Banking Passivity and Regulatory Failure in Emerging Markets: Theory and Evidence from the Czech Republic

Jan Hanousek, CERGE-EI

and

Gerard Roland, UC Berkeley, ECARES, CEPR and CERGE-EI

Abstract

We present a model of bank passivity and regulatory failure. Banks with low equity positions have more incentives to be passive in liquidating bad loans. We show that they tend to hide distress from regulatory authorities and are ready to offer a higher rate of interest in order to attract deposits in contrast to banks that are not in distress. Therefore, higher deposit rates may act as an early warning signal of bank failure. We provide empirical evidence that the balance sheet information collected by the Czech National Bank is not a better predictor of bank failure than higher deposit rates. This confirms the importance of asymmetric information between banks and the regulator, and suggests the usefulness of looking at deposit rate differentials as early signals of distress in emerging market economies where banks equity positions are often low.

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JEL classification: C53, E58, G21, G33

1. INTRODUCTION

Banking crises in emerging market economies have been a regular occurrence in recent years. The East Asian economies, Mexico, Russia and Turkey were all hit hard within less than 10 years and nearly all countries in Central and Eastern Europe have experienced turbulence in their banking and financial sectors[1].

Such crises usually reveal bank passivity, i.e. a failure to liquidate bad loans. Instead, banks engage in covering up bad loans, which most often leads to a worsening of their financial situation. These issues have been widely studied. (see e.g. Mitchell, 1993, 1997; Berglöf and Roland, 1997, Perotti, 1998, Schoors and Sonin, 2005, Hainz, 2007.) Banking regulation is usually seen as the remedy to bank passivity and cover-ups. In the aftermath of the East Asian crisis, there was strong insistence on the introduction of rules to create greater transparency in the banking sector. However, better regulation is not just a matter of changing the rules and increasing the reporting requirements of banks to regulators. Better rules will not by themselves prevent banks from hiding important information from the regulator. Indeed, there is a fundamental problem of asymmetric information between the regulator and the banks and the high costs of monitoring usually do not allow informational asymmetries to be easily overcome. (Aghion, Bolton and Fries, 1998 analyze the issue of how to elicit truthful information from banks.)

In this paper, our analysis is more positive than normative in that we try to understand the behaviour of banks and regulators in the transition context, and more generally in the context of emerging market economies. Banks in greater danger of financial distress and with relatively low

[1] In the early 1990s, for example, Poland's banks experienced a crisis, followed in 1994-1996 by the failure of several small banks in the Czech Republic, and severe problems in Latvia in 1995 when four of its large banks failed. For a detailed description and overall picture see EBRD(1996-1997).

equity positions are shown to have more incentives to behave passively toward bad loans than banks with higher equity

positions. Troubled banks also have a greater tendency to hide the situation of distress from regulatory authorities, thus making it more difficult for the latter to detect distress early on. We also demonstrate that to attract deposits, banks with low equity positions will be ready to offer higher rates of interest than banks that are not in distress. We thus highlight the role of interest rates in the context of bank passivity and regulatory failure. Higher deposit rates may thus act as an early warning signal of bank failure, a feature that has already been noticed in the empirical finance literature (see e.g. Ellis and Flannery, 1992; Wheelock and Wilson, 1995).

We confront the results of the model with balance sheet information of banks collected by the Czech National Bank. We focus on data from the Czech banking crisis 1994 to1996. We show that these data are *not* a better predictor of banking failure than higher deposit rates, and thus that the regulator does not have privileged information on banks, despite the existing reporting rules.

The idea that competition between banks on depositor rates is harmful has been present for a long time in the banking literature. Kane (1989) and Cole et al. (1995) have analysed the effect of deregulation, and in particular the elimination of deposit rate ceilings (regulation Q), on the S and L crisis in the US. More recent empirical work has established a correlation between increases in interest rates and occurrences of financial crises (Demirgüc-Kunt and Detragiache, 1997). While the incentive effects of equity regulations on various forms of risk-taking are well understood (see e.g. Rochet, 1992; Bolton and Freixas, 2000 and the subject of a vast literature, there have been surprisingly few models focusing on the perverse effects of deposit rate competition. An important exception is Hellman et al. (2000). They constructed a model showing that high equity requirements without deposit rate ceilings lead to inefficiently high amounts of equity requirements make to the bank avoid taking excessive risks. As stated above, our model is less normative than positive,

modelling how equity differences affect interest rate competition and subsequent bank failure with the purpose of empirically testing this relationship. Moreover, we focus on a bank's passivity in hardening the budget constraints of firms rather than on its choice of assets. In other words, we center on the quality of a bank's loan portfolio, an important issue in understanding financial crises, rather than on its risk-taking behaviour.

The paper is organised as follows: section 2 introduces the theoretical model; section 3 describes the emergence of the Czech banking sector; section 4 presents empirical evidence of the Czech Republic's banking crisis; and the final section outlines conclusions and possible policy implications.

