authors take the view that a central bank's objectives should consist exclusively of keeping inflation low, ensuring stable economic growth and maintaining financial stability – with emphasis on the first two, particularly inflation fighting. As a result, much of the literature on monetary policy concerns ways to achieve low inflation through improvements in institutional design and promotion of central bank independence.[1] In reality, many central banks do not consistently adhere to the policy guidelines set out by e.g. Mishkin (2000a) in their daily conduct of monetary policy, mainly because they assume a grab bag of regulatory functions not generally seen as central to monetary policy, and moreover may conflict with monetary policy objectives. The Central Bank of Russia (CBR) is a prime example of a central bank that assumes a wide range of often-conflicting functions. Besides the daily conduct of monetary policy, the CBR acts as a regulator and supervisor of the banking sector, assumes single licensing and closure authority over banks and acts as a lender of last resort (LLR) for imperilled banks. The CBR is also presently implementing a deposit insurance scheme (DI), and is the country's single largest creditor and main owner of Sberbank, Russia's largest bank. Thus, the multi-tasked CBR faces abundant opportunities for conflicts of interest as it engages in its various functions.

This paper explores how the CBR's "in-house" bank supervision function may complement the central bank's other functions and objectives. It provides an empirical evaluation of the current financial supervisory authority (FSA) arrangement within the central bank, investigating whether "hands-on" supervisory information is useful for monetary policy and whether the CBR uses this information in the conduct of monetary policy in setting interest rates. Supervisory information can be particularly useful to a central bank in times of bank distress, since monetary policy can be used to accommodate bank balances and avoid financial turmoil. Using a simple Taylor rule framework, I find that the CBR does not use its hands-on supervisory information to maintain financial stability, but rather to accommodate state-owned banks' balances.

The paper is organised as follows. I begin section 2 with a brief review of the literature on the optimal allocation of regulatory powers within a central bank and apply select insights to an appraisal of potential alterations to the CBR's regulatory design. The discussion in the next section then turns to

[1] For a discussion on the need for central bank independence in achieving inflation targets, see Cukierman (1994) and references therein.

the CBR's role of regulator and supervisor of the banking sector. I empirically investigate the usefulness of supervisory information for the conduct of monetary policy and analyse whether the current design of supervision contributes to our understanding of the central bank's monetary policy behaviour through monetary policy rules. Section 4 concludes.

2 A review of the literature on regulatory design and lessons for the CBR

The CBR presently assumes a wide range of functions. Because of the inconsistencies they potentially generate, this has implications on how smoothly the central bank operates. The literature suggests that the current regulatory design impairs the CBR's ability to adequately achieve all its objectives. This section briefly surveys the literature on optimal design of banking regulation and relates it to the current functions taken on by the CBR.

Introduction

Until the end of the 19th century, central banks did not generally assume an explicit role of lender of last resort nor shoulder supervisory and regulatory tasks. The subsequent changes in banking (and financial markets more generally), however, necessitated a lender-of-last-resort (LLR) function.[2] Central banks now often act as LLRs for otherwise economically sound banks with liquidity problems.[3] The specific nature of commercial banking, where banks are mainly involved in granting long-term (illiquid) loans and receiving short-term (liquid) deposits from the public, makes the banking sector particularly vulnerable to shocks. The main risks that arise from transforming deposits into long-term credit portfolios are interest-rate risk (due to the maturity mismatch) and liquidity risk (due to the possibility of unexpected withdrawals by depositors). In the event of multiple withdrawals by depositors, a bank will be unable to fully service all depositors at the same time. When a bank is hit by such a liquidity shock and is unable to extract funds via the interbank market, the bank may turn to the LLR to meet liquidity demands of its depositors.

[2] See e.g. Goodhart and Schoenmaker (1995) and Goodhart (2000) on how the changing nature of the financial system has affected the functions and objectives of central banks. Capie et al. (1994) describe how central bank functions have evolved over time.

[3] Bagehot (1873) put forward the rules for extending LLR funds for the Bank of England to "distinctly acknowledge that it is its duty to support the market in times of panic" by lending to "illiquid but solvent banks" but at "penalty rates."

Diamond and Dybvig (1983) show that banks can be protected from bank runs through the government provision of depositor insurance (DI). While DI may solve the coordination failure between a large group of small depositors (and thus lower systemic risk), it can also increase the moral hazard present on the banks' side by removing the incentive for depositors to monitor their banks. Moreover, the bank's own profitability concerns create moral hazard problems in choosing its asset portfolio. In the presence of DI, risk-taking behaviour on behalf of the bank can be heightened by limiting the liability the bank faces in the event of default. Such increased risk-taking increases the probability of bank failures.

In general, bank stability is affected by vulnerability to individual runs and systemic risk on the liability side and bank risk-taking behaviour on the asset side. Most safety and soundness regulatory instruments in the banking industry aim at reducing the perverse incentives banks face when composing their asset portfolios through banking regulation and prudential supervision.[4]

Supervision and systemic stability

Countries may use a number of arrangements for the allocation of bank supervision.[5] If a central bank is concerned with systemic stability and acts as a LLR, one can argue that supervision should be in the hands of the central bank to facilitate its LLR functions. Since only those banks whose solvency is at doubt typically come to the central bank for help, as LLR, the central bank will only be inclined to lend when the bank's failure poses a threat to financial system stability - a judgement that can be facilitated on the basis of "in-house" supervisory information. When there is a well-functioning interbank market, however, solvent banks can get loans elsewhere when they need extra liquidity. Private supervisory information may then be useful in gauging a bank's solvency.

When a central bank's primary concern is maintaining financial stability, it may be reluctant to close down a large bank[6] and resort to regulatory

[4] Much of the focus of prudential regulation has been on bank solvency via capital adequacy requirements. These requirements are intended to reduce the gambling behaviour of banks by putting bank equity at risk (see e.g. BIS Core Principles for effective banking supervision (1997) and Dewatripont and Tirole (1994) for a more general discussion). See also Mishkin (2000b) and Summer (2002) on the need for prudential supervision and banking regulation.

[5] For example, the US Federal Reserve assumes supervisory functions, but shares them with other supervisory agencies. In the Netherlands, supervision has always been a central bank function. In Finland and the UK, the financial supervisory authorities are separate from the central bank, but work in close cooperation. In Russia, supervision and prudential regulation are housed within the CBR.

[6] For example, because of reputational issues or because the central bank wants to

forbearance. On the other hand, if banks assume forbearance will be forthcoming, they may increase their risky behaviour and produce precisely the outcome the central bank hoped to avoid. Already we can see that combining LLR and supervisory functions may be incongruent within the central bank's objective function.

Moreover, focusing on reducing moral hazard runs the danger of distracting the financial supervisory authority from assessing how its actions impact the economy. A unified regulator must be willing to grapple with the conflict between strict enforcement and maintaining systemic stability.

These conflicts are real and cannot simply be avoided through institutional design. Claeys et al. (2005a) empirically investigate the degree of regulatory forbearance for the Russian banking market. The evidence suggests that prudential regulations in Russia are not effectively enforced because they conflict with other objectives inherent to the CBR's objective function. To the extent that regulatory forbearance impacts the risk-taking behaviour of banks, our results provide some empirical support for separating supervision and LLR functions. Nonetheless, a single authority may be preferable when conflicts intensify, because it can adhere to its internal hierarchy of LLR and supervisory functions and let the hierarchy depend on the situation at hand to reach an efficient outcome.[7]

Supervision, deposit insurance and lender of last resort

Much of the theoretical literature focuses on specific aspects of banking supervision. One strand of literature analyses the usefulness of capital adequacy rules as part of prudential regulation in reducing moral hazard problems in banking.[8] Some authors focus on how deposit insurance schemes (DI) may affect moral hazard and how DI should be optimally designed.[9] A small group of papers address the question of how different regulatory functions should be optimally coordinated to avoid inconsistent policy.

A relatively new strand of investigation deals with the "LLR-DI-FSA

maintain a well-functioning payments system when the large bank is an important player in the interbank market.

