Sophisticated Discipline in Nascent Deposit Markets:
Evidence from Post-Communist Russia

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April 2006

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Abstract

In nascent markets with relatively immature institutions, do depositors have the capacity to discipline banks with poor fundamentals? If so, what information specifically guides their response? Using a database from post-communist, pre-deposit-insurance Russia, we present evidence for quantity-based sanctioning of weaker banks by both firms and households, particularly after the 1998 financial crisis. More notably, the discipline that we observe is surprisingly sophisticated. Specifically, our evidence is consistent with the proposition that depositors interpret a bank's deposit rate and capital as jointly reflecting its subsequent stability. In estimating a deposit supply function, we show that, particularly for poorly capitalized banks, interest rate increases run into diminishing, and eventually negative, returns in terms of deposit attraction.

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Depositors may penalize banks for undertaking risks, performing poorly or otherwise jeopardizing the value of their assets. By withdrawing funds or requiring deposit rate premiums from less stable institutions, their actions have the potential to increase allocative efficiency and mitigate moral hazard. But this sort of quantity or price-based discipline only materializes if depositors possess both the willingness and ability to monitor their banks. Whereas the former depends upon the degree to which deposits are believed to be protected by regulatory oversight and (explicit or implicit) insurance guarantees, the latter requires both access to and understanding of the relevant bank data (Barth *et al.*, 2006).

While not as much of a concern when depositors are experienced and mechanisms for disseminating financial information are reliable, the ability to discipline banks in settings in which these features are under-developed has been open to question. Indeed, doubts have been expressed as to the private sector's capacity for effective monitoring in countries in which informational structures – such as accounting rules and disclosure requirements – lag behind international standards (Levy-Yeyati *et al.*, 2004). On the other hand, it has been suggested that this sort of institutional immaturity is coincident with banking sector simplicity and a more concentrated business community, both of which may contribute to depositors confronting lower costs to uncovering bank information. As a result, some believe there to be "no systematic tendency" for less developed countries to be less endowed with the prerequisites for market discipline (Caprio and

Honohan, 2004). Careful empirical studies, however, that either confirm or cast doubt upon the ability of depositors to discipline banks in immature institutional environments are rare.

Post-communist Russia presents us with a worthy test case of depositors' capacity to provide discipline in a nascent market with under-developed institutions. Concurrent with the systemic transformation launched in the early 1990s, hundreds of private commercial banks entered its new, largely un-regulated, deposit market (Spicer and Pyle, 2002). Not surprisingly, several significant banking crises ensued. And since monies held in non-state banks were uninsured, the country's depositors made quick acquaintance with the private costs of institutional failure. In other words, from soon after the dawn of the new market era, depositors possessed ample motivation to penalize banks *known* to be performing poorly and/or assuming undue risks.[1] But, as noted, the willingness to impose discipline on institutions recognized as less stable is not tantamount to the ability to do so.

Barth *et al*. (2004, 2006) capture the cross-national variation with respect to this ability to impose discipline in a "private sector monitoring" (PSM) index, a measure of institutional development that ranks Russia in the bottom quintile of over one hundred countries. [2] In

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[1] In many emerging market economies, depositors' willingness and ability to monitor banks is influenced by the presence of large state-owned and/or foreign-owned banks. The deposits of the former often carry an implicit, if not explicit, insurance guarantee. And foreign banks may be recognized as already being exposed to discipline by the international markets on which their debt and equity trade (Caprio and Honohan, 2004). Relative to its level of development, however, Russia (during our period of analysis) had neither a relatively large state nor foreign-owned banking sector (Barth *et al*., 2006). In 2001, for example, over half of the banking system's assets were held at privately owned, domestic banks.

[2] The following considerations are factored positively into a country's score on the PSM index: (1) whether a certified external audit of the bank's financial statement is required; (2) whether all of the ten biggest banks are rated by international rating agencies; (3) whether income statements include accrued or unpaid interest or principal on non-performing loans and whether banks are required to produce consolidated financial statements; (4) whether off-balance sheet items are disclosed to the public; (5) whether banks must disclose risk management procedures to the public; and (6) whether subordinated debt is allowable as a part of regulatory capital. The version of the PSM index presented in Barth *et al*. (2006) is slightly modified to include the percentage of the ten biggest banks rated by domestic rating agencies; since there is no entry for Russia in this sub-category, its PSM index is not reported. The authors' measures of bank transparency paint a similar picture. With respect to both the quality of its bank audit regime and its pace in adopting best practice accounting standards, Russia is ranked in the bottom third of countries surveyed.

conjunction with Russians' relatively brief experience with evaluating the relative merits of deposit-taking institutions, the institutional immaturity that this ranking suggests raises a question about depositors' ability to monitor and discipline banks, even though their motivation for doing so would appear to be great.

Drawing on a unique database from the pre-deposit-insurance stage of Russia's post-communist transition (1997-2003), we demonstrate below that, indeed, depositors have actively disciplined private, domestic banks. In spite of the country's apparent institutional immaturity, standard measures of the capacity to meet deposit obligations (*e.g.*, capitalization and liquidity) correlate strongly with net deposit flows in the subsequent period. But while evidence for quantity-based discipline is strong and robust, that for the standard form of price-based discipline is not. Clear evidence, that is, that depositors "demand" higher deposit rates from less stable institutions is lacking.

In and of itself, the absence of such evidence should not be interpreted as suggesting that market discipline is weak. Indeed, the combination of strong evidence for quantity disciplining and nearly non-existent support for the standard form of price disciplining is consistent with a different type of price discipline that, arguably, is more sophisticated than that uncovered in previous studies. Depositors, we say, exhibit this *sophisticated discipline* if they view the deposit rate as a complementary proxy for institutional stability and not purely as a mechanism through which banks compete for funds and offer compensation for risk or poor performance reflected in their fundamentals. So viewed, banks cannot necessarily expect to increase the net inflow of deposits, *ceteris paribus*, by raising deposit rates. More than just compensating for observable risk, raising rates may carry the suggestion of additional risk. If so, standard tests for market discipline may not produce strong results and should be complemented by direct estimation of the deposit supply function. This would

produce evidence consistent with sophisticated discipline if higher rates exhibited diminishing marginal -- even negative – returns in terms of deposit attraction.

To date, much of the evidence for deposit market discipline comes from countries with mature and relatively transparent banking sectors. For instance, a number of studies of partially uninsured large deposits in the United States demonstrate that a bank's cost of funds in one period is associated with previous period measures of depositor risk: low capital-assets ratios (Cook and Spellman, 1994; Hannan and Hanweck, 1988; Park and Peristiani, 1998); high variability of return on assets (Hannan and Hanweck, 1988); higher percentages of bad loans and, generally, lower return on assets (Cook and Spellman, 1994; Park and Perstiani, 1998); and greater exposure to junk bonds (Brewer and Mondschean, 1994). Cook and Spellman (1994), moreover, show that interest rates on wholly insured deposits at S&L's reflect capitalization and performance measures; even government sponsored "guarantees," after all, may not be ironclad. Finally, Park and Peristiani (1998) demonstrate a negative relationship between U.S. thrifts' predicted probability of failure and the subsequent growth of large uninsured deposits. Both price and quantity discipline, in other words, have been shown to prevail in the United States' banking sector, particularly with respect to deposits that are not fully insured.

A few empirically focused studies have pursued this theme in countries with less developed informational infrastructures. Controlling for the presence of deposit insurance and using data from a sample of both OECD and developing countries, Demirgüç-Kunt and Huizinga (2004) find a negative relationship between the implicit cost of bank funds and prior period measures of bank capitalization, profitability and liquidity.[3] The evidence for quantity disciplining, however, is weaker. Indeed, they find no significant relationship between the net growth in bank deposits and its earlier

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[3] Bank risk characteristics are entered into their regressions individually.

measures of either profitability or liquidity. Investigating experiences in Argentina, Chile and Mexico, Martinez-Peria and Schmukler (2001) turn up evidence consistent with both the standard forms of quantity and price discipline. Controlling simultaneously for several measures of bank stability and risk, they demonstrate that banks' deposits increase and their deposit rates generally decrease with a reduction in the percentage of non-performing loans and improvements in liquidity and capitalization. These authors also highlight how the relative magnitude of deposit market discipline increases after banking crises, suggesting that shocks to the sector breed greater depositor vigilance.