2. THE MODEL

Our model combines elements from the Mitchell (1997) and the Dewatripont-Maskin (1995) models, and resembles the model of Berglöf and Roland (1997). The latter is augmented to analyze the interest rates set by banks of heterogeneous quality. We first show that banks in distress will be ready to offer a higher rate of interest to attract deposits, compared to banks that are not in distress, and thus show why higher deposit rates may act as an early warning signal of bank failure. Second, we show why the bank regulator may have less information than the market.

Consider two types of banks that differ only in their equity. Low equity banks only have equity E in the amount of 1. High equity banks have equity in the amount of $E=W$, assumed to be "large". We assume that low equity banks are present in the banking population in proportion γ and high equity banks in proportion $(1-\gamma)$. A high proportion of low equity banks may, for example, be a

result of bad bank licensing policies which we do not model here. We assume there are many banks of each type. Consider the following game between banks, enterprises and a banking regulator.

At *t=0,* enterprises submit projects to banks. We assume each bank faces the same pool of projects. Even though banks differ in their equity endowment (assumed to be illiquid), we assume for simplicity that they all have only one exogenously given liquid unit of funds, which is exactly the amount required to finance all the projects facing a bank. There is, however, asymmetric information on project types. A proportion α of "good" projects yield at *t=1* a verifiable return R_g to the bank and a nonverifiable private benefit B_g to the enterprise management[2]. A proportion *(1-*α*)* are "poor" projects that yield the same results *only* if the enterprise exerts effort. If no effort is exerted, then the project yields no verifiable return or private benefit at *t=1*.

The project can then either be liquidated or refinanced. If it is liquidated, it yields at *t=2* a liquidation value of *L* for the bank and a private benefit of *0* for the enterprise. If the project is refinanced, however, one unit of fund is necessary (per project refinanced). In this case, there is a probability *q* that the project yields at *t=2* a verifiable return of R_p and a probability *(1-q)* that it yields a liquidation value of $L_s<L$. We also assume that $L_s<1$. In both cases (good or bad verifiable return), a private benefit of B_p is assumed to accrue to the enterprise management.

Refinancing of poor projects at *t=1* is assumed to happen via funds generated at *t=0* but also by attracting retail deposits. It is assumed that $\alpha R_g<(1-\alpha)$ so that refinancing always requires new deposits in the amount of $(1-\alpha)-\alpha R_g$. In other words, banks are facing liquidity constraints in refinancing. We assume that the total supply of funds *F* is inelastic and lower than $(1-\alpha)-\alpha R_g$ so that banks compete for deposits by bidding up the deposit interest rate *r*. These assumptions play a key role in our model.

[2] The private benefit B_g is then net of effort.

The bank's decisions to liquidate or refinance matter to the regulator. We assume that at *t=2,* at the end of the game, the regulator must bail out banks that have a negative net position due to deposit insurance. The regulator thus has an interest in preventing *ex ante* such bailouts by monitoring the banks. The regulator is particularly interested in preventing banks from "gambling for resurrection" by refinancing poor projects, knowing that the downside will be bourne by the regulator. To be precise, we assume that $q(R_p-1)+(1-q)(L_s-1)<1$, i.e. that the expected net return on a poor project is negative and thus is expected to deteriorate the balance sheets of banks. Whether or not banks will want to engage in gambling for resurrection is still, however, a very different matter that we will analyze in more detail below. We assume for now that there are grounds for such a temptation by assuming that $q(R_p-1)+(1-q)(L_s-1)>L$, i.e. that the *ex post* net return from refinancing is strictly positive. This inequality leaves room for some bidding up of interest rates to attract scarce deposits. Since the initial funds injected are a sunk cost, the bank will only compare the *ex post* return to refinancing and to liquidation. The expected *ex post* return from refinancing is thus assumed to be higher than the expected return from liquidation. However, from the *ex ante* point of view, poor projects are not profitable, since $q(R_p-1)+(1-q)(L_s-1)<2$. If the bank could commit to liquidation, this may induce the firm to provide effort.

We will say that a bank is *active* when it liquidates poor projects at *t=1* and that it is *passive* when it refinances these projects. The enterprise's behavior depends very much on whether the bank is active or not. We assume that $B_p>B_g>0$. The inequality on the left means that if banks are passive, enterprises with poor projects expert lower effort because they derive a higher net private benefit. On the other hand, the inequality on the right means that enterprises commit to higher effort because they are better off compared to the alternative of liquidation. If, then, banks are active and are expected to liquidate poor projects, i.e. if enterprises have hard budget constraints, enterprises will put forth higher efforts. Conversely, if they have soft budget constraints and expect to be

refinanced, they will not exert effort. Hard budget constraints would follow if the bank were able to commit to liquidation, but it cannot commit because initial investments are a sunk cost. The bank will refinance if the *ex post* returns from doing so are superior to the return from liquidation; poor projects can thus get refinanced even though they are not profitable from an *ex ante* point of view.