[7]See Wall and Eisenbeis (1999) for a general discussion on how regulatory structure impacts priority choices among conflicting public policy goals. Eisenbeis (2004) discusses agency problems and goal conflicts in designing a financial regulatory structure with a special focus on the EMU.

[8]See e.g. the Journal of Banking and Finance,Volume 19, Issues 3-4, pp. 393-741 (June 1995) on "The Role of Capital in Financial Institutions."

[9]See e.g. Prescott (2002), Cordella and Yeyati (2002) and Morrison and White (2004). Demirgüç-Kunt and Kane (2001) empirically review deposit insurance design across countries. Demirgüç-Kunt and Detragiache (2002) empirically analyse the impact of deposit insurance on banking system stability.

nexus," i.e. analysing for the optimal allocation of the lender-of-last resort, deposit insurance and supervision functions.[10] Using an incomplete contracts setting, Repullo (2000) considers who should act as LLR: the central bank or a deposit insurance agency (DIA)? His results indicate that the LLR function should be allocated contingent upon the size of the liquidity shock banks are facing. He further assumes that supervisory information can be shared and that the agency in charge of LLR collects it. This information is assumed to contain qualitative information that enables the supervisor to generate an assessment of the bank's assets, although this information is not verifiable. As a result, a solvent bank can be denied a loan and an insolvent bank can get a loan. This is important because of the imparity between the agencies' objective functions and the social welfare function. A central bank is assumed to care about the impact of a bank failure on systemic stability, while a deposit insurer is assumed to care about the impact of a bank failure on reimbursement of insured depositors. The main results suggest a role for both the central bank and the DIA as LLR; the central bank for small liquidity shocks, the DIA for large liquidity shocks.

When applying this setting to the CBR, one can assume that part of the supervisory information available to the central bank cannot be observed by outsiders. Further, the CBR's main objective is somewhat clouded as it also happens to be the main owner of Russia's largest commercial bank. In addition to the expected pay-off from the loan of last resort, systemic and individual bank stability, as well as the repayment of insured depositors (once DI comes into force)[11] enter the equation.

Repullo (2000) suggests a way to determine who should be responsible for bank supervision. When small liquidity shocks are more frequent than large ones, his model suggests that the central bank should be in charge of supervision. This argument, however, is limited to the consideration that when the costs of transferring information are high, the agency that uses the information most should be in charge of supervision. It ignores the impact of possible conflicts of interest on risk-taking behaviour of banks, as well as the costs of increased risk-taking created by a) the presence of an LLR, or b) low enforcement of prudential regulation, in the objective functions of the different agencies. The propensity for risk-taking could be incorporated into the analysis by assuming that a supervised bank has opportunities to divert funds to more risky projects and that the probability that the bank will gamble depends on which body assumes the LLR and supervisory functions.

[10] Others analyze the issue of how regulation should be optimally designed more generally. Mayes (2005) presents an enlightening discussion of the issues at hand.

[11] This is scheduled for implementation by the end of 2005 (Tompson, 2004).

In constructing the pay-offs for deciding whether a loan of last resort should be granted, one would then also take into account how the design of the regulatory scheme affects a bank's risk-taking choices.

In a subsequent paper, Repullo (2003) takes up the issue of the extent to which the presence of a LLR enhances bank risk-taking. He finds that the presence of a LLR in itself does not necessarily imply greater risk-taking, but rather that a bank's appetite for risk-taking is stepped up when penalty rates are charged. Again, the paper says little about supervision as such. There is only a consistently enforced capital rule. Unsurprisingly, the fact that the Russian banking market is subject to prudential rules carries little weight in bank portfolio decisions when banks do not expect the rules will be enforced. In other words, an increase in enforcement is one straightforward way to get banks to incorporate supervision into their decisionmaking and diminish their propensity for risk-taking.

Kahn and Santos (2001) parallel the argument in Repullo (2000) and use the assumption that banks have the discretion to divert funds to more risky investments. In a setting with a unified regulator, the authors find a) excessive regulatory forbearance, b) insufficient monitoring and c) sub-optimal investment in loans. One crucial assumption is that the single regulator lacks the arbitrary authority to close a bank. A bank is only closed when the regulator decides not to lend to the bank when it faces a liquidity shortfall. When the regulator has full authority to close banks (on top of the power to extract rents from the bank under all circumstances), the bank loses all incentives to invest in illiquid assets. The authors argue that regulatory forbearance can be reduced by setting specified loan rates for the LLR and giving the DIA authority to shut down banks. Alternatively, they suggest both the central bank and the DIA could act as a LLR (see Repullo, 2000). The first solution does not clarify to which extent banks will be tempted to take on more risk, nor what happens with the degree of bank monitoring by the supervisory agency.

The results in Kahn and Santos (2001) offer some insights into the implications of the CBR's arrangements. They argue that when the central bank assumes all responsibilities, including the authority to close banks (as the CBR), there will be excessive regulatory forbearance, insufficient monitoring and a sub-optimal level of lending. This is a valid appraisal of the current situation in Russia. Lending figures remain low by international standards[12] and empirical evidence suggests low levels of monitoring and enforcement of regulations (Claeys et al., 2005). The emphasis, therefore, needs to go to regulatory enforcement. In fact, if the regulator fails to credibly commit

[12] See e.g. the data on loans in Tompson (2004) and Chowdhury (2003).

to closing banks, risk-taking behaviour increases regardless of which agency assumes authority.[13] Indeed, when banks can count on the regulatory forbearance of the central bank, they are prone to assume risk and expect to be bailed out when they get into trouble. This is costly in terms of failure of loans or investments, which inevitably entails a loss of funds that could have been allocated more efficiently.

Supervision and monetary policy

The potential conflict between monetary policy and supervision arises when supervisory information impacts monetary policy so that decisions defy (or follow) what is commanded by economic conditions and favour (or disfavour) bank balances. A supervisor sometimes needs to act as protector or stern disciplinarian, but either stance can conflict with monetary policy in certain conditions. Such conflict becomes apparent, e.g. in the case where monetary policy needs to be tightened, but bank balances are weak. On the other hand, when the central bank has an external monetary objective such as an exchange rate target, its policy may harm individual bank stability (Goodhart, 2000). This is clearly the case when monetary policy is used to hold depreciation pressure at bay by increasing interest rates. Indeed, this characterises much of the CBR's policy in the post-1998 crisis period, when Rb depreciation against the USD forced the CBR to keep interest rates high. More recently, high oil prices and a declining USD led to Rb appreciation, and motivated the Russian government in April 2004 to impose a limit on Rb appreciation against a USD/EUR currency basket. With an appreciating currency, interest rates can be lowered, even if internal inflationary pressures suggest a higher rate is necessary. Such a stance helps banks without endangering their individual stability.

If monetary policy transmission is assumed to work through the bank channel, the conflicts that arise will be more acute. Particularly in the case where bank loan portfolios are characterised by a massive maturity mismatch, so that any increase in interest rates negatively impacts bank profitability. On the other hand, when banks are mainly financed with retail deposits, conflicts are less likely since these interest rates are unlikely to follow large short-term swings in the money market. The potential conflict between supervision and monetary policy therefore depends on the structure of the banking sys-

[13] In general, these papers do not consider the conflicts of interest arising from assuming all three functions of a supervisory authority (LLR, deposit insurer and closure authority). To look at the conflict-of-interest problem, one needs to define which aspect of policy holds top priority for the central bank – something that is not always immediately apparent. Only when the relative importance of different functions is defined can one interpret or build an appropriate utility function. Obviously, priorities can also shift over time.

tem. Russian bank portfolios are characterised by their short-term nature in both assets and liabilities (see e.g. Chowdhury, 2003). Although the term structure of loans to the private sector is gradually lengthening, short-term loans must often be rolled over because of the lack of long-term funding.[14] Despite the low level of long-term loans, the inability of Russian banks to attract long-term liabilities generates a maturity mismatch that makes the sector vulnerable to interest rate changes.

Next to the conflicting objectives of exchange rate stability and low inflation, the combination of supervisory powers and monetary policy may change expectations with respect to the stance of monetary policy, which in turn impacts how banks behave. If central banks use supervisory information in monetary decisionmaking, combining the tasks of supervision and monetary policy may have its advantages and can be used to maintain financial stability. CBR concerns about financial stability may explain why it has resorted to regulatory forbearance in its supervisory function. As this should be visible in its conduct of monetary policy, I empirically investigate this notion in section 3.