Compared to the countries highlighted in the Martinez-Peria and Schmukler (2001) study, Russia's temporal experience with liberalized deposit markets has been brief and its institutions to support depositor monitoring have been less fully developed.[4] In our subsequent exploration of the capacity for market discipline in this setting, we contribute to the general literature in this area in two new and important ways. First, we explore the impact of depositor type in a manner not done elsewhere. Whereas previous studies have examined market discipline by actors holding deposits of different sizes (Cook and Spellman, 1994; Martinez-Peria and Schmukler, 2001), our data uniquely allow us to distinguish depositors by legal status – *i.e.*, non-bank firm, bank or household. While likely to be correlated with deposit size, a party's identity in this sense may convey information about its willingness and ability to impose discipline. Relative to households, for example, enterprise managers might be presumed to either have better access to or more appreciation for the financial information released by banks. They may also face lower costs of switching institutions, a potentially non-trivial consideration for households, particularly those outside the largest urban areas where retail banking networks are poorly developed. And although we have no information on the time structure of bank liabilities, we might expect that inter-bank deposits would be less sensitive to risk

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[4] Barth *et al.*'s (2004) PSM index for Russia (5) lags behind those Argentina and Chile (both 8) as well as Mexico (6).

characteristics than the deposits of households or firms since a relatively high percentage may represent stocks of short maturity, such as overnight loans, whose value is less threatened by the risk of institutional failure.

Our second contribution to this general literature is more substantial. After estimating, like other studies, two standard sets of models to study market discipline, one for deposit growth and one for interest rates, we employ an additional model to test for the presence of *sophisticated discipline*. Specifically, we estimate depositors' supply function so as to evaluate whether or not price in this market is interpreted as a supplementary proxy for bank-level risk. The critical identification problem is handled by assuming that a bank's lending rate reflects changes in its lending opportunities and should therefore be entered as an independent variable in its deposit demand function, while not in its supply function.

In carrying out this estimation, we draw inspiration from the framework outlined by Hellman *et al.* (1998, 2000) in which

> …depositors can perfectly infer (from the bank's deposit rate and capital base) whether the bank will gamble or invest in the prudent asset … assumptions [chosen] not for realism but to consider an environment most conducive to solving the moral hazard problem via private monitoring (1998, p. 5).[5]

From our perspective, the important point in their stylized framework is that deposit rates and capitalization – both independently and through their interaction – determine the net inflow of deposits and, thus, the presence of market discipline. Specifically, higher interest rates, particularly for lower levels of capitalization, are recognized as coincident with future bank intentions to engage

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[5] In Hellman *et al.*'s model (1998, 2000), deposit rate competition among banks lowers their franchise value and, with it, incentives for making non-risky loans. The quote in the text above is taken from the working paper version (1998), which considers this competition in a world without deposit insurance. In an unpublished paper, Hanousek and Roland (2001) model a similar relationship and offer some empirical support from the Czech Republic.

in a more risky lending strategy. Depositors, therefore, must weigh the benefits of higher rates against an increased potential of bank failure. The authors' caveat as to their assumption's realism clearly speaks to a lack of credulity in depositors' actual ability to read banks' behavior in this manner.[6] To the extent that such sentiment as to depositor sophistication is widely held, it would seem reasonable to identify any empirical support for the actual interpretation of deposit rates in this manner as evidence of a surprisingly subtle and sophisticated form of discipline.

We divide the article into four sections. Section I discusses the empirical methodology, and section II presents the data and variables used in the subsequent analysis. We then present our empirical results in section III, followed by conclusions in section IV.

I. Methodology

We start by investigating the evidence for market discipline generally and then proceed to look for it in the behavior of specific depositor groups. In so doing, we employ two standard sets of reduced form models:

$$\Delta D_{i,t} = \boldsymbol{b}\, ' Bank_{i,t-1} + d_t + v_i + e_{i,t} \tag{1}$$

$$i_{i,t}^d = \boldsymbol{b}\, ' Bank_{i,t-1} + d_t + v_i + w_{i,t} \tag{2}$$

with the number of banks $i = 1,\ldots,N$ and the number of observations per bank $t = 1,\ldots,T$.[7] The left-hand side variables are, respectively, the first difference of the log of deposits held by bank i at time t, and the (implicit) real interest rate paid on those deposits. $Bank_{i,t-1}$ is a vector of bank-specific variables assumed exogenous and included with a quarterly lag to account for the fact that financial

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[6] Stiglitz (1994), one of the article's co-authors, suggests in a book on post-communist reform that it would be unrealistic to rely on the private market to discipline banks: "Individuals have neither the capacity nor the incentive, even in the absence of deposit insurance, to monitor effectively (247)."

[7] The panel is unbalanced because some banks fail, some merge, and some are founded during the sample period.

reports are not instantaneously made available to the public. Time dummies, d_t, are included to control for macroeconomic shocks that influence the banking system as a whole. And we allow for unobserved bank heterogeneity by introducing a bank-specific, time-invariant effect, v_i. The error terms, $e_{i,t}$ and $?_{i,t}$, are assumed to be independently distributed with mean zero and variance $s^2_{i,t}$.[8]

In both models (1) and (2), observing the coefficient estimates for the bank-specific variables provides the basis for tests of market discipline. Generally speaking, we look for statistically significant associations between those variables that measure a bank's capacity for responding to deposit withdrawals and its subsequent net deposit flows and deposit rates. All else equal, weaker banks are described as subject to market discipline if they experience less net growth in deposits or if they pay higher deposit rates. Depositors, that is, are presumed to react to the observed weakness by either (a) channeling monies away from weaker institutions or (b) requiring a deposit rate premium as compensation. Two dependent variables, it is thought, provide a more comprehensive test of market discipline than relying upon just one (Martinez-Peria and Schmukler, 2001).[9]

The data allow us to estimate several versions of these two models. For one, we explore the impact of the financial crisis on market discipline, estimating model (1) for periods both before and after the August 1998 ruble devaluation and sovereign debt repudiation.[10] By splitting the post-crisis data into sub-periods, we then can check whether the documented effects remain stable over time. We also test the relationship between depositor identity and market discipline by estimating separate models for both the deposits held by and the deposit rates paid to non-bank firms, households and

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[8] The full set of right and left-hand side variables are described in greater detail in Section 2.

[9] Martinez-Peria and Schmukler (2001) note that using net deposit flows alone may not allow distinctions to be drawn between market and regulatory discipline. That is, regulatory pressure on under-capitalized banks could result in a bank deciding to reduce both its assets and liabilities, accomplishing the latter through reduced deposit rates.

[10] Data restrictions prevent us from estimating model (2) for the period prior to the 1998 financial crisis.

banks. And last, we run the models both inclusive and exclusive of banks that are state owned or are "pocket banks" who gear lending activity to owners or company insiders.[11] With respect to all versions, we report within (fixed effects) or pooled estimators depending on whether the fixed effects are jointly significant.

We employ a new and separate model to test for sophisticated discipline in which the deposit rate itself serves as a complementary proxy of institutional stability. As such, rate increases amount to more than a means to attract deposits or offer compensation for increased risk, *ceteris paribus*. They are interpreted, as well, as coincident with an increase in risk not reflected in other observed measures (Hellman *et al.*, 1998, 2000). If higher deposit rates, particularly in combination with other risk measures (*e.g.*, low capitalization), are so interpreted, the effect of raising interest rates on the volume of deposits supplied will not necessarily be positive. The deposit supply curve, that is, may be backward bending.