We assume that the regulator monitors the bank by detecting its activity or passivity under probability D. This is a stylized assumption but reflects the fact that the regulator has access to the books of the bank and may choose to scrutinize more closely the lending activities of some banks but not necessarily all. When a bank is suspected of passivity, the bank management is fired and has a payoff of *0*. We assume that the bank management derives a private benefit ρ from keeping their jobs and get hurt when fired. Bank managers thus potentially trade off the expected benefits from gambling for resurrection with the expected costs of getting fired.

Now that we have defined the relations between enterprises and banks and between banks and regulators, let us define exactly the timing of decisions in the full game.

At *t=0,* the regulator decides on a level of *D* and spends *C(D)* on monitoring activities. We assume that *C(D)* is a convex function. The bank lends money to enterprises, and enterprises with poor projects decide on their level of effort.

At *t=1*, returns on projects are observed. Banks become active or passive, and compete to attract deposits for the refinancing of poor projects if that is their choice. Call $a \in [0,1]$ a bank's choice of level of "activity" in liquidating poor projects. Directly afterwards, the regulator monitors and fires passive bank managers it has detected.

At *t=2*, the regulator bails out banks with a negative net position.

Note that the government may have different incentives from the regulator. It may have incentives to encourage ex post bail out for reasons that are not modeled in the paper. We rule out by assumption intervention from the government in the regulator's activities. The only possible time inconsistency the regulator may be subject to is the firing of managers. Ex ante, it needs this for incentive reasons but ex post it is indifferent to firing the manager after the latter has been passive. We assume it can commit to it via the legal system.

Even though we have a three-tier hierarchy, our analysis concentrates on the regulator-bank relationship. Indeed, enterprise behavior is easy to characterize. It is obvious that firms have soft budget constraints if and only if $(1-a)B_p \geq B_g$. Given that $B_p > B_g$ firms will have hard budget constraints only if the bank is sufficiently active, i.e. if $a > \tilde{a} = 1 - \frac{B_g}{B_p}$. We assume that $\frac{B_g}{B_p} \leq \frac{\alpha R_g}{1-\alpha}$. This implies that if a bank is inactive but cannot raise the funds it needs for refinancing, enterprises will still have soft budget constraints because they get B_p with probability $\frac{\alpha R_g}{1-\alpha}$ which is still better than getting B_g with certainty if they put up effort.

The next question we ask is critical. What is the maximum interest rate banks are willing to offer, as a function of their equity, at which they prefer to refinance poor projects rather than to liquidate them?

If a bank is active and hence if enterprises exert high effort, bank management will have at *t=2* a position of

$$E - 1 + R_g + \rho$$

It is clear in this case that the bank will be in a healthy position whatever its initial equity position, since $R_g+\rho>0$. However, to know what incentive leads a bank to be passive or active, we

must look at the bank's incentive after low effort has been exerted. If the bank decides to be active, its expected position will be

$$E-1+\alpha R_g+(1-\alpha)L\,.$$

If it decides to be passive, its expected position will be

$$\begin{aligned}&q[(E-1+(1-\alpha)R_p-[(1-\alpha)-\alpha R_g](1+r)]+\\&(1-q)\max\{0,E-1+(1-\alpha)L_s-[(1-\alpha)-\alpha R_g](1+r)\}\end{aligned}.$$

Depending on the level of equity, the downside payoff after refinancing will differ. If *E=1*, then the downside payoff is equal to $(1-\alpha)L_s-[(1-\alpha)-\alpha R_g](1+r)$, which is always < 0 since we have assumed that $L_s<1$. Thus, when the bank has large initial equity, its expected position is

$$E-1+(1-\alpha)[qR_p+(1-q)L_s]-[(1-\alpha)-\alpha R_g](1+r)]\,.$$

But when it has low initial equity, its expected position is

$$q[(1-\alpha)R_p-[(1-\alpha)-\alpha R_g](1+r)]\,,$$

where the expression between brackets is assumed to be positive. Note that a bank with a lower equity position will, everything else being equal, benefit from the safety net of deposit insurance in the bad return outcome.

We can now compare the net benefit of refinancing (i.e. being passive) for a high equity bank and for a low equity bank when low effort has been exerted. In particular, if r^H is the interest rate offered by the high equity bank and r^L is the interest rate offered by the low equity bank, the net benefit of refinancing[3] to the manager of the high equity bank will be

[3] Note that the return on refinancing is not the same as the expected position of the bank. The former must include expenditure αR_g whereas when we compute the latter αR_g is netted out because it is both an income and on expenditure.

$$(1-D)\{(1-\alpha)[qR_p+(1-q)L_s]-\alpha R_g-[(1-\alpha)-\alpha R_g](1+r^H)+\rho\}$$

For the low equity bank, the net benefit will be

$$(1-D)\{q[(1-\alpha)R_p-\alpha R_g-[(1-\alpha)-\alpha R_g](1+r^L)]+\rho\}$$

Note that the net benefit to management from liquidating is $(1-\alpha)L+\rho$ both for a high and a low equity bank. The latter expression sets the upper limit for interest rates a bank would be willing to offer in competing to attract deposits. Note also that this upper limit decreases as D increases. Given our assumption that $q(R_p-1)+(1-q)(L_s-1)>L$, there will thus exist values of D, r^H and r^L for which the net benefit of refinancing outweighs the net benefit of liquidation. Banks would thus be willing to bid up interest rates to the point where their net benefit of refinancing is equal to $(1-\alpha)L+\rho$.