Lessons for the CBR

The theoretical literature on regulatory structure has to be interpreted carefully in the developing market cases such as Russia. The quality of published information is often quite poor and the legal system may be too weak to coordinate the various functions of the central bank and the supervisor. When accounting rules are inadequate and give rise to window-dressing and creative accounting, regulations may turn out to be meaningless and supervision void altogether, no matter where it is done. In such a situation, one needs to assess how supervision can be rendered effective before addressing the optimal allocation of regulatory powers. Given the low enforcement of prudential regulation in Russia, one can arguably defend keeping a FSA inhouse the CBR. However, when supervisory information adequately reflects banking sector health, a central bank can use this information to carry out its monetary policy decisions and to optimally balance its act as a LLR. The supervisory authority can therefore be delegated to an outside office which is less prone to political pressure nor suffers from an inherent inconsistency in its objective function, while allowing the central bank access to this information. This should improve difficulties in enforcement and allow a central bank to preserve financial stability. In a fragile banking system, this may be one of the central bank's primary concerns. In Russia, however, it might

[14] This is because all deposits, regardless of their maturity, are demand deposits by law. The CBR is looking into a law that would make term deposits possible (Tompson, 2004).

turn out that the CBR is only concerned with the stability of state-owned banks.

Empirical assessment of inconsistencies

To date, empirical assessments of the possible costs of improperly designing a central bank's powers or functions are fairly limited. The main questions that need to be addressed are:

1. Does the current design lead to regulatory forbearance?
2. Does regulatory forbearance lead to increased risk-taking by banks?
3. What are the benefits of "in-house" supervisory information for LLR functions?
4. How does "in-house" supervisory information benefit monetary policy?

Claeys et al. (2005a) empirically investigate how well the CBR enforced its prudential regulations and provide evidence of a significant degree of regulatory forbearance. Claeys et al. (2005b) investigate theoretically and empirically how the interplay between a repressive form of monetary policy and supervision can negatively impact risk behaviour of Russian banks. Goodhart and Schoenmaker (1995) analyse whether supervision should be separated from monetary policy through the investigation of bank failures under different regimes. Their empirical evidence suggests that a system of combined arrangement experiences significant fewer failures compared to a separate arrangement (although the question remains as whether such a system is more efficient). Di Noia and Di Giorgio (1999) find that inflation rates are higher and more volatile in countries where supervisory functions are housed entirely inside the central bank. Peek et al. (1999) investigate the role of supervision in central banking for the United States. Their results indicate that while inflation and unemployment forecasts can be improved using supervisory information, the latter does not affect the Federal Reserve's monetary policy through staff forecasts. Supervisory information does, however, significantly influence the monetary decisions made through voting behaviour by members of the Federal Open Market Committee. This paper follows a similar approach and addresses the question of whether supervisory information is useful for the conduct of monetary policy in Russia in preserving financial stability. Since the CBR does not report any inflation or unemployment forecasts nor publishes any decision discussions or votes of members of its monetary board, I investigate whether supervisory information contributes to the understanding of observed monetary policy behaviour in Russia.

3 Is supervision central to the Central Bank of Russia?

This section provides a preliminary and necessarily limited empirical answer to the question of whether prudential supervision is useful for the conduct of monetary policy in the Russian Federation. Does "hands-on" supervisory information guide monetary policy decisions of the Russian central bank? Does supervisory information add significantly to our understanding of central bank behaviour by improving the performance of benchmark rules based on this wider information set?

A simple Taylor rule can often be used as a benchmark to assess the monetary policy decisions made by the central bank.[15] In the first step, I analyse whether the policy of the CBR can be described adequately using modified versions of the original Taylor rule. In the second step, I investigate what a benchmark Taylor rule would look like if the CBR would use the widest information set available, including supervisory information. For this purpose, I assume that the central bank observes current and past inflation, interest rates, actual and potential output and the exchange rate. I assess how this information affects the forward-looking behaviour of the central bank.[16] I assume the central bank has "hands-on" supervisory information, available only to the public with a lag. To gauge the usefulness of supervisory information, I analyse how this information may help to improve the performance of the Taylor rule as a benchmark for monetary policy.

3.1 A Taylor rule tailored to the CBR

Methodology

Given the CBR's explicit exchange rate stability objective, I apply an open economy version of the Taylor rule.[17] Based on Taylor's original rule (1993) and interest rate smoothing, I assume that the following equation describes central bank behaviour in the Russian Federation:

[15] This has been extensively documented for the US and later Germany and the Euro Area. See e.g. Clarida and Gertler (1996), Clarida, Galí and Gertler (1998), Rudebush and Svensson (1998) and Peersman and Smets (1999).

[16] Assuming forward-looking behaviour on the part of the CBR may be overdoing it for some parts of the estimation sample. I characterise monetary policy as if the CBR was forward-looking in its policies throughout the entire sample period.

[17] The CBR's 2003 annual report states: "The main objectives and principles of the monetary policy pursued by the Bank of Russia in 2003, as in the previous years, were determined by the task of consistently reducing the inflation rate and ensuring the national currency's stability to bring about growth in real income, savings and investment and create conditions for long term sustainable economic growth."

$$i_t = (1-\lambda)\cdot i_t^0 + \lambda\cdot i_{t-1} + \nu_t, \quad (1)$$
$$i_t^0 = i^* + \gamma_1\cdot[E_t\{\pi_{t+n}\} - \pi^*] + \gamma_2\cdot[E_t\{ip_t - ip_t^*\}] + \gamma_3\cdot\Delta ee_t, \quad (2)$$

where i_t is the central bank's instrument rate and i^* is the long-term nominal equilibrium interest rate, consistent with the inflation target π^*. $E_t\{\pi_{t+n}\}$ is the expected annual inflation rate for the period between t and $t+n$, conditional upon the information set available at time t, ip_t (ip_t^*) is the log of monthly (potential) industrial production[18] and Δee_t is the log difference of the monthly exchange rate.[19] Following Clarida and Gertler (1996) and Clarida, Galí and Gertler (1998), i_t^0 is the central bank's target rate which reacts to changes in expected inflation,[20] the output gap and the effective exchange rate. ν_t can be interpreted as a shock parameter which prevents the CBR from setting the rate according to the rule or as a deliberate policy shock by the CBR which wants to deviate from the rule. According to equation (1), I assume that each month the central bank sets the interest rate as a convex combination of the target rate and the lagged interest rate to capture how the actual rate partially adjusts towards the target.

For estimation purposes, equation (1) is rewritten as follows:

$$i_t = (1-\lambda)\cdot[\gamma_0 + \gamma_1\cdot\pi_{t+n} + \gamma_2\cdot(ip_t - ip_t^*) + \gamma_3\cdot\Delta ee_t] + \lambda\cdot i_{t-1} + \mu_t, \quad (3)$$

where $\mu_t = -(1-\lambda)[\gamma_1(\pi_{t+n} - E_t\{\pi_{t+n}\}) + \gamma_2(ip_t - ip_t^* - E_t\{ip_t - ip_t^*\})] + \nu_t$, $\gamma_0 = i^* - \gamma_1\cdot\pi^*$. Given that μ_t is a linear combination of forecast errors, it is orthogonal to all variables known by the CBR at time t when setting the interest rate. Further assume that iv_t is a vector of variables within the central bank's information set such that $E_t[\mu_t|iv_t] = 0$ holds.

Monetary policy in Russia

[18] I apply a quadratic trend to industrial production to obtain an estimate of the long-term trend component ip_t^*.

[19] I use the Rb/USD exchange rate, but investigate the impact of changes in the nominal effective exchange rate as well. The CBR recently announced it will abandon dollar targeting in its managed float policy for the ruble and switch to a USD/EUR currency basket (see BOFIT Weekly 6, 11.2.2005). For the period under consideration, the Rb/USD rate was mainly targeted.