We directly estimate the supply function employing the following two specifications:

$$\Delta D_{i,t} = \boldsymbol{b}' Bank_{i,t-1} + \boldsymbol{d}_1 i_{i,t}^d + \boldsymbol{d}_2 (i_{i,t}^d)^2 + d_t + v_i + \boldsymbol{e}_{i,t} \qquad (3)$$

$$\Delta D_{i,t} = \boldsymbol{b}' Bank_{i,t-1} + \boldsymbol{d}_1 i_{i,t}^d + \boldsymbol{d}_2 (i_{i,t}^d)^2 + \boldsymbol{d}_3 i_{i,t}^d * (1 - Cap_{i,t-1}) + \boldsymbol{d}_4 i_{i,t}^d * (1 - Cap_{i,t-1})^2 + d_t + v_i + \boldsymbol{e}_{i,t} \quad (4)$$

where the real deposit rate, $i_{i,t}^d$, its square and its interaction with a measure of bank capitalization, (with $Cap_{i,t-1}$ representing the capital-assets ratio) and its square, are included to test for the interaction of price and risk measures and the hypothesized backward-bending supply curve. $Bank_{i,t-1}$ is a vector of exogenous supply shifters – the same as employed in models (1) and (2), with the exception being that we exclude those regressors that had been either consistently insignificant or unstable and rarely significant in the prior estimations.

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[11] Small sample size prevents us from doing a meaningful analysis for the group of state-owned banks alone.

The key problem is to identify the supply function. To solve it, we assume that a bank's lending rate belongs to its demand, but not its supply, function for deposits. Most depositors (actual or potential) are unlikely to observe lending rates, and even if they were to observe them, we would not expect them to their supply decisions directly. On the other hand, the bank's lending rate should reflect its investment opportunities (and their associated returns), which determine its demand for funds. If bank managers pursue some pre-determined net interest margin target across bank activities, a bank's pricing of the funds that it attracts as deposits should be a function of these investment opportunities. In other words, the total deposit rate should be affected by (and, thus, can be instrumented by) the total lending rate. As should be clear, this argument is valid for the aggregated interest rate (and net interest margin) but need not hold for rates that apply to actors of a particular type (*i.e.*, households, firms or banks). Therefore, we estimate the supply function for total deposits only.

We employ the Difference Generalized Method of Moments estimator (GMM) proposed by Arellano and Bond (1991). Terms involving the deposit rate are treated as endogenous. The lending rate, its square, as well as suitably lagged values of endogenous variables are used as instruments. We apply the Sargan test of over-identifying restrictions to determine the general validity of the chosen instruments and the associated assumptions as to the endogeneity or exogeneity of the regressors.[12]

II.   Data and Variables

All banks are required to disclose their financial statements to the Central Bank of Russia (CBR) on a regular basis.[13] Balance sheet information and profit and loss accounts are reported, respectively, on monthly and quarterly bases. After roughly a two-month lag, these data are then

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[12] We employ the heteroscedasticity robust version of the Sargan test, the Hansen J statistic. We also test for the absence of second-order serial correlation in the first-differenced residuals.

[13] See *Vestnik Banka Rossii* No. 75 of November 20, 1997 and No. 33-34 of June 27, 2000 (www.cbr.ru).

made available to the public through several channels. Since 1999, the financial statements of most banks have been posted on the website of the CBR (www.cbr.ru). Some of this information is then published by the financial press.[14] Private information agencies, moreover, in cooperation with the CBR, gather raw, bank-specific accounting data to generate standardized financial indicators. Some of this processed data, often sufficient for a general analysis of a bank's risk profile, is made available for free, whereas the most detailed information can only be accessed through fee-based channels.[15]

The bank data used in the analysis here were made available to the authors by two established and highly respected private financial information agencies, Interfax and Mobile.[16] The former provides quarterly measures of bank balances and profit and loss accounts as well as bank-specific scores on a battery of regulatory standards from 1999 through 2002. The latter offers bank balances on a monthly basis from mid-1995 through 2002 and profit and loss accounts on a quarterly basis from October 2000 through 2002. As the profit and loss data are necessary for constructing implicit interest rates as well as efficiency ratios, we limit our analysis to quarterly observations. The absence of profit and loss data before 1999 inhibits us from investigating price discipline prior to that year.

We merge quarterly observations of the two datasets (both expressed in rubles) by date and bank registration numbers.[17] For those cases in which a bank merged or was acquired, we treat the resulting larger bank as "new" from the standpoint of our sample. However, given the requisite differencing and lagging in our analysis, this requires dropping at least the first two observations for

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[14] For example, the monthly financial periodical *Den'gi i Kredit* regularly publishes the financial statements of a number of banks.

[15] Since January 1998, the major monthly financial indicators for all Russian banks have been made available at www.banks-rate.ru.

[16] For more information on these firms, see their respective websites at www.interfax.ru and www.mobile.ru.

[17] Karas and Schoors (2005) provide a detailed comparison of the datasets and demonstrate their consistency with one another.

this "new" bank. To avoid this loss of data, we sum up the financial statements of the two merging banks for the two quarters preceding the merger and use those merged accounts as the needed lags.[18]

The bank-specific variables used in this paper include deposits and interest rates as well as measures of risk, performance and balance sheet structure. The (implicit) interest rate that a bank offers on its deposits has been calculated by dividing interest expenses during a particular period by the corresponding level of deposits (Martinez-Peria and Schmukler, 2001).[19] Since our dataset disaggregates both interest expenses and deposits by the legal status of the depositor, the variables measuring deposit flows and interest rates can be constructed separately for non-bank firms, households and banks.

Many of the bank-specific measures of risk and performance that we include in our specifications are common to the literature. Capitalization, measured as the ratio of capital over assets, is expected to be positively associated with the subsequent growth of real deposits and inversely related to the next quarter's deposit rates. As much as any single measure of bank stability, it has been shown to serve as the basis for market discipline by depositors (Cook and Spellman, 1994; Hannan and Hanweck, 1988; Park and Peristiani, 1998; Martinez-Peria and Schmukler, 2001; Demirgüç-Kunt and Huizinga, 2004).

In general, one would expect liquidity to have the same effect as capitalization with respect to market discipline. Highly liquid banks, that is, should be considered more capable of

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[18] Given the relatively small number of mergers and acquisitions (30) in comparison to the number of banks in our sample (about 1500), we do not expect that a different treatment of mergers would have a significant impact on our results.

[19] Taking into account the imperfect nature of such a measure, we had to drop unreasonable values and outliers to prevent them from driving our regression results. Given the high interest rates known to have prevailed after the 1998 crisis (*i.e.*, even the weighted average interest rate paid on household deposits up to 1 year in the first quarter of 1999 was above 20% (www.cbr.ru)), we decided to treat all rates below 50% as reasonable. Other cut-off points were examined as well, but the regression results always remained qualitatively unchanged.

accommodating unexpected withdrawals (Martinez-Peria and Schmukler, 2001; Demirgüç-Kunt and Huizinga, 2004). We therefore expect a bank's current liquidity ratio – *i.e.*, the sum of its liquid assets divided by the sum of its liabilities on demand accounts and accounts up to 30 days – to be positively associated with deposit growth and negatively with interest payments, *ceteris paribus*.

The relationship of market disciplining behavior and a second measure of liquidity, excess reserves (relative to assets) deposited with the central bank, is not *a priori* clear. In a more mature market economy, we might expect excess reserves to measure the capacity to meet demand for deposit withdrawals. We should consider, however, that Russian banks engaging in speculative activities and wishing to conceal the nature of their business often clear their position and park their monies with the CBR when the accounts are closed. High excess reserves may thus be related to greater risk and thus lower deposit growth and higher deposit rates. It is also possible that high excess reserves may be a function more of problems in the payment system than a desire to maintain excess liquidity for deposit withdrawals (Schoors, 2001).