Developing an equality between the net benefit from refinancing for high and low equity banks, we then get

$$[(1-\alpha)-\alpha R_g](qr^L-r^H)=(1-q)(1-\alpha)[1-L_s].$$

Since $L_s<1$, it is clear that the right-hand side of the equation is positive (and thus the left-hand side). Therefore, since $\alpha R_g < (1-\alpha)$, we have that $r^L>qr^L> r^H$.

This result leads us to the following propositions:

Proposition 1: Low equity banks will be prepared to offer a higher deposit interest rate than high equity banks.

The intuition for this result follows directly from the fact that the same return can be obtained with a higher interest rate for a low equity bank, since the low equity bank will expect to benefit from deposit insurance whereas the high equity bank will not. Proposition 1 shows us why

higher deposit interest rates can act as a warning signal for bank distress.[4] In competing with high equity banks, low equity banks will be ready to offer a higher interest rate precisely because they expect to be in distress.

Now that we have established that low equity banks offer higher interest rates than high equity banks, the next question concerns the equilibrium interest rate for deposits. We have assumed that the total supply F is inelastic and lower than $(1-\alpha)-\alpha R_g$, thus motivating competition among banks to attract funds. We have also assumed that a proportion γ of banks have low equity and that there are many banks. We can then establish the following proposition.

Proposition 2: If $\gamma[(1-\alpha)-\alpha R_g] > F$, then the equilibrium interest rate is r^L and if $\gamma[(1-\alpha)-\alpha R_g] < F$ the equilibrium interest rate is r^H . In either case, banks with low equity are always less active than banks with high equity.

Indeed, the needs for funds are of $(1-\alpha)-\alpha R_g$ and thus the total needs of low equity banks are of $\gamma[(1-\alpha)-\alpha R_g]$. If $\gamma[(1-\alpha)-\alpha R_g] > F$, then low equity banks will compete among themselves for the scarce funds and bid up the interest rate up to r^L. But in that case, all high equity banks will be crowded out because of the high interest rate and all will be active. If, on the other hand, $\gamma[(1-\alpha)-\alpha R_g] < F$, then competition for funds at the margin will occur among the high equity banks who set their interest rates to r^H. In that case, all low equity banks will be passive. But in either case, low equity banks will always be more passive than high equity banks, and will be in a better position to attract funds because of their greater willingness to pay.

[4] If we were to take the model literally, then competing for deposits would be a bad signal in itself. This would however obviously not be the case if we had a richer and more realistic structure of demand for deposits. Moreover, we have only analyzed competition for deposits at the refinancing stage. A more complicated model would have both at t=0 and at t=1 competition for deposits. The effect that we identify here would nevertheless still be present in a more complicated model.

We now analyze the regulator's decision to monitor banks and how this decision can affect banks' incentives. We will look at the incentives of banks with a low equity level.

These banks will choose to be active if and only if

$$\alpha R_g + (1-\alpha)L + \rho > (1\text{-D})\{q[((1-\alpha)R_p - [(1-\alpha) - \alpha R_g](1+r^*)] + \rho\},$$

i.e., if $D > \tilde{D} = \dfrac{(1-\alpha)[q(R_p - (1+r^*) - L] - (1-q)\alpha R_g + q\alpha R_g r^*}{q[(1-\alpha)R_p - [(1-\alpha) - \alpha R_g](1+r^*)] + \rho}$.

where r^* is the equilibrium interest rate derived in proposition 2.

Below this threshold $\tilde{D}$, banks will choose to be active and above it they will choose to be passive. The regulator therefore need never go beyond $\tilde{D}$ to achieve the required incentive effect. What remains is whether the regulator gains from paying the cost of $C(\tilde{D})$ to obtain active behavior from banks, with the result of hardening the budget constraints of enterprises, or whether that cost is higher than the cost of *ex post* bailout of banks. We thus arrive at the following proposition.

Proposition 3: Effective bank regulation will only take place if

$$C(\tilde{D}) \le (1-q)[((1-\alpha) - \alpha R_g)(1+r^L) - (1-\alpha)L_s]$$

If this inequality is violated, then it does not pay to monitor banks effectively. This comparison hinges on the relative costs of bank monitoring versus the costs of bank bailout. Since in transition economies, both are likely to be high, whichone is more important becomes a question that must be determined empirically.

Note that the regulator need not engage in active monitoring of the bank in order to detect passivity. Indeed, the regulator may use information on profit taxes paid by banks to infer whether they were passive or not. In equilibrium, active banks generate at t=1 profits R_g and pay taxes tR_g ,

assuming a proportional tax on profits. Passive banks, on the other hand, generate at t=1 profits αR_g and pay taxes $\alpha t\ R_g$.[5] Thus, by observing tax filings, the regulator can easily detect passive banks. The response of such a bank would be to "hide" and report more profits than it actually made. In other words, a passive bank would have to report (and pay taxes on) the profits of an active bank, i.e. pay tR_g instead of αtR_g. This is a case in which hiding passivity costs the bank.