[20] This is a generalisation of the original rule first proposed by Taylor (1993), whereby the central bank responds to lagged inflation rather than to expected inflation. Clarida et al. (1998) argue that an advantage of this specification is that it implicitly reflects the reality of policymaking, namely that a central bank takes into account the broadest set of information available. Even so, I have included tests that allow for a policy that reacts to past inflation to assess the "forward-looking-ness" of the CBR's stance.

I use monthly data for the period (1996:11–2003:08). I assume that the CBR's monetary policy stance is reflected in movements of the money market rate. Figure 1 graphs the CBR's refinancing rate together with movements in the money market rate. The money market rate almost always falls below the refinancing rate set by the CBR (with the exception of 1997:12 and 1998:9–1998:10). After the 1998 crisis, the gap is gradually reduced. The money market rate may not perfectly reflect monetary policy as intended by the CBR but I consider it the best reflection of the monetary policy stance.[21] I use the annualised monthly inflation rate for consumer prices as the CBR's inflation target (adapted from Goskomstat). For the forward-looking Taylor rule, I assume that the CBR is concerned with the one-year ahead inflation rate, $n = 12$, rather than the month-to-month variation in inflation.[22] Because of a possible endogeneity bias,[23] I use a non-linear GMM estimation procedure to estimate the coefficients.

[Insert Figure 1]

Table 1 presents the estimation results for equation (3) when using monthly data for the period (1996:11–2003:08).[24] In the baseline equation, I use the current output gap and ex-post values of inflation. The first line shows the results for the baseline specification when accounting for movements in the Rb/USD exchange rate. The coefficient on the inflation gap, γ_1, indicates that a 1 per cent rise in one year ahead expected inflation will induce the CBR to raise nominal interest rates with 40 basis points. The CBR does not seem to succeed in raising *real* rates in response to inflationary pressures.[25] The coefficient on the output gap is negative and significant. It indicates that a 1 per cent increase in industrial production compared to its quadratic trend leads the CBR to reduce nominal (and real) rates by 33 basis points, indicating pro-cyclical interest-rate behaviour on the part of the CBR. This result is corroborated when including alternative measures for the output

[21] Others have estimated monetary policy rules for the CBR for several subperiods assuming alternative instruments. See e.g. Esanov et al. (2004).

[22] I use data up to 2004:12 for this purpose. The CBR only recently started reporting target rates for inflation (see CBR annual reports from 1997, when the shift to a form of inflation targeting officially started).

[23] The CBR may react to changes in inflation and output by adjusting the interest rate, which may in turn impact how these variables behave.

[24] Both inflation and interest rates are I(0). DF tests of the null of I(1) or non-stationarity are always rejected.

[25] This is because γ_1 is not significantly larger than 1. This is consistent with the findings in Esanov et al. (2004).

gap, using either a Hodrick Prescott smoothing filter to detrend industrial production or a five-sector production measure (see lines 2 to 4).

To account for the CBR's exchange rate stability objective with respect to the USD, I add the Rb/USD exchange rate in the baseline equation and the instrument set. The results indicate that a 1 per cent depreciation of the Rb relative to the USD induces a 0.94 per cent increase in the target rate (0.94*0.6 increase in the money market rate). This corroborates the view that the CBR follows an appreciation policy with respect to the USD. The Russian money market rate decreased significantly, however, in response to a depreciation in the trade-weighted exchange rate (see line 5). This is explained by the fact that while the CBR was targeting the Rb/USD by increasing rates following depreciation, the Rb was appreciating against a trade-weighted basket of currencies (see Figure 2).

[Insert Table 1]
[Insert Figure 2]

Finally, I add current and lagged inflation and oil prices to the equation. Although current inflation does not enter significantly, lagged inflation and current oil prices negatively influence the interest rate. The observation that the coefficient on the output gap is unstable across specifications casts some doubt on whether monetary policy of the CBR can be described as partial output-targeting. Difficulties in observing the output gap, especially on a monthly basis, reinforces this suspicion. Furthermore, estimation error in the output gap typically leads to overestimation of its reaction coefficient (Peersman and Smets, 1999), such that even for significant γ_2, its economic impact cannot be exaggerated.

The J-statistic indicates that we cannot reject the overidentifying restrictions in any of the specifications. Figure 3 plots the actual rate versus the implied target rate for the baseline equation.

[Insert Figure 3]

3.2 Bank supervision and monetary policy

To capture the CBR's prior knowledge of individual bank health acquired through supervision, I construct several monthly aggregate "bank sector indices" (BSI) to reflect the banking sector's health. I focus initially on private banks and exclude balance sheet movements from state-owned banks (SOBs).[26] Next, I include SOBs in assessing aggregate banking health and

[26] The three state-owned banks are Sberbank, Vneshtorgbank and Vnesheconombank.

investigate SOBs' balance sheet movements separately. I assume that in each month t, the CBR uses the widest information set possible to gauge individual and aggregate bank health. Figure 4 illustrates the sequence of information arrival at the CBR.

[Insert Figure 4]

At the beginning of each month t, the CBR observes financial information of all banks at time t^0 which reflects balance sheet and income statement information for the previous month t_{-1}. At the end of each month t, at time t^e, the number of bank failures for month t is known. At time t^e all information from month t can be used to calculate an individual bank's failure probability. Based on the estimation results of an aggregate failure prediction model I obtain:[27]

1. an aggregate coefficient vector, $\hat{\beta}$, which I use to construct
2. bank-specific failure probabilities, $\hat{p}_{i,t}$ (predicted failure probabilities scaled between 0 and 100), which reflect each bank i's failure probability at time t, based on financial information FI of month t_{-1} observed at t^0.

To obtain an aggregate bank "stress" indicator, I construct an unweighted average of the bank-specific failure probabilities:

$$\overline{P_t} = \frac{1}{I_t} \sum_{i}^{I_t} \hat{p}_{i,t}, \tag{4}$$

where I_t is the number of banks still operative in month t. Higher levels of $\overline{P_t}$ will indicate higher average vulnerability of the banking sector. Of course, it is unlikely that the CBR would take such an average at face value in assessing the banking sector's health. More likely, the CBR would consider the size and interbank linkages of banks most likely to fail. I therefore construct an aggregate indicator that takes into account the CBR's concern over those banks that are most likely to fail and represent some sort of systemic threat in the event of their failure. Assume that the CBR focuses on the cumulative market share of bank assets (or interbank liabilities) held by banks most likely to fail and define:

[27] More detailed information on the estimation results for the failure prediction model is presented in the Appendix.

$$BSI_t = \sum_{i}^{\forall i \in BAD_{i,t}} MS_{i,t}, \tag{5}$$

where $BAD_{i,t} = \left\{ i | \hat{p}_{i,t} > 90^{th}\ percentile\ of\ \hat{p}_t \right\}$, $\hat{p}_t = \{\hat{p}_{1,t}, \hat{p}_{2,t}, ..., \hat{p}_{I_t,t}\}$ and $MS_{i,t}$ is the market share of bank i in month t in total bank assets (or interbank liabilities). BSI_t then captures the cumulative market share (either in terms of assets or interbank liabilities) of the 10 per cent of banks most likely to fail. When the CBR uses this information in the conduct of monetary policy, higher values for BSI_t are expected to lead to lower interest rates to ease bank balances. To account for the possibility that the CBR may also be concerned with large banks in terms of assets (or interbank liabilities) but smaller failure probabilities, I further test how interest rates behave when including a weighted average of failure probabilities by including:

$$WBSI_t = \frac{1}{I_t} \sum_{i}^{I_t} \omega_{i,t} \cdot \hat{p}_{i,t},$$

where $\omega_{i,t}$ is bank i's assets (or interbank liabilities) in total assets (or interbank liabilities) in month t. I use weights that reflect either regional or national market shares.