Controls are also included for measures that directly capture bank performance. Higher returns relative to assets, we would expect, will increase the stability of deposit institutions and make them less prone to market disciplining (Demirgüç-Kunt and Huizinga, 2004). Moreover, growth in their share of non-performing loans should be inversely related to deposit growth and positively associated with interest rates (Cook and Spellman, 1994; Martinez-Peria and Schmukler; and Park and Peristani, 1998).

We also take into account efficiency considerations by controlling for operational costs relative to bank size. If we were to assume a homogenous level of service quality across banks, higher personnel expenses as a share of assets should be related to more sanctioning actions. Less cost-effective banks, that is, should be perceived as less stable and, thus, more prone to deposit

outflows or pressure to raise deposit rates. On the other hand, since most Russian banks have been known to operate with poorly trained staffs, higher personnel costs may be interpreted as associated with a higher level of human capital and, thus, better asset management and a more stable institution. The expected sign, therefore, is not clear.

Variables capturing balance sheet structure are included as controls as well. Although the literature does not generally consider them as proxies for stability or performance in studies of market discipline, it is at least possible that, *ceteris paribus*, they could be interpreted as such. In this respect, the expected sign for loans to non-banks as a share of assets is not *a priori* clear, in part because we cannot distinguish loans either by risk or maturity. A high share of loans to non-banks could either signal greater credit risk or indicate a greater predisposition to engage in more traditional and, perhaps, less speculative activities. The relationship between lending to households as a share of all loans is similarly ambiguous. On the one hand, few Russians have well-developed credit records, making lending to them a risky proposition. However, loans to households may have shorter maturities and thus expose lenders to less liquidity risk.

Controls for the structure of bank liabilities are also included. Term deposits as a share of all non-bank claims partly capture the maturity structure of liabilities. Banks capable of attracting time deposits have effectively had their stability certified by previous depositors, thus making them potentially less prone to market discipline. However, since term deposits tend to command higher interest rates than demand deposits, the relationship between this variable and the standard form of price-based market discipline is not altogether clear. Growth in term deposits, all else equal, will produce higher payments to depositors. But to the extent that this growth is interpreted as a signal of depositor-conferred stability, we would expect there to be downward pressure on any deposit risk premium. We thus do not have a clear expectation as to the sign on this variable.

Table I summarizes our predictions for the signs of the coefficients on the right-hand side variables.[20] And Table II presents summary statistics, by quarter, for all banks included in our sample. Deposit growth, interest rates and return on assets are all expressed in real terms. Deposit growth has been positive across all three depositor types but has been fastest over this period among households. As is apparent in rows 5 to 8, firm deposits represent the largest share of bank liabilities, followed by those of households and then banks. The lowest (implicit) real interest rates are paid on firms' deposits, whereas the highest are paid on inter-bank funds. There are 155 banks in our sample that report capitalization of less than zero at least once during the period under consideration, with most of these cases occurring in the aftermath of the 1998 financial crisis.

As was noted in the previous section, we check the robustness of our empirical results by performing all estimations both with and without state-owned as well as "pocket" banks. Because of their access (real or presumed) to public resources, the former are generally believed to provide depositors with weak incentives for monitoring and disciplining (Caprio and Honohan, 2004). Indeed, in Russia, state-owned banks have enjoyed a number of advantages over their private competitors, including privileged access to state funds, *de facto* exemption from some regulatory norms, and during the entirety of the period covered by our data, explicit backing for their retail deposits (Tompson, 2004). For the purposes of our analysis, we can distinguish between two types of state-owned banks in Russia, those owned by the CBR and those owned by federal or regional authorities or other government entities.[21] The former (*Sberbank*, *Vneshtorgbank* and *Vnesheconombank)* have enjoyed the full and consistent backing of the CBR and so, considering them less likely to have

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[20] We should note that most of our risk measures (*e.g.*, capitalization, liquidity, return on assets, asset structure etc.) can also be constructed from the data publicly available free of charge (see the aforementioned website www.banks-rate.ru).

[21] The list of state-owned banks was compiled from Sherif *et al.* (2002), Matovnikov (2002) and Mamontov (2005).

been subject to market discipline, are excluded from our sample. The second group, however, includes institutions that have been allowed to fail (*e.g.*, Unikombank, Soto-bank, Trade-bank), although the state formally guarantees their household deposits (Civil Code of Russia, article 840). We include these banks in the estimations since they may well have been disciplined by other depositor classes.[22]

To identify "pocket" banks, which have geared their lending activities heavily toward owners and insiders, we use two regulatory standards: owner exposure (the aggregate amount of credits and loans extended to the bank's shareholders or partners) and insider exposure (the aggregate amount of credits and loans extended to employees and managers).[23] The respective legal thresholds that are not to be exceeded are 50% and 3% of the bank's equity capital. We first thought to define an institution as a "pocket" bank if during our sample period it violates each of these two standards at least once. However, the number of banks identified by this procedure, roughly forty, is small. Considering, moreover, that banks might manipulate their books in order to satisfy these regulatory standards, we relaxed the definition by reducing the thresholds to 66% (definition 1) and further to 33% (definition 2) of the respective legal thresholds. We thus characterize an institution as a "pocket" bank if, during our sample period, it breaches each of these revised thresholds at least once.

III. Results

We lay out our main results in two sections. First, we present and discuss the standard market discipline model, examining how measures of bank risk in one quarter relate to the subsequent quarter's net deposit flows and interest payments. In a second section, we test whether

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[22] Their exclusion however does not alter the results.

[23] For the official definition of these and other regulatory standards see Bank of Russia Instruction No.1 of October 1, 1997, "On Bank Regulation Procedure" (an English version is available on www.cbr.ru).

depositors interpret deposit rates as complementing standard measures of bank risk. To save space, the tables report only the variables of economic interest, not the time dummies.

III.A Market discipline and depositor type

This section presents our findings as to whether or not we observe standard forms of market discipline behavior in Russia. Table III displays estimation results for the deposit flow model (1) for the pre-crisis period (April 1997 – July 1998), the post-crisis period (October 1999 – January 2003) and 6 sub-periods after the crisis. In broad terms, the results confirm the presence of market discipline. Most notably, a higher capital-assets ratio and greater liquidity predict greater net deposit inflows in the subsequent period. Although these findings hold up both before and after the 1998 crisis, discipline exercised in response to these variables seems to have increased substantially in its aftermath. This result is consistent with the proposition that crises breed greater depositor vigilance (Martinez-Peria and Schmukler, 2001). Further, the relationship between deposit flows and these two measures of bank risk is shown to be robust across all post-crisis sub-periods.

We also see evidence in support of the presence of market discipline both before and after the crisis in the negative and statistically significant correlation between deposit growth in a quarter and the previous quarter's increase in non-performing loans. This relationship, however, is not as strong as the findings for capitalization and liquidity and is shown not to be robust to the segmentation of periods after 1998. And, interestingly, return on assets is not consistently correlated with net deposit inflows after the crisis, even though it was before. It is possible that Russian depositors have learned not to put too much weight on the profitability rates posted by Russian banks. Indeed, Malyutina and Parilova (2001) note that "It has already become a conventional wisdom that official figures for profits of Russian banks are the most manipulated and thus unreliable ones."

We should note, as well, that after the crisis excess reserves with the CBR are negatively associated with deposit inflows, which suggests that it might be interpreted as a proxy for a riskier asset management strategies. Moreover, one balance sheet structure variable – loans to non-bank firms as a share of total assets – was statistically insignificant before the 1998 crisis but becomes significant and positive in its aftermath. This latter finding is also at least consistent with the proposition that depositors feel safer with banks appearing to engage in more traditional and, perhaps, less speculative investment activities. Finally, we observe banks that pay their personnel more, *ceteris paribus*, are more successful in attracting funds.