Again, in order to analyze the bank's incentive, we must compare its expected positions under active and passive conditions, and when enterprises have exerted low effort. In the first condition, (out of equilibrium) case, the bank will choose to be active, will not try to hide, and will pay taxes only on its real profits. In the second case, the bank will pay excess taxes but will benefit from its gamble for resurrection. A bank will thus choose to be active if

$$\alpha R_g(1-t)+(1-\alpha)L+\rho > q[(1-\alpha)R_p - tR_g - ((1-\alpha)-\alpha R_g)(1+r^*)]+\rho\ .$$

This expression can be rewritten as

$$(q-\alpha)tR_g > (1-\alpha)[q(R_p-(1+r^*))-L]-\alpha(1-q(1+r^*))R_g\ .$$

The left-hand side represents the net cost of being passive and hiding; the right-hand side represents the net benefit. What does inspection of this inequality tell us?

First, note that if $q<\alpha$, there is no real cost to hide. Even though taxes are paid in the amount tR_g instead of αtR_g, since the downside outcome of refinancing is insured, it is as if taxes were only paid on qtR_g, i.e. on the upside outcome. If, however, $q>\alpha$, then a higher tax rate on profit

[5] The model is of course very stylized, but in reality, banks with a worsening portfolio would report lower profits to the tax authorities and this could be a useful source of information for bank regulators.

discourages banks from hiding since it increases the cost of doing so. This result is expressed in the following proposition.

Proposition 4: If detection of passivity can occur via tax filings, then:

a) if $q<\alpha$, banks have no cost to hiding their passivity;

b) if $q>\alpha$, there is a threshold tax rate $\tilde{t} = \frac{(1-\alpha)[q(R_p - (1+r^*)) - L] - \alpha(1-q(1+r^*))R_g}{q-\alpha}$

above which banks are discouraged from hiding.

3. BACKGROUND ON THE CZECH BANKING SECTOR

The first step in reforming the banking sector was law No. 130/1989 approved on November 15, 1989, which created a central bank, the State Bank of Czechoslovakia (hereafter SBCS). According to this law, the SBCS was accountable and responsible for state monetary policy, but not for commercial banking. The law regulating the commercial banks and the savings and loans sector was approved a month later on December 13, 1989. This law enabled two-tier banking, in that it brought into being commercial banks and set the basic rules for their operation. The Ministry of Finance was charged with regulating the banking sector.[6] According to this law, interest rates were governed by the SBCS and deposits in state financial institutions were guaranteed by the state. In January 1990, the SBCS transferred its commercial operations to three newly established banks: Komer□ni banka (KB), Vseobecka uverova (VUB), and Investicni banka (IP, which in 1993

[6] The Federal Ministry of Finance supervised banks and the Ministries of Finance of the Czech and Slovak Republics controlled saving and loans.

merged with Post office banks as IPB). On December 20, 1991 new laws on central banks and other banks were adopted (Nos. 21 and 22/1992). These laws, effective February 1, 1993, established the independence of the national bank from the government and gave the SBCS authority for banking supervision. On January 1, 1993, the Czech National Bank (CNB) took over the functions of the SBCS as a result of the split of Czechoslovakia. The laws on banks also contained clearly specified rules for granting licenses, and defined a general regulatory framework.

Unfortunately, the conditions for obtaining banking licenses were quite soft, requiring a minimum subscribed equity capital of only CZK 50 million (US$2 million). This low requirement was increased in April 1991 to CZK 300 million (US$10 million). And yet, the "Law on Foreign Exchange" protected the local market from foreign competition, thus preventing firms from directly acquiring capital abroad.

With such low capital requirements the number of new banks literally exploded from early 1990, when there was a central bank plus seven banks licensed for universal banking, to 23 by the end of 1990. This trend continued with 36 banks by the end of 1991 and 51 by the end of 1992. These newly established banks were small, with the only significant exception being Agrobanka.[7] In 1993, the rate of new bank creation slowed, with only 8 new banking licenses granted (See Table 1). Between mid-1994 and 1996, the CNB decided not to grant any new bank licenses, most likely in a response to failures of small and medium-sized banks.

Due to soft licensing procedures and insufficient screening of license candidates, many newly formed banks lacked not only an adequate capital base, but also employees equipped with proper managerial skills and business ethics. And because of their lack of capital, small and medium-sized banks began to finance high risk projects other banks refused. The standard adverse selection problem also meant that a higher interest rate only served to attract high-risk clients. In addition,

[7]Agrobanka, founded in 1990, became the fifth largest bank in the Czech Republic within a year.

several new banks were using deposits to extend credit to other activities of the bank's owners, or simply tunnelling the deposited money out of the bank. But whether from incompetence or theft, the overall effect on the cash flow and balance sheets of these banks was seriously damaging.[8] Several bank failures beginning in December 1993 upset public trust in the banking sector and rocked the stability of small and medium-sized banks.