To test the hypothesis that the CBR is using supervisory information in its conduct of monetary policy, I include another target variable, BSI, with coefficient γ_4 in equation (3). Table 2 presents the results for the benchmark Taylor rule when including supervisory information through different measures of poor bank health when excluding SOB balances. Table 3 includes SOB balances in the construction of the BSIs and adds an extra line that only takes into account the SOBs' average failure probability (as opposed to overall banking sector vulnerability). Line 1 reproduces the baseline estimation with the monthly Rb/USD exchange rate. Lines 2 and 3 present the results when aggregate bank health is proxied by the cumulative market share of banks most likely to fail. The results indicate that a rise in BSI through increased asset shares of the most troubled banks significantly reduces the money market rate. Furthermore, a deterioration of bank balances with large regional shares in assets or interbank linkages (no matter if SOBs are included) also leads to an easing of monetary policy (lines 4 and 5). This suggests that a deterioration in bank health of those banks with systemic importance (in terms of assets or regional coverage) results in an easing of monetary policy by the CBR. This is in line with the results of Peek et al. (1999) for the US Federal Reserve and corroborates the findings in Claeys et al. (2005a). However, the results for interbank liability shares in line 3 suggest otherwise. Furthermore, when private banks' failure probability is weighted against national shares in assets or interbank linkages, a worsening of bank health leads to a strengthening of monetary policy or no change (see lines 6 and 7 in Table 2). The results for the unweighted failure probabilities support these findings. Nonetheless, once SOBs are included, the nationally weighted BSI has a significant negative impact on monetary policy. This result is supported when only the SOBs' average health is included (see line 8 in Table 3), indicating that the CBR puts particular emphasis on SOBs' balance health and thereby impacts monetary policy.

The empirical evidence presented suggests that monetary policy has been eased somewhat to favour bank balances solely to accommodate sizeable banks and state-owned banks with high failure probabilities. A variety of other measures capturing commercial bank health suggest that the CBR is otherwise not particularly prone to ease monetary policy to promote banking sector stability.

3.3 Extensions for future research

In all estimations, I assume that the CBR's monetary policy can be best understood via forward-looking versions of the Taylor rule using ex post realised values for inflation rather than inflation forecasts. One alternative procedure adds forward-looking measures of inflation directly into the equation. Here, one could use actual forecasts rather than assuming (less realistically) rational expectations on behalf of the CBR. Inflation forecasts can be generated under the assumption that the CBR uses the widest information set available by estimating a macroeconomic model of the Russian economy through e.g. SVAR analysis. Identification of the empirical model, however, requires imposing restrictions on the dynamic behaviour of structural shocks. Furthermore, the reliability of the SVAR analysis hinges upon the absence of structural breaks and relative long data availability – two conditions hardly met by Russia at this time. Moreover, even with better data quality, it may be inappropriate to assume the CBR "knows the model" and uses forecasts of inflation and output. The CBR still does not publish inflation forecasts; it only started to publish inflation (and implied output growth rate) targets in 1997.[28] Thus, an intriguing question remains: How useful would supervisory information be to the CBR if it were to use inflation forecasts?

[28] Inflation targets are published yearly in "Guidelines for the Single State Monetary Policy."

4 Concluding Remarks

The empirical results in this paper suggest that although supervisory information may be useful for monetary policy behaviour, it only marginally improves our understanding of what determines monetary policy in Russia. Do these results help answer the question of where supervision efforts should be directed? And more importantly, even when supervision can potentially contribute to monetary policy, how successful has the CBR been in maintaining financial stability through its use of supervisory information in the conduct of monetary policy? The CBR has mainly pursued an exchange rate target vis-a-vis the USD – to the detriment rather than improvement of bank balances – and has only recently started to target inflation seriously. Using a simple Taylor rule framework, I found that the CBR does not use its "hands-on" supervisory information to maintain overall financial stability, but rather to accommodate state-owned banks' balances. On one hand, this implies that one should not be too worried that commercial banks can successfully put pressure on the CBR. However, since the evidence indicates that the CBR essentially caters to the needs of larger banks (particularly regionally important and state-owned banks), there is definitely a conflict within the CBR's objective function. Moreover, despite privatisation commitments, state shareholdings in the banking sector rose after the 1998 crisis and the decision to privatise Sberbank and Vneshtorgbank was postponed until 2007. In addition, low enforcement of prudential regulation and the CBR's inability to maintain banking system stability (e.g. the 1998 financial crisis and deposit runs in the summer of 2004) call into question the rationale for keeping supervision in-house at the CBR.

A Constructing an aggregate Russian Bank Sector Index (BSI)

I estimate a failure probability model to identify a set of variables (with their respective weights) that capture the financial soundness of banks. The US Federal Reserve determines a CAMEL rating for banks as part of its early warning system to reflect the degree of individual bank health. CAMEL ratings are based upon a set of variables that reflect a bank's **C**apital adequacy, **A**sset quality, general **M**anagement and governance, **E**arnings and **L**iquidity management. Based on the monthly Mobile database for the period 1995:11–2003:8, I construct a number of variables that reflect the CAMEL rating categories as closely as possible. My choice of variables is, however, restricted due to the need for monthly frequency and subsequent availability of the data. The variables which are included for estimating the failure probability model using logit estimation are described in Table A1. The dependent variable in the logit regression is a dummy variable, failure, which equals one if a bank's license is revoked before 2003:8, and zero otherwise. Because there can be a significant lag between "economic failure" and "regulatory failure" (the CBR's de-licensing behaviour),[29] I restrict the estimation sample to banks which have positive equity and a non-working assets ratio below 100 per cent. I further assume, after estimation, that those banks which have negative capital and/or have a non-working assets ratio of over 100 per cent have a failure probability of 0.99. Summary statistics of the variables in the estimation sample are presented in Table A2 for private and state-owned banks (SOBs) separately. Next to CAMEL related variables, I also include a market share and concentration measure in the specification. Figure 5 plots the monthly number of failures included in the estimation sample.

[Insert Figure 5]

The variable set should be based on the widest information set available to the CBR as well as capture the CBR's private knowledge of bank health compared to public awareness. One drawback of the current variable set is that it cannot appropriately account for qualitative measures such as the management and governance policy of a bank (information which is typically obtainable in conjunction with on-site examinations by the supervisory authority). Unfortunately, since the CBR does not publish bank ratings, I cannot extract this private information. Instead, I can only assume that part of the unobserved component of the estimated default probability reflects this unobserved information. Furthermore, since I estimate the weights based on the whole period for which I observe the variables (1995:11 - 2003:8), I implicitly assume that the CBR has forward-looking information on banks' balances.

The estimation results for the logit model are summarised in Table A3.[30,31] Banks with high loans-to-assets and non-government-loan ratios have higher

[29] Licenses were often not withdrawn until the banks were already illiquid and stripped of assets. See Schoors, 1999.

[30] The results here are for the sample excluding the three state-owned banks. Results that included SOBs are, however, quite similar and are available upon request.

[31] In contrast to the default models for Russian banks estimated in Peresetsky et al. (2004), I use the entire time series to estimate the weights for the calculation of individual bank failure probability.

failure probabilities, which is indicative of the risks involved when investing in the Russian economy (see van Soest et al., 2003). Banks with high capital adequacy and a low share of non-working assets have lower failure probabilities. Sizeable banks, banks with a high market share and banks that operate in highly concentrated markets (high Herfindahl index) all have lower failure probabilities. The coefficients of the model are used as weights to predict monthly, bank-specific, failure probabilities and are assumed to reflect individual bank health based on the CBR's knowledge at the end of each month.