In Table IV, we lay out the results for the model that uses the deposit rate as the dependent variable.[24] In terms of providing evidence for market discipline, the results are clearly weaker than those noted in Table III. Although the negative signs on the capitalization and liquidity measures are what we would expect if depositor discipline were present, the statistical significance of these associations is not strong and does not hold up to the decomposition across sub-periods. Specifically, there is no evidence that weakly capitalized banks pay higher interest rates to depositors as compensation. We also find only weak evidence that depositors accept higher interest rates in return for lower liquidity. Finally, we do not see any significant relationship between the dependent variable and either the bank's profitability or its increase in non-performing loans. In sum, Tables III and IV strongly confirm the presence of quantity discipline but offer little to no support for the standard form of price discipline.

In Table V we repeat the main equations of Table III and IV for the three depositor types: non-bank firms, households and banks. The results confirming quantity discipline, particularly in the post-crisis period, appear to be driven most strongly by the behavior of firms. As can be observed,

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[24] Because of data limitations, we only provide estimates for 1999 onward.

firm deposits are much more sensitive to liquidity, the change in loan quality and the capital-assets ratio than those of households or banks. Households, however, do display some sensitivity to each of these measures, particularly in the post-crisis period. As depositors in other institutions, banks are shown to be responsive to capitalization in the post-crisis period but little else.

Disaggregated by depositor legal status, the results for the standard form of price discipline are, again, not as strong. Table V demonstrates only weak and sporadic associations between increased bank risk and the "demands" of firms, households or banks for compensation in the form of higher deposit rates. Only among firms (but not households or banks), do we observe a negative and statistically significant association between capitalization and subsequent deposit rates. And only among households and banks (but not firms), do we see a similar relationship between these rates and liquidity. And, notably, with respect to non-performing loans and profitability, we do not observe any evidence for the standard form of price discipline among any of the depositor types.

We include Table VI to demonstrate the general robustness of our results to the exclusion of state banks and "pocket" banks, variously defined. Most notably, capitalization and liquidity remain strong predictors of deposit flows but, at most, only weak predictors of subsequent interest rates.

III.B Sophisticated discipline

Among studies of deposit market discipline, our finding of strong evidence for quantity disciplining but little to no support for the standard form of price discipline stands out as unique. But, as we noted earlier, this result should not be interpreted, in and of itself, as suggesting that market discipline is weak. Indeed, our finding is consistent with a different, perhaps more sophisticated, form of price discipline in which deposit rates represent more than just a mechanism for competing for funds and compensating for observable risk.

We now explore the manner in which deposit rates might complement other variables that capture a bank's prospects for honoring its liabilities. Specifically, we ask whether these rates are interpreted as a signal of bank stability (Hellman *et al.*, 1998 and 2000). If they do, we should not expect there to be a clear positive relationship between the rates a bank posts and its subsequent ability to attract deposits, perhaps especially for banks already viewed as weak with respect to other measures, such as capitalization.

Table VII presents estimations of the deposit supply function, using specifications (3) and (4). We first report results for all banks, then inclusive of just non-state banks and non-"pocket" banks, variously defined. Both specifications (3) and (4) allow for a non-linear relationship between interest rates and deposits such that after a certain "switching point" the slope of the supply curve can change sign. In specification (4), the interest rate is interacted with capitalization to investigate whether the price elasticity of deposit supply is sensitive to an observed measure of bank risk (Hellman *et al.*, 1998 and 2000). All reported equations pass both the Sargan test for over-identifying restrictions and the test for second-order autocorrelation at the 10% significance level.

The results in Table VII demonstrate a non-linear interest rate effect in the columns that represent specification (3), suggesting an implied switching point of six percent, above which increases in real interest rates produce negative returns with respect to deposit attraction. In addition, in the columns that represent specification (4), we observe a joint effect of interest rates and capitalization on deposit growth. The implied switching point of roughly twelve percent appears stable across sample definitions, suggesting that the results do not depend on the presence of insider banks in the Russian banking market. Both the independent and interaction effects of interest rate changes and bank capitalization can be viewed in Figure 1, which shows the deposit growth plane in the interest rate/capitalization space, evaluated at the average values of the other independent variables. At low and intermediate interest rate levels, a bank's deposit growth in response to interest

rate hikes is positively correlated with bank capitalization. Moreover, higher capitalization is positively correlated with the switching point beyond which interest rate increases produce negative returns with respect to deposit attraction. Panel A shows the results for all banks in our sample and Panel B shows them for banks that are neither state-owned nor are "pocket" banks.

This evidence is consistent with depositors growing suspicious as interest rates rise. Their suspicion, moreover, that interest rate hikes might reflect new sources of bank risk, not otherwise observed, is sensitive to an observed measure that all our results have suggested is important to market disciplining behavior. In other words, the evidence suggests that if depositors are confident in a bank's ability to meet deposit withdrawals, on the basis of its capital-assets ratio, they are more apt to view its rate increases as coincident with increases in the expected return on their deposits and, thus, increase their supply of deposits accordingly. But a bank which already has given depositors reason for suspicion, due to its lower capitalization, does not have the same ability to translate its increase in deposit rates into a corresponding increase in the expected returns and, thus, the deposits of its depositors.

IV. Conclusions

Even though the deposit market in Russia is young and its supporting institutional / informational infrastructure relatively immature, the country's depositors have developed the capacity (in addition to the willingness) to identify and discipline weaker banks. Banks net deposit inflows, specifically, have been shown to be highly sensitive to measures of bank capitalization, liquidity and changes in loan quality, particularly after the financial crisis of 1998. Quantity disciplining, moreover, appears to have been driven by the behavior of non-bank firms and, to a lesser extent, households. This finding is at least consistent with the proposition that firm managers have greater knowledge of the relevant banking data and its meaning. Nevertheless, the evidence

that households, themselves, have developed a capacity for disciplining banks, is noteworthy and may in part be a reflection of their prior experience with bank failures, in massive numbers, earlier in the country's post-communist transition.

The strong presence of quantity discipline and the relative absence of price discipline, at least as traditionally conceived, present us with a combination of findings not observed in prior studies. Rather than interpret this combination as an apparent disjunction weakening the case for market discipline, we view it as consistent with a more subtle form of discipline than that which has been explored in other contexts. Indeed, we observe that the supply of deposits is highly sensitive to real interest rates and, importantly, that increases in those rates eventually produce a decrease in deposit inflows. This effect, moreover, is particularly pronounced for banks already viewed as weak because of their low capitalization. The deposit rate, thus, appears to be viewed not just as a mechanism of inter-bank competition but also as a proxy for risk that would otherwise not be observable to depositors. And it is at least conceivable that because a subset of bank managers have yet to fully understand depositors' interpretation of rate increases, some banks continue to raise interest rates only to see their stock of deposits decline.

Our results do suggest a real cost – in terms of reduced market discipline and subsequent moral hazard incentives – as Russia now moves forward with the introduction of widespread deposit insurance. But more generally, given the doubt that has been expressed as to whether depositors in nascent markets will be both willing and able to discipline the banks entrusted with their funds, our findings offer support for the proposition that markets and market actors develop mechanisms and strategies to mitigate market failures with greater speed than perhaps initially thought. We should remember, however, that the post-communist experience with bank failures has imposed great costs across Russian society and effectively forced depositors to become the relatively quick learners and

sophisticated discipliners that can now be observed in these data. Banking data from an earlier period of the country's transition may well have revealed an entirely different picture.