In reaction to the first three bank failures, the banking law was amended to include obligatory insurance on deposits. This insurance covered the deposits of citizens up to 100,000 CZK per head and per bank, with the premium limited to 80 percent of the deposit balance on the day of a bank's closure. The amendment also increased the extent and authority of banking supervision granted to the CNB. The CNB could now impose sanctions for non-compliance, which ranged from enforcing corrections and imposing fines to the revocation of banking licenses.[9]

After the introduction of deposit insurance, Ceska banka filed for bankruptcy and the new law was applied to its clients. However, when a series of additional failures soon followed in the election year of 1996, the CNB became far more generous, with individual clients of the failed banks recovering their full deposits up to 4,000,000 CZK in contradiction to the law's stipulations.

The CNB coped with the resulting sensitive political problem of lost deposits by tightening the licensing procedures and introducing obligatory deposit insurance. In its efforts to stem the tide of bank failures, the CNB tried the following approach. In early July 1995, it tightened its policies, increasing the minimum reserve requirements (MRR) and unifying its rates.

[8] The Economist, September 1996: "Each of these bank failures stemmed from a deadly cocktail of mismanagement, orgiastic lending (often to the bank's own stockholders), and more often than not, fraud".
[9] The CNB was given the authority to fulfil several obligatory rules: approve/change bank management; give a penalty up to 50 mln. CZK; enforce reduction of shareholder's capital and its transfer to reserves if these were not sufficient; and withdraw or freeze banking licenses.

4. DATA AND RESULTS

We were able to access official data collected by the supervisory body of the CNB (see Table 5 for a detailed description of available variables).[10] This data set consists of monthly reports of 20 local banks in 1995, 14 of which endured significant problems during the period studied.[11] Data on retail interest rates were published monthly in leading newspapers (or in the magazine Ekonom). The data set containing information on interest rates alone is much broader (29 banks) and covers all the banks actually doing business in the Czech Republic.

As suggested by Proposition 1, passive banks (those potentially in trouble) will offer higher interest rates on their deposits. The situation in the Czech Republic is clearly depicted in Figure 1. For this figure we utilised deposit data on 29 banks. We use the symbols "1" and "0" to mark those banks that failed and survived, respectively, during the period 1994-1996. As a benchmark (denoted by "2") we use a bank that during the period offered practically no corporate lending, and therefore for which interest rates should not reflect problems with its loan portfolio. Figure 1 exhibits a clear pattern for one-year deposits, indicating generally higher rates for problem banks, in line with our theoretical model. Moreover, the interest rate differentials between sound and problematic banks become even more noticeable over time. It is clear that banks with higher interest rates on term deposits are more likely to fail later on.

[10] There also exist two sets of publicly available accounting data represented by a subset of the ASPEKT (or CEKIA) databases of the Czech capital market which cover annual reports of publicly traded banks. Unfortunately, these data sets cannot be applied to our model for two reasons. First, the publicly available information covers only a short version of the balance sheet and it differs drastically from those data available to regulators. Second, when additional public information exists (for example, a standard balance sheet provided by ASPEKT or CEKIA), then several variables are always missing, especially for banks that were *ex-post* seen as "problematic". In addition, above mentioned sources covers only balance sheet information and provides no information on loss coverage, etc.

[11] We have obtained data only on local banks from the regulator. Table 5 contains a detailed description of the data and definition of all available variables. Foreign banks and their branches were excluded for several reasons. Legal issues represent the most obvious reasons, but there are several related points. First, foreign banks or their branches have shown inherent differences services, structure, financing, etc. Second, there are differences in the primary accounting method used (local versus international). Finally, foreign banks and their branches usually follow their home country's banking regulations, which has been stricter compared with local banks. Although we construct the financial ratios that have been used in models of bank failures, we must stress that our indicators do not have the same meaning as in the other studies, since all data we use reflect local accounting standards.

Although Figure 1 indicates a strong pattern, it is important to test whether the difference between these groups is significant. As noted before, 14 out of the 29 banks exhibited significant problems. For the purpose of this analysis we call these banks (marked by the symbol "1" in Figure 1) "problematic" and the remaining banks we call "control group" (symbols "0" and "2"). Table 6 summarises several t-tests of difference between these two groups for different time periods and duration of term deposits. These results clearly show that mean interest rates for problematic banks were significantly greater than those of sound banks.[12] These differences are generally larger for later period and longer maturities.