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TABLE 1

CBR Reaction Functions: Forward Looking Modified Taylor Rules

	λ	γ_0	γ_1	γ_2	γ_3	γ_4	J-stat	Chi2
Baseline (Rb/USD)[1]	**0.63**	1.19	**0.40**	**-0.33**	**0.94**		0.14	11.30
	0.03	*1.32*	*0.05*	*0.05*	*0.12*			(0.96)
Alternative output gap:								
HP1600[2]	**0.79**	-2.16	**0.56**	**-1.42**	**1.23**		0.16	12.94
	0.03	*2.34*	*0.09*	*0.31*	*0.17*			(0.91)
HP14400[3]	**0.70**	1.39	**0.37**	**-0.40**	**1.42**		0.15	12.60
	0.03	*1.80*	*0.08*	*0.07*	*0.15*			(0.92)
IP5[4]	**0.63**	**3.39**	**0.44**	**-0.54**	**1.75**		0.13	10.10
	0.04	*1.61*	*0.07*	*0.10*	*0.20*			(0.98)
Alternative ER:								
NEER[5]	**0.66**	**-4.11**	**0.62**	**0.24**	**-2.46**		0.14	11.86
	0.03	*1.81*	*0.08*	*0.06*	*0.23*			(0.94)
Baseline extended with[6]:								
current inflation[7]	**0.62**	-1.06	**0.42**	**-0.26**	**1.00**	0.03	0.12	10.17
	0.03	*1.62*	*0.06*	*0.06*	*0.11*	*0.02*		(0.97)
lagged inflation[8]	**0.49**	0.67	**0.53**	**0.12**	**1.79**	**-0.07**	0.13	10.52
	0.02	*1.15*	*0.05*	*0.03*	*0.07*	*0.01*		(0.97)
producer prices[9]	**0.70**	0.22	**0.42**	**-0.17**	**1.68**	**-0.44**	0.15	11.97
- fuel	*0.02*	*1.48*	*0.05*	*0.04*	*0.13*	*0.08*		(0.99)

Note: The dependent variable is the monthly average of the daily money market rate (IFS). For each element z in the instrument set iv_t the following lags are included: $z_{t-1}, ..., z_{t-6}, z_{t-9}, z_{t-12}$. The baseline instrument set iv_t includes lagged values of inflation, output gap, exchange rate and money market rate. A quadratic trend of industrial production is used to proxy for the monthly outputgap. All equations include 6 dummy variables that account for the august 1998 crisis (1998:7 - 1998:12). The sample period is 1996:11 - 2003:8. The number of observations is 82. Standard errors in italics. Chi2 provides a test for overidentifying restrictions. Under the null hypothesis that the overidentifying restrictions are satisfied, the test statistic is asymptotically Chi-squared distributed with the number of overidentifying restrictions as degrees of freedom. P-values in parentheses.

[1] The log difference of end-of-month Rb Dollar ER (IFS)
[2] Outputgap using Hodrick Prescott filter on industrial production ($\lambda = 1600$)
[3] Outputgap using Hodrick Prescott filter on industrial production ($\lambda = 14400$)
[4] Outputgap using production of 5 basic industrial sectors: industrial production, construction, agriculture, transportation and retail trade (Goskomstat; period is 1997:1 - 2003:8)
[5] The log difference of the nominal effective ER (IFS)
[6] For each extra variable included, the instrument set iv_t is expanded with its lagged values.
[7] γ_4 is the coefficient on π_t
[8] γ_4 is the coefficient on π_{t-12}
[9] γ_4 is the coefficient on the monthly annualised inflation rate of producer prices - fuel (Goskomstat)

TABLE 2

CBR Reaction Functions: The Role of Supervisory Information in Monetary Policy (SOB excluded)

	λ	γ_0	γ_1	γ_2	γ_3	γ_4	J-stat	Chi2
Baseline (Rb/USD)	**0.63**	1.19	**0.40**	**-0.33**	**0.94**		0.14	11.30
	0.03	*1.32*	*0.05*	*0.05*	*0.12*			(0.96)
including[1]:								
BSI								
assets	**0.72**	**4.28**	**1.17**	**0.32**	**1.86**	**-0.05**	0.17	13.66
	0.03	*1.86*	*0.09*	*0.05*	*0.19*	*0.01*		(0.99)
interbank liabilities	**0.82**	**-4.44**	**0.45**	**-0.36**	**1.01**	0.01	0.19	15.27
	0.02	*2.24*	*0.06*	*0.06*	*0.15*	*0.00*		(0.98)
WBSI								
Regional:								
assets	**0.72**	**5.13**	**1.11**	**0.29**	**1.48**	**-0.41**	0.17	14.06
	0.03	*1.79*	*0.09*	*0.05*	*0.22*	*0.05*		(0.99)
interbank liabilities	**0.65**	**10.20**	**0.86**	**0.20**	**3.02**	**-0.45**	0.19	15.63
	0.02	*1.48*	*0.05*	*0.04*	*0.16*	*0.04*		
National:								(0.97)
assets	**0.60**	0.86	**0.24**	0.00	**0.93**	**8.60**	0.19	15.47
	0.02	*0.66*	*0.02*	*0.02*	*0.07*	*0.35*		(0.97)
interbank liabilities	**0.75**	-2.50	**0.49**	**-0.28**	**0.77**	1.18	0.18	14.78
	0.02	*1.77*	*0.05*	*0.04*	*0.11*	*0.85*		(0.98)
$\overline{P}$	**0.41**	**-3.54**	**0.06**	**0.04**	**0.98**	**0.74**	0.20	16.53
	0.02	*0.80*	*0.02*	*0.01*	*0.07*	*0.05*		(0.96)

Note: The dependent variable is the monthly average of the daily money market rate (IFS). For each element z in the instrument set iv_t the following lags are included: $z_{t-1}, ..., z_{t-6}, z_{t-9}, z_{t-12}$. The baseline instrument set iv_t includes lagged values of inflation, output gap, exchange rate and money market rate. A quadratic trend of industrial production is used to proxy for the monthly outputgap. All equations include 6 dummy variables that account for the august 1998 crisis (1998:7 - 1998:12). The sample period is 1996:11 - 2003:8. The number of observations is 82. Standard errors in italics. Chi2 provides a test for overidentifying restrictions. Under the null hypothesis that the overidentifying restrictions are satisfied, the test statistic is asymptotically Chi-squared distributed with the number of overidentifying restrictions as degrees of freedom. P-values in parentheses.

[1] For each extra variable included, the instrument set iv_t is expanded with its lagged values.

TABLE 3

CBR Reaction Functions: The Role of Supervisory Information in Monetary Policy (SOB included)

	λ	γ_0	γ_1	γ_2	γ_3	γ_4	J-stat	Chi2
Baseline (Rb/USD)	**0.63**	1.19	**0.40**	**-0.33**	**0.94**		0.14	11.30
	0.03	*1.32*	*0.05*	*0.05*	*0.12*			(0.96)
Including[1]:								
BSI								
assets	**0.70**	**6.95**	**1.02**	**0.25**	**1.91**	**-0.04**	0.18	15.00
	0.03	*1.98*	*0.07*	*0.04*	*0.20*	*0.01*		(0.98)
interbank liabilities	**0.44**	-0.46	**0.23**	**-0.14**	**1.64**	**0.01**	0.19	15.77
	0.02	*0.96*	*0.02*	*0.02*	*0.06*	*0.00*		(0.97)
WBSI								
Regional:								
assets	**0.70**	**7.69**	**1.21**	**0.22**	**1.68**	**-0.46**	0.18	14.44
	0.03	*1.84*	*0.12*	*0.04*	*0.19*	*0.05*		(0.98)
interbank liabilities	**0.64**	**10.51**	**0.85**	**0.20**	**2.96**	**-0.45**	0.19	15.68
	0.02	*1.52*	*0.05*	*0.04*	*0.16*	*0.04*		(0.97)
National:								
assets	**0.68**	1.86	**0.48**	**-0.33**	**0.77**	**-0.32**	0.19	15.94
	0.02	*1.09*	*0.04*	*0.05*	*0.13*	*0.15*		(0.97)
interbank liabilities	**0.79**	0.90	**0.70**	**-0.24**	**1.89**	**-5.03**	0.19	15.65
	0.02	*1.85*	*0.06*	*0.04*	*0.23*	*0.74*		
								(0.97)
$\overline{P}$	**0.41**	**-3.74**	**0.06**	**0.04**	**0.97**	**0.75**	0.20	16.51
	0.02	*0.80*	*0.02*	*0.01*	*0.07*	*0.05*		(0.96)
SOB[2]	**0.36**	**1.94**	**0.46**	**-0.06**	**1.34**	**-5.07**	0.21	13.97
	0.01	*0.54*	*0.01*	*0.02*	*0.03*	*0.87*		(0.99)

Note: The dependent variable is the monthly average of the daily money market rate (IFS). For each element z in the instrument set iv_t the following lags are included: $z_{t-1}, ..., z_{t-6}, z_{t-9}, z_{t-12}$. The baseline instrument set iv_t includes lagged values of inflation, output gap, exchange rate and money market rate. A quadratic trend of industrial production is used to proxy for the monthly output gap. All equations include 6 dummy variables that account for the August 1998 crisis (1998:7 - 1998:12). The sample period is 1996:11 - 2003:8. The number of observations is 82. Standard errors in italics. Chi2 provides a test for overidentifying restrictions. Under the null hypothesis that the overidentifying restrictions are satisfied, the test statistic is asymptotically Chi-squared distributed with the number of overidentifying restrictions as degrees of freedom. P-values in parentheses.