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Table I. Empirical Predictions

Bank-specific RHS variables	Expected sign	
	Specification 1 and 3	Specification 2
Capital / Total assets	+	-
Liquid assets / Demand liabilities	+	-
Change in loan quality	-	+
Return on assets	+	-
Excess reserves / Total assets	?	?
Loans to non-banks / Total assets	?	?
Loans to households / Loans to non-banks	?	?
Term deposits / Total deposits	+	?
Personnel expenses / Total assets	?	?
Real deposit rate	+	Not included
Real deposit rate ^2	-	Not included

Table II. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Total deposit growth	26023	0,03	0,61	-7,73	12,96
Firm deposit growth	26011	0,03	0,72	-8,83	9,18
Household deposit growth	24187	0,05	0,89	-9,63	12,14
Bank deposit growth	9497	0,00	1,20	-13,06	12,91
Total deposits / Total assets	26023	0,40	0,20	0,00	0,98
Firm deposits / Total assets	26023	0,27	0,18	0,00	0,97
Household deposits / Total assets	26023	0,09	0,09	0,00	0,76
Bank deposits / Total assets	26023	0,05	0,10	0,00	0,93
Interest rate on total deposits	16858	-0,02	0,03	-0,07	0,44
Interest rate on firm deposits	16517	-0,03	0,02	-0,07	0,44
Interest rate on household deposits	15150	0,00	0,07	-0,07	0,48
Interest rate on bank deposits	7134	0,01	0,07	-0,07	0,46
Interest rate on total loans	16402	0,01	0,05	-0,07	0,45
Interest rate on firm loans	16263	0,01	0,05	-0,07	0,43
Interest rate on household loans	15038	0,02	0,06	-0,07	0,43
Interest rate on bank loans	8238	0,02	0,09	-0,07	0,47
Capital / Total assets	26023	0,28	0,20	-0,87	0,99
Liquid assets / Demand liabilities	26023	0,63	0,79	0,00	9,99
Bad loans / Total loans	26023	0,05	0,13	0,00	1,00
Return on assets	26023	-0,03	0,03	-0,50	0,93
Excess reserves / Total assets	26023	0,10	0,12	0,00	0,96
Loans to non-banks / Total assets	26023	0,41	0,20	0,00	0,99
Loans to households / Loans to non-banks	26023	0,12	0,19	0,00	1,00
Term deposits / Total deposits	26023	0,31	0,25	0,00	1,00
Personnel expenses / Total assets	16954	0,01	0,01	0,00	0,26

Note: The table presents the summary statistics of the bank-specific variables with each observation representing a measure for a single bank in a specific quarter. Only observations used in at least one of the regressions are included.

Table III. Response of Growth of Total Deposits to Bank Risk Characteristics

Explanatory Variables	Pre-crisis Apr97-Jul98	Post-crisis Oct99-Jan03	Overlapping post-crisis supperiods (rolling window of one year)					
			Oct99-Jul00	Apr00-Jan01	Oct00-Jul01	Apr01-Jan02	Oct01-Jul02	Apr02-Jan03
Capital / Total assets	**0,212**	**0,693**	**1,200**	**1,372**	**1,398**	**1,502**	**1,660**	**2,035**
t-statistic	*4,57*	*10,06*	*6,12*	*6,26*	*6,54*	*5,82*	*5,05*	*7,78*
Liquid assets / Demand liabilities	**0,039**	**0,120**	**0,220**	**0,210**	**0,210**	**0,122**	**0,196**	**0,089**
t-statistic	*2,27*	*5,17*	*4,54*	*3,47*	*2,42*	*2,03*	*3,17*	*1,95*
Change in loan quality	**-0,648**	**-0,751**	**-1,040**	**-0,356**	**-0,591**	**-0,611**	**-0,285**	**-0,638**
t-statistic	*-5,95*	*-2,98*	*-2,27*	*-0,71*	*-1,12*	*-1,74*	*-1,29*	*-1,72*
Return on assets	**0,742**	**0,301**	**-0,107**	**-0,770**	**-2,678**	**-0,589**	**-0,691**	**0,823**
t-statistic	*2,78*	*0,55*	*-0,08*	*-0,69*	*-2,46*	*-0,60*	*-0,85*	*1,22*
Excess reserves / Total assets	**-0,094**	**-0,813**	**-1,369**	**-1,296**	**-1,356**	**-1,162**	**-0,841**	**-0,973**
t-statistic	*-0,79*	*-9,72*	*-7,02*	*-6,25*	*-6,81*	*-5,70*	*-4,06*	*-4,30*
Loans to non-banks / Total assets	**-0,038**	**0,286**	**0,870**	**0,567**	**0,185**	**0,265**	**0,364**	**0,408**
t-statistic	*-0,88*	*3,84*	*4,71*	*3,42*	*0,87*	*0,81*	*1,31*	*2,03*
Loans to households / Loans to non-banks	**-0,005**	**0,011**	**0,058**	**0,142**	**0,131**	**0,059**	**-0,105**	**-0,112**
t-statistic	*-0,09*	*0,19*	*0,31*	*0,80*	*0,83*	*0,30*	*-0,48*	*-0,61*
Term deposits / Total deposits	**-0,024**	**-0,007**	**-0,007**	**0,368**	**0,341**	**0,085**	**0,194**	**0,291**
t-statistic	*-0,77*	*-0,13*	*-0,05*	*2,04*	*2,05*	*0,48*	*1,11*	*2,25*
Personnel expenses / Total assets		**6,190**	**6,953**	**8,017**	**11,164**	**14,542**	**21,005**	**15,595**
t-statistic		*4,21*	*2,40*	*1,93*	*2,84*	*5,52*	*6,94*	*5,03*
Number of observations	**9069**	**16954**	**4943**	**4883**	**4888**	**4902**	**4744**	**4674**
Number of banks	**1657**	**1386**	**1313**	**1267**	**1266**	**1265**	**1256**	**1259**
R-squared	**0,06**	**0,10**	**0,18**	**0,16**	**0,18**	**0,17**	**0,20**	**0,21**
F-test fixed effects (p-value)	**0,10**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**

Note: The table reports regression results of the growth of total deposits on bank risk characteristics. Within (fixed effects) or pooled results are reported. When the fixed effects are not jointly significant at 10 percent, pooled OLS results are reported. Estimates for time dummies, fixed effects, and the constant term are not reported, even though they are included in the regressions. Robust t-statistics are in italic. The ratio of personnel expenses to total assets is not included in the pre-crisis specification because of the data limitations.

Table IV. Response of Interest Rates Paid on Total Deposits to Bank Risk Characteristics

Explanatory Variables	Post-crisis Oct99-Jan03	Overlapping post-crisis supperiods (rolling window of one year)					
		Oct99-Jul00	Apr00-Jan01	Oct00-Jul01	Apr01-Jan02	Oct01-Jul02	Apr02-Jan03
Capital / Total assets	**-0,004**	**-0,016**	**0,004**	**-0,016**	**-0,007**	**-0,010**	**-0,004**
t-statistic	-1,13	-1,49	0,48	-2,12	-1,16	-1,30	-0,72
Liquid assets / Demand liabilities	**-0,001**	**-0,001**	**-0,002**	**-0,001**	**-0,001**	**-0,001**	**-0,001**
t-statistic	-1,81	-1,14	-1,41	-1,13	-0,57	-1,05	-0,56
Change in loan quality	**-0,003**	**0,004**	**-0,011**	**0,006**	**0,004**	**-0,012**	**0,000**
t-statistic	-0,64	0,59	-0,85	1,18	1,23	-0,88	0,00
Return on assets	**-0,007**	**-0,004**	**0,026**	**0,018**	**-0,002**	**-0,001**	**-0,031**
t-statistic	-0,48	-0,13	1,02	1,18	-0,18	-0,04	-0,54
Excess reserves / Total assets	**-0,005**	**0,001**	**0,009**	**-0,010**	**0,004**	**-0,006**	**-0,001**
t-statistic	-1,69	0,10	1,64	-2,02	0,88	-1,51	-0,30
Loans to non-banks / Total assets	**0,000**	**-0,001**	**0,001**	**-0,011**	**-0,001**	**0,003**	**-0,002**
t-statistic	0,13	-0,06	0,08	-1,14	-0,09	0,52	-0,50
Loans to households / Loans to non-banks	**0,010**	**0,008**	**-0,009**	**0,017**	**-0,002**	**0,005**	**0,003**
t-statistic	2,08	1,17	-0,61	2,03	-0,48	1,40	1,12
Term deposits / Total deposits	**0,024**	**0,023**	**0,008**	**0,015**	**0,010**	**0,010**	**0,005**
t-statistic	8,12	2,94	1,48	2,77	2,04	3,46	1,81
Personnel expenses / Total assets	**-0,458**	**-0,198**	**-0,044**	**-0,370**	**-0,069**	**-0,275**	**-0,211**
t-statistic	-6,25	-1,86	-0,62	-3,31	-1,14	-2,98	-1,71
Number of observations	**16858**	**4904**	**4859**	**4863**	**4874**	**4724**	**4658**
Number of banks	**1376**	**1302**	**1265**	**1264**	**1262**	**1253**	**1259**
R-squared	**0,30**	**0,14**	**0,12**	**0,34**	**0,69**	**0,56**	**0,74**
F-test fixed effects (p-value)	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**