Another key component of our model is the asymmetric information between banks and the regulator regarding the extent of bad loans on a bank's balance sheets. The timing of recapitalisation offers and subsequent revisions of estimates of bad loans[13] suggest that regulators have incomplete information at the time recapitalisation is offered. There exists a literature on predicting bank failures in mature market economies (see Looney et. al., 1989; Lane et. al., 1985, Barber et al., 1996, Hwang et al., 1997; among others) based on financial indicators. Since we have the official data made available to the regulator, it is particularly interesting to test how well these data predict the crisis, thus giving us a precise idea of the quality of the information available. Using Czech regulatory data on available financial indicators gives us a unique opportunity to test how well informed the bank supervisory authorities are. Based on Proposition 3, the cost of hiding might be very low, and hence our working hypothesis is that the supervisory body is not a real insider, despite the regulatory data available.[14] It would be impossible to support such a hypothesis using a single (*ad hoc)* model, and so we considered a broad class of models and present the best

[12] An interesting question is to what extent these differences reflect the size difference between banks rather than financial distress. We addressed this issue via several test procedures (ran on all maturities) and we were not able to reject the hypothesis of no difference in interest rates between small and large banks at the beginning (1993).
[13] The cases of Japan and Mexico are well documented.
[14] However, supervisors, if they carry out on-site inspections, have much more information than is available in accounting data.

model in terms of predicting the bank failure. Our argument is the following: if the model with the best predicted ability using all available regulatory data does not give a good prediction, one can conclude that the supervisory body is not an insider (despite having "confidential" regulatory data) and that the cost of hiding is indeed small.

Therefore, we ran many logit models of bank failure. Table 7 presents the best predicting logit models of bank failures with and without interest rate variables. The findings are striking. First, financial indicators (mostly loss account data), although they were drawn from official data collected by the supervisory body of the CNB (Model I), result in a very poor fit and do not prove a significantly better predictor of actual bank failure than one-year deposit rates alone (Model II).[15] This finding suggests that the unaudited monthly financial indicators with detailed information available to only the CNB did not contain any information with respect to the prediction of actual bank failure that was different from information publicly available. We can interpret this result to mean that the CNB did not get from their supervisory data any better information than market interest rate on deposits. Given the rather poor predictive power of models I and II, this suggests that despite banking regulations, asymmetric information between the CNB and the banks remains a serious issue.

Furthermore, on the basis of our theoretical model, we expect that adding the retail interest rate variable to an econometric model of bank failure should help predict which banks will be the problem banks. Indeed, this expectation is confirmed. Independent of the interest rate, balance sheet data given to the regulators may or may not reflect accurately the situation of the bank, depending on whether the accounting data are truthful or not. But whereas balance sheet data may be

[15] Preliminary analysis (Table 6) suggests that two-year deposit rates might be even better predictor. The reason for using one-year rates instead is simple. For two-year deposit rates we have missing observations: Not every bank provided a table of retail interest rates by all maturities, and several banks specified longer maturities as "negotiable". Since we do not want to lose more observations, we opted for a one-year interest rate that was provided by all banks in our sample.

uninformative, market data may be more informative. In the real world we would expect an interaction between market and regulatory data, which would reveal certain hidden signals in regulatory data.

Looking at the results in Table 7 for the first half of 1995 we see that, although both Models I and II provide similarly poor predictions, combining them (Model III) significantly increases the quality of the predictions. [16] More importantly, it suggests that the information of the CNB and of the market differs and that interest rate information complements the information contained in the balance sheets. Note, however, an interesting difference between the results for the first and second half of 1995. For the first half of 1995, model III is better than both models I and II. However, for the second half of 1995, there ceases to be a significant difference in the quality of prediction between models I and III. This suggests that balance sheet information became more informative over time. A natural interpretation is that the high interest rates resulted in such a deterioration of the financial position of problem banks that there was a substantial difference between them and good banks with respect to common financial ratio measures.[17]

Another possible scenario is that these banks had attracted the attention of regulators who forced them to provide more accurate data. In any case, if there is a lag between the time when interest rates increase and the time this information is incorporated into the balance sheet data, then we should conclude that interest rate differentials provide an early signal of banking distress.

[16] Note that neither Model I nor II significantly dominates a naïve estimator (=1), but their combination, Model III does.

[17] As seen in the model, problem banks can attract cash via a much higher interest rate on term deposits than other (i.e., "safe") banks offer. Unfortunately, this only speeds up the process of worsening bank conditions in a repeated game. Financial indicators would ultimately reflect this fact. It can even be magnified when some of the other banks are insiders (For instance, Cordella and Yeyati, 1998 shows that when banks do not control their risk exposure, the presence of informed depositors may increase the probability of bank failures).

5. CONCLUSIONS

Despite the small sample available, we provide evidence from the Czech banking crisis that the interest rate differentials between sound and problematic banks were significant and increasing as bank failures approached. Second, our data support the assumption that the bank supervisory body did not, despite banking regulations and reporting requirements based on private balance sheets, have information (in terms of quality of early warning signals) superior to publicly available information incorporated into interest rates. These findings add to the general body of theoretical and empirical literature on the effects of informational asymmetries in the banking sector and on the adverse selection effects of interest rate competition. They highlight the difficulty of overcoming informational asymmetry between banks and the regulator. Despite calls for more transparency and better reporting rules, informational asymmetries are likely to continue to be an important part of the financial reality in emerging markets where fragile equity positions of banks will lead to increased risk-taking, with systemic consequences.