[1] For each extra variable included, the instrument set iv_t is expanded with its lagged values.

[2] γ_4 is the coefficient on the average failure probability of the state-owned banks only.

TABLE A1

Description of Variables for the Logit Model[1]

Capital/assets	The capital-to-assets ratio of bank i in month t (%).
Non-working assets/assets	The ratio of non-working assets in total assets of bank i in month t (%).
Return on assets	The ratio of monthly net income to two-month average of assets of bank i in month t (%).
Liquidity	The ratio of liquid assets in total assets of bank i in month t (%).
Non-government claims/assets	The ratio of non-government securities in total assets of bank i in month t (%).
Loans/assets	The loans (to non-financial institutions)-to-assets ratio of bank i in month t (%).
Size (log assets)	The log of assets of bank i in month t.
Regional[2] market share (assets)	The regional market share in assets, calculated as the ratio of bank i's individual assets to the sum of bank assets for region j in month t (between 0 and 100).
Regional[2] Herfindahl (assets)	The regional Herfindahl index, calculated as the sum of squared regional market shares for each region j in month t (between 0 and 10000).

[1] Source: Own calculations based on Mobile database.
[2] Note: I use 80 regions for the calculation of regional market shares.

Table A2

Summary Statistics

	Mean		Std. Dev.		Min		Max	
	SOB	Private	SOB	Private	SOB	Private	SOB	Private
Capital/assets	17.03	32.47	13.71	20.47	0.03	0.00	41.11	99.99
Non-working assets/assets	17.94	12.73	14.99	14.87	6.07	0.00	69.19	99.97
Net Return on Assets	0.04	0.07	1.53	3.15	-7.32	-137.63	5.09	147.64
Liquidity	5.98	22.37	3.96	18.72	0.01	0.00	20.33	99.76
Non-government claims/assets	4.19	11.09	3.94	15.87	0.00	0.00	16.21	99.78
Loans/assets	21.57	38.12	15.36	22.61	0.64	0.00	46.15	100.00
Size (log assets)	19.43	11.62	2.02	2.00	16.50	3.61	22.66	19.26
Regional market share	24.04	5.35	30.77	13.56	0.98	0.00	88.43	100.00
Regional Herfindahl index	4140	3107	2158	2199	213	213	7824	10000

Source: Own calculations based on Mobile database.

Note: I use 80 regions for the calculation of regional market shares. Number of observations for SOBs is 117. Number of observations for private banks is 100,362. Sample period is 1995:11 - 2003:8.

Table A3

Estimation Results for the Logit Model (SOBs excluded)

	Coefficient Estimates	Odds Ratios	Mean Values
Capital/assets	-0.0140***	0.9861	32.47
	[0.0027]		
Non-working assets/assets	0.0153***	1.0154	12.73
	[0.0025]		
Net Return on Assets	-0.0152***	0.9849	0.07
	[0.0030]		
Liquidity	-0.0364***	0.9642	22.37
	[0.0049]		
Non-government claims/assets	0.0135***	1.0136	11.09
	[0.0038]		
Loans/assets	0.0064**	1.0065	38.12
	[0.0026]		
Size (log assets)	-0.2427***	0.7845	11.62
	[0.0360]		
Regional market share (assets)	-0.0264***	0.9740	5.35
	[0.0085]		
Regional Herfindahl index (assets)	-0.0001***	0.9999	3106.95
	[0.0000]		
Constant	1.5202***		
	[0.4059]		
Observations	100362		
Number of banks	1754		
Number of months	94		
Wald chi2 (9)	315.58		
P-Value	0.0000		

The dependent variable in the logit regression is a dummy variable, failure, which equals one if the bank's license was revoked before 2003:8 and zero otherwise. Sample period is 1995:11 - 2003:8. The positive (negative) predictive value of the model is 63.86 percent (89.02 percent). 88.88 percent of the observations are correctly classified. The logit estimations are performed over the pooled sample. Robust standard errors are given in brackets (clustered on banks). *, ** and *** indicate significance levels of 10, 5 and 1 percent, respectively.

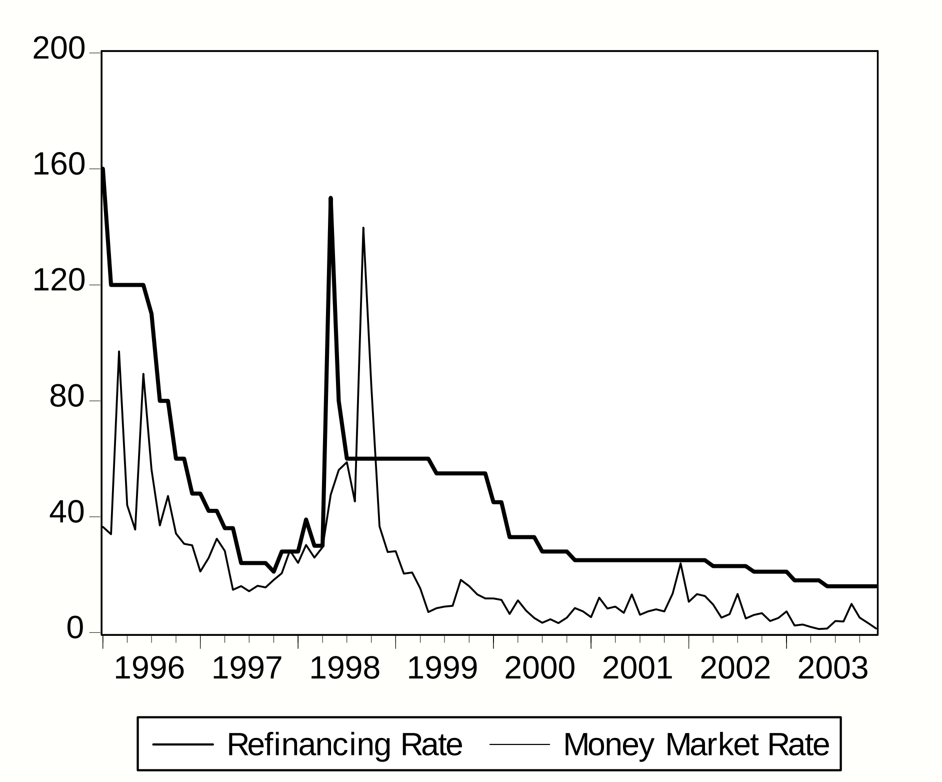

Figure 1: Refinancing rate and money market rate, percentage (1996:1–2003:12). Source: IMF International Financial Statistics.

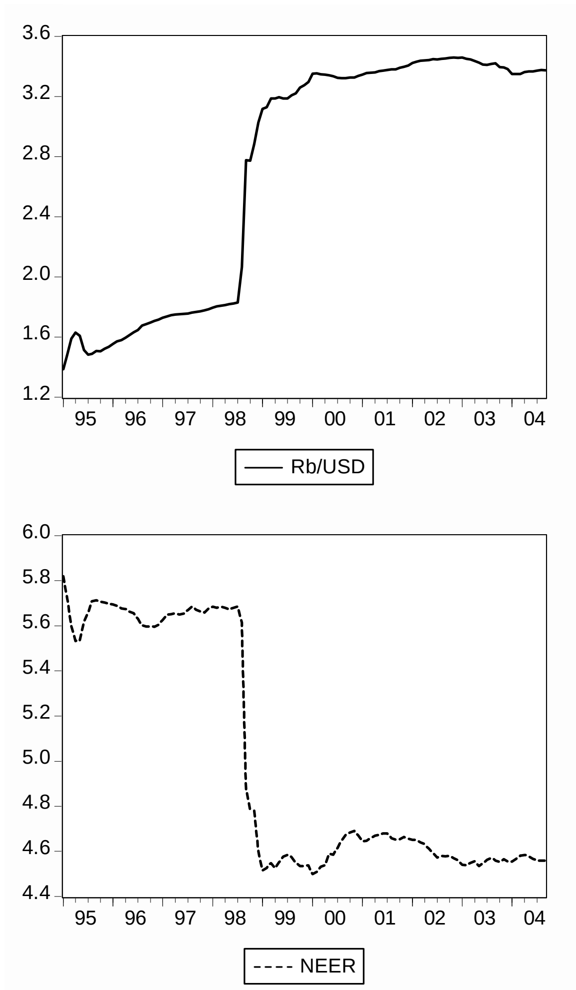

Figure 2: Monthly average of Rb/USD exchange rate versus nominal effective exchange rate (1995:1–2004:9). Source: IFS.