Note: The table reports regression results of the interest rates paid on deposits on bank risk characteristics. Within (fixed effects) or pooled results are reported. When the fixed effects are not jointly significant at 10 percent, pooled OLS results are reported. Estimates for time dummies, fixed effects, and the constant term are not reported, even though they are included in the regressions. Robust t-statistics are in italic. Only results for the post-crisis period are reported due to the data limitations.

Table V. Split by Legal Status of Depositors

Explanatory Variables	Firms Deposit Growth Pre-crisis	Firms Deposit Growth Post-crisis	Firms Deposit rate Post-crisis	Households Deposit Growth Pre-crisis	Households Deposit Growth Post-crisis	Households Deposit rate Post-crisis	Banks Deposit Growth Pre-crisis	Banks Deposit Growth Post-crisis	Banks Deposit rate Post-crisis
Capital / Total assets	0,211	0,584	-0,009	0,069	0,277	-0,006	0,218	0,227	-0,018
t-statistic	4,04	7,95	-2,51	1,23	2,97	-0,62	1,77	2,26	-1,63
Liquid assets / Demand liabilities	0,069	0,132	0,000	0,035	0,060	-0,002	-0,080	-0,002	-0,003
t-statistic	3,34	5,74	0,52	1,23	2,75	-1,79	-1,39	-0,09	-1,96
Change in loan quality	-0,550	-0,784	0,001	-0,537	-0,285	-0,003	-0,388	-0,631	-0,004
t-statistic	-4,56	-3,65	0,68	-2,78	-2,20	-0,30	-0,94	-1,90	-0,18
Return on assets	0,810	0,050	0,010	1,390	0,561	0,012	0,332	1,405	0,043
t-statistic	2,18	0,09	1,95	3,94	1,66	0,45	0,25	1,83	0,80
Excess reserves / Total assets	-0,197	-1,028	0,003	-0,243	0,033	0,011	0,332	0,454	-0,012
t-statistic	-1,57	-10,93	1,77	-1,01	0,28	1,25	0,44	2,60	-0,76
Loans to non-banks / Total assets	-0,029	0,293	0,005	-0,078	0,242	0,010	-0,265	-0,013	0,004
t-statistic	-0,56	3,78	2,64	-1,34	2,83	1,23	-2,63	-0,17	0,39
Loans to households / Loans to non-banks	-0,049	0,002	0,001	-0,100	-0,224	0,042	0,143	-0,168	-0,010
t-statistic	-0,76	0,03	0,40	-1,53	-2,64	4,83	0,89	-2,48	-0,80
Term deposits / Total deposits	0,201	0,515	0,009	-0,462	-1,024	0,012	-0,135	-0,120	0,006
t-statistic	4,90	8,50	5,00	-9,78	-13,91	1,85	-1,85	-2,29	0,91
Personnel expenses / Total assets		7,527	-0,060		0,143	-1,281		1,304	-0,438
t-statistic		4,65	-2,41		0,12	-6,49		0,79	-1,89
Number of observations	9059	16952	16575	8471	15716	15172	3607	5890	7148
Number of banks	1656	1386	1378	1598	1304	1301	834	872	1040
R-squared	0,05	0,12	0,57	0,06	0,04	0,24	0,03	0,01	0,10
F-test fixed effects (p-value)	0,35	0,00	0,00	0,98	0,00	0,00	1,00	1,00	0,00

Note: The table reports regression results of deposit growth and interest rates on bank risk characteristics for firms, households and banks. Within (fixed effects) or pooled results are reported. When the fixed effects are not jointly significant at 10 percent, pooled OLS results are reported. Estimates for time dummies, fixed effects, and the constant term are not reported, even though they are included in the regressions. Robust t-statistics are in italic. The ratio of personnel expenses to total assets is not included in the pre-crisis specification because of the data limitations. Results for the interest rate regressions are reported for the post-crisis period only due to the data limitations.

Table VI. Robustness checks

Explanatory Variables	All Banks		Non-state Banks		Only Non-pocket banks					
					Legal definition		*Definition 1*		*Definition 2*	
	D	*I*	*D*	*I*	*D*	*I*	*D*	*I*	*D*	*I*
Capital / Total assets	0,693	-0,004	0,690	-0,004	0,699	-0,006	0,666	-0,006	0,667	-0,007
t-statistic	*10,06*	*-1,13*	*9,98*	*-1,05*	*9,82*	*-1,43*	*8,57*	*-1,41*	*7,08*	*-1,35*
Liquid assets / Demand liabilities	0,120	-0,001	0,122	-0,001	0,121	-0,001	0,134	-0,001	0,105	-0,001
t-statistic	*5,17*	*-1,81*	*5,21*	*-2,16*	*5,00*	*-1,91*	*4,96*	*-1,95*	*3,71*	*-1,34*
Change in loan quality	-0,751	-0,003	-0,753	-0,003	-0,739	-0,002	-0,651	-0,003	-0,277	-0,004
t-statistic	*-2,98*	*-0,64*	*-2,97*	*-0,67*	*-2,70*	*-0,37*	*-2,12*	*-0,62*	*-0,88*	*-0,62*
Return on assets	0,301	-0,007	0,333	-0,007	0,344	-0,004	0,309	-0,008	0,194	-0,004
t-statistic	*0,55*	*-0,48*	*0,61*	*-0,46*	*0,60*	*-0,23*	*0,50*	*-0,49*	*0,27*	*-0,26*
Excess reserves / Total assets	-0,813	-0,005	-0,821	-0,006	-0,815	-0,006	-0,842	-0,007	-0,757	-0,007
t-statistic	*-9,72*	*-1,69*	*-9,69*	*-1,77*	*-9,40*	*-1,80*	*-8,51*	*-1,87*	*-6,21*	*-1,48*
Loans to non-banks / Total assets	0,286	0,000	0,286	0,000	0,286	0,001	0,287	0,001	0,265	-0,002
t-statistic	*3,84*	*0,13*	*3,80*	*0,04*	*3,69*	*0,32*	*3,19*	*0,19*	*2,25*	*-0,42*
Loans to households / Loans to non-banks	0,011	0,010	0,010	0,010	0,013	0,011	0,032	0,007	0,013	0,012
t-statistic	*0,19*	*2,08*	*0,17*	*2,12*	*0,23*	*2,09*	*0,53*	*1,34*	*0,19*	*2,44*
Term deposits / Total deposits	-0,007	0,024	-0,012	0,024	-0,007	0,024	-0,030	0,024	-0,059	0,023
t-statistic	*-0,13*	*8,12*	*-0,23*	*8,08*	*-0,14*	*7,91*	*-0,48*	*7,07*	*-0,76*	*4,80*
Personnel expenses / Total assets	6,190	-0,458	6,153	-0,457	6,167	-0,460	5,709	-0,419	5,480	-0,345
t-statistic	*4,21*	*-6,25*	*4,15*	*-6,17*	*4,09*	*-6,09*	*3,35*	*-5,09*	*2,40*	*-3,68*
Number of observations	16954	16858	16647	16552	16095	16003	12135	12054	7364	7300
Number of banks	1386	1376	1359	1349	1312	1303	1012	1004	647	639
R-squared	0,10	0,30	0,11	0,30	0,10	0,30	0,11	0,28	0,09	0,26
F-test fixed effects (p-value)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Note: The table reports regression results of deposit growth (D) and interest rates (I) on bank risk characteristics. Within (fixed effects) or pooled results are reported. When the fixed effects are not jointly significant at 10 percent, pooled OLS results are reported. Estimates for time dummies, fixed effects, and the constant term are not reported, even though they are included in the regressions. Robust t-statistics are in italic.
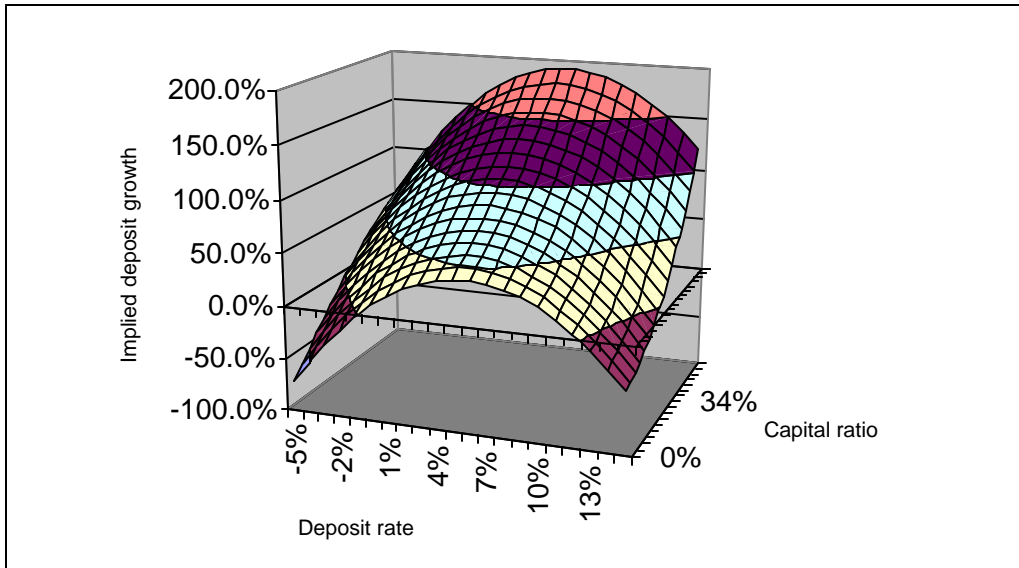
Table VII. Supply of Total Deposits

Explanatory Variables	All Banks		Non-state Banks		Only Non-pocket banks					
					Legal definition		Definition 1		Definition 2	
Capital / Total assets	**2,107**	**2,311**	**2,111**	**2,294**	**2,087**	**2,261**	**2,076**	**2,259**	**1,974**	**2,095**
t-statistic	13,09	10,51	13,08	10,61	13,09	10,45	11,48	9,06	9,65	7,84
Liquid assets / Demand liabilities	**0,226**	**0,232**	**0,225**	**0,233**	**0,231**	**0,239**	**0,254**	**0,262**	**0,219**	**0,225**
t-statistic	6,20	6,34	6,07	6,24	5,93	6,09	5,85	5,98	4,11	4,22
Change in loan quality	**-0,771**	**-0,750**	**-0,763**	**-0,743**	**-0,753**	**-0,732**	**-0,609**	**-0,604**	**-0,281**	**-0,272**
t-statistic	-2,81	-2,61	-2,78	-2,58	-2,60	-2,39	-1,95	-1,81	-0,81	-0,71
Excess reserves / Total assets	**-1,540**	**-1,514**	**-1,538**	**-1,517**	**-1,550**	**-1,528**	**-1,600**	**-1,580**	**-1,458**	**-1,428**
t-statistic	-12,79	-13,49	-13,10	-13,54	-13,09	-13,43	-11,96	-12,24	-9,04	-9,09
Loans to non-banks / Total assets	**0,611**	**0,620**	**0,608**	**0,615**	**0,634**	**0,637**	**0,586**	**0,602**	**0,676**	**0,680**
t-statistic	3,91	4,34	3,97	4,31	4,15	4,42	3,11	3,41	2,78	2,88
Term deposits / Total deposits	**0,310**	**0,291**	**0,309**	**0,289**	**0,307**	**0,285**	**0,255**	**0,233**	**0,243**	**0,230**
t-statistic	2,70	2,67	2,72	2,66	2,67	2,56	1,85	1,74	1,42	1,36
Personnel expenses / Total assets	**14,458**	**14,087**	**14,268**	**13,916**	**14,311**	**13,972**	**13,759**	**13,571**	**13,311**	**12,961**
t-statistic	5,04	5,07	5,01	5,00	4,98	4,94	4,21	4,20	2,87	2,84
Interest rate	**14,564**	**22,941**	**13,507**	**21,647**	**13,153**	**21,171**	**14,609**	**21,916**	**12,438**	**16,151**
t-statistic	1,95	2,97	2,04	2,85	2,11	2,84	2,09	2,65	2,08	2,14
Interest rate ^2	**-124,359**	**-98,466**	**-115,800**	**-94,103**	**-110,010**	**-91,084**	**-115,563**	**-96,871**	**-79,520**	**-65,295**
t-statistic	-2,05	-2,33	-2,22	-2,47	-2,27	-2,49	-2,41	-2,53	-2,41	-2,34
Interest rate * (1-Capital)		**-35,305**		**-33,961**		**-33,645**		**-31,668**		**-23,233**
t-statistic		-2,20		-2,21		-2,19		-1,86		-1,46
Interest rate * (1-Capital)^2		**23,744**		**23,225**		**23,655**		**21,948**		**17,422**
t-statistic		2,21		2,21		2,26		1,93		1,71
Number of observations	**16518**	**16518**	**16221**	**16221**	**15679**	**15679**	**11775**	**11775**	**7066**	**7066**
Number of banks	**1359**	**1359**	**1332**	**1332**	**1286**	**1286**	**987**	**987**	**622**	**622**
AR(2) p-value	**0,48**	**0,24**	**0,36**	**0,20**	**0,37**	**0,23**	**0,51**	**0,37**	**0,16**	**0,13**
Hansen test p-value	**0,16**	**0,10**	**0,16**	**0,10**	**0,11**	**0,09**	**0,57**	**0,37**	**0,51**	**0,30**
Implied switching point	**0,06**	**0,12**	**0,06**	**0,12**	**0,06**	**0,12**	**0,06**	**0,11**	**0,08**	**0,12**

Note: The table reports regression results of the growth of total deposits on bank risk characteristics, the deposit rate, and a number of interaction terms. The Difference GMM estimator is used. Term involving deposit rate are treated as endogenous. Lending rate, its square and suitably lagged values of endogenous variables are used as instruments. Estimates for time dummies are not reported, even though they are included in the regressions. Robust t-statistics are in italic. The 2nd order autocorrelation test tests the null hypothesis of no 2nd order autocorrelation in the differenced residuals. The Hansen test tests the validity of over-identifying restrictions and is robust to heteroscedasticity. Only results for the post-crisis period are reported due to the data limitations.

Figure 1. Implied Deposit Growth in the Deposit Rate – Capital Space.

Based on the estimated supply function (see Table VII) for different interest rates and capitalisation the figure shows implied deposit growth. Other regressors are assumed constant and are taken at their average values. Panel A represents a specification for all banks, while panel B for non-insider banks based on definition 2.

Panel A.

Panel B.