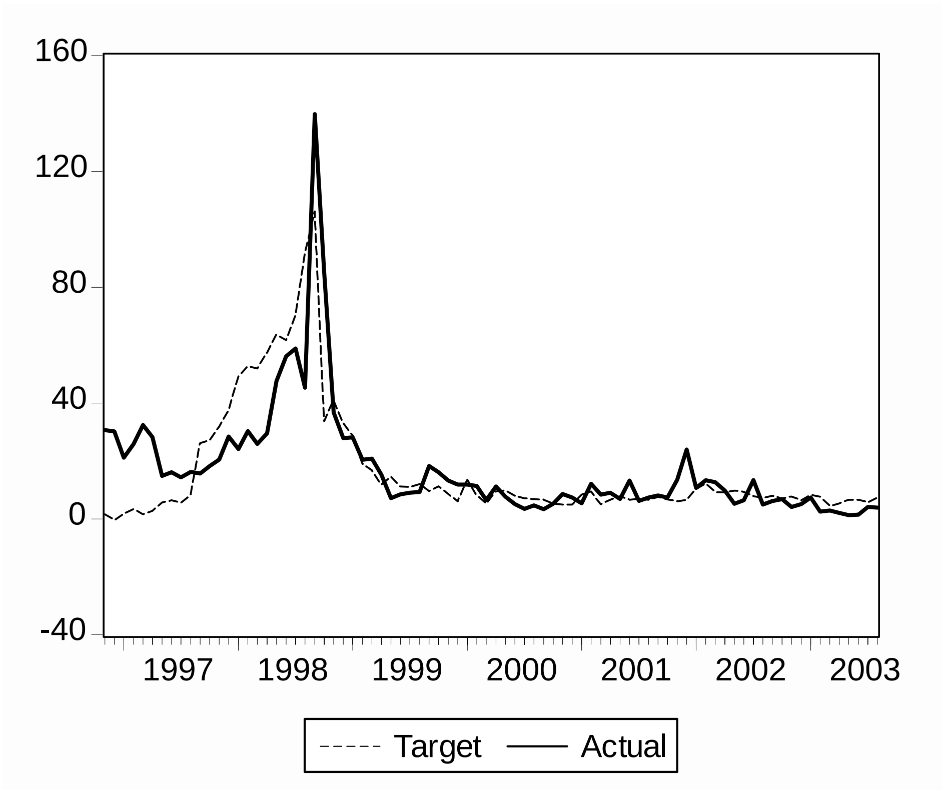

Figure 3: Target rate $(\gamma_0 + \gamma_1 \cdot \pi_{t+n} + \gamma_2 \cdot (ip_t - ip_t^*) + \gamma_3 \cdot \Delta ee_t)$ vs actual money market interest rate, percentage (1996:11 - 2003:08).

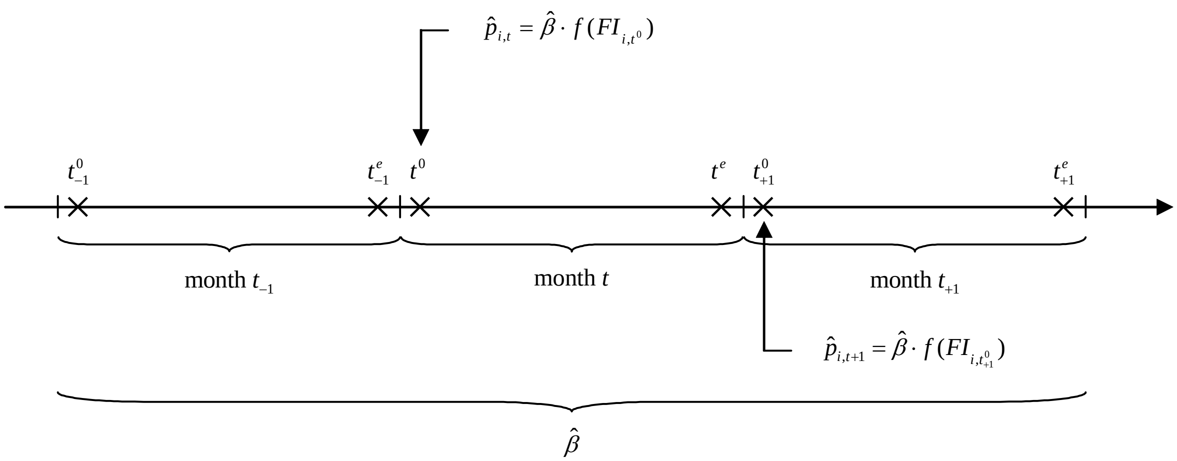

Figure 4: Sequence of information arrival at the CBR.

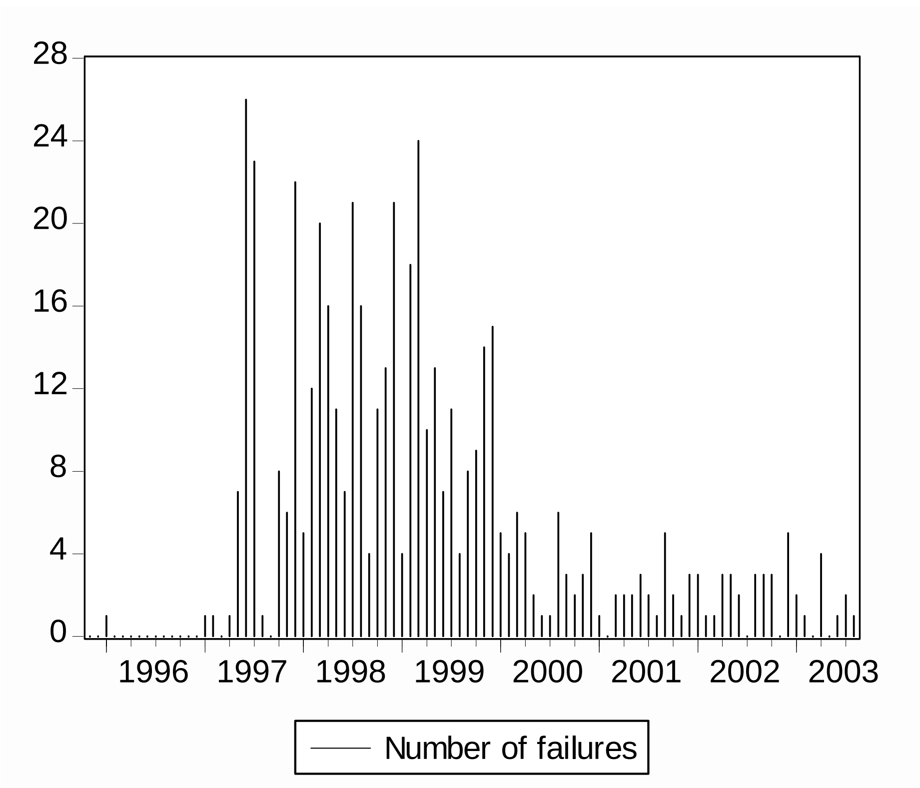

Figure 5: Monthly number of bank failures (license revocations) (1995:11–2003:8). Source: Mobile and CBR.

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