Two lessons stand out from a normative point of view. First is that the market interest rate variable should be used to adjust for the default risk of the bank since it is a useful early signal, especially in case of a fragile equity position. Moreover, our results suggest the benefits of combining balance sheet and interest rate data since the information they provide is complementary, at least in the early stages. In the Czech case this approach would significantly improve the quality of bank supervision and upgrade any early warning signal. A second lesson relates to the importance of sound bank capitalisation. Indeed, both our model and the empirical evidence suggest that bank passivity and perverse competition on interest rates are much less of an issue when banks are sufficiently capitalised.

Table 1. Number of Banks in Operation in the Czech Republic, 1990 – 1997

Number of banks, eop.	1990	1991	1992	1993	1994	1995	1996	1997
Total	9	24	37	52	55	54	53	50
Large banks	5	6	6	6	6	6	5	5
Small banks	4	14	19	22	21	18	12	9
Foreign banks		4	8	11	12	12	13	14
Foreign bank branches			3	7	8	10	9	9
Specialised banks			1	5	7	8	9	9
Banks under conservatorship				1	1		5	4
Banks without licence					1	4	6	

Source: Reports on Monetary Development in the Czech Republic, CNB 1994-1997
Report on Bank Supervision in the Czech Republic, CNB 1996

Table 2. Share of Total Assets, banks with valid licence as of 31 Dec.1997

End of the period	1993	1994	1995	1996	1997
Total banking sector	100	100.00	100.00	100.00	100.00
Large banks		77.18	71.72	68.87	65.67
Small banks		4.44	4.92	5.21	4.72
Foreign banks, incl. branches		11.67	16.46	18.84	22.28
Specialised banks		1.47	2.11	3.09	4.29
Banks under conservatorship		5.24	4.78	4.00	3.04
Banks without licence		0.64	2.24	2.42	*2.10

Source: Reports on Monetary Development in the Czech Republic, CNB 1994-1997
Report on Bank Supervision in the Czech Republic, CNB 1996

Table 3. Consolidation Program of the CNB

Consolidation was done by:	Number of Banks	Share on the Total Assets of the banking sector, June 30, 1996
– reduction of shareholder's capital and conservatorship	5	1.64
– closing the bank	2	1.24
– selling the bank and subsequent merging	3	1.66
– increasing the capital	6	3.98
No consolidation needed	3	1.13
Total [1)]	18	8.84

Source: Report on Bank Supervision in the Czech Republic, CNB 1996

1) For one bank two methods were combined: first, reduction of shareholder's capital and conservatorships; and then the bank was merged with another existing bank.

Table 4. Minimum Reserve Requirement Rates since 1992

	Rates (percent) effective by:							
	11/92	2/93*	7/93	8/94	8/95	8/96	5/97	8/98
demand deposits	9	9-12	9	12	8.5	11.5	9.5	7.5
time deposits	3	3-4	3	12	8.5	11.5	9.5	7.5

* A lower rate was used for banks with deposits up to 25 billion CZK, otherwise the higher rate was applied.
Source: CNB, Monetary indicators.

Table 5 Brief description of financial variables used in predictions.

Name	Description of variables
TDTA	Total Deposits to Total Assets = Total Deposits/Total Assets
NIM	Net Interest Margin = Net Interest Income/Average Interest Earning Assets
CA	Capital Adequacy = Total Capital/Risk-weighted Assets
EM	Equity Multiplier = Average Assets/Average Equity
SNFC	Share of Net Fees and Commissions Income = Net Income from Fees and Commissions/Net Operating Revenue
SNII	Share of Net Interest Income = Net Interest Income/Net Operating Revenue
NIER	Non-Interest Expense Ratio = Non-Interest Expense/Total Operating Revenue
IER	Interest Expense Ratio = Interest Expense/Total Operating Revenue
NLTD	Overall Liquidity Ratio = Net Loans/Total Deposits
NPLTL	Loans Under Special Review to Total Loans = Gross Loans Under Special Review/Gross Total Loans
LLRNL	Loans Under Special Review Coverage by Provisions = Provisions for Loans Under Special Review/Gross Loans Under Special Review
LLRCL	Classified Loans Coverage by Provisions = Provisions for Classified Loans/Gross Classified Loans
IBATL	Inter-bank Assets to Total Liabilities = Inter-bank Assets/Total Liabilities
PCOI	Provision Charge to Operating Income = Provision Charge/Operating Income
CDIL	Client Deposits to Inter-bank Liabilities = Client Deposits/Inter-bank Liabilities
OE	Operating Efficiency = General Administrative Expenses/Operating Revenue
QATL	Quick Assets to Total Liabilities = Quick Assets/Total Liabilities
LLNL	Loss Loans to Total Loans = Net Loss Loans/Net Total Loans
ROA	Return on Assets = Net Income/Total Assets
ROAE	Return on Average Equity = Net Income/Average Equity
ROAA	Return on Average Assets = Net Income/Average Assets
ROE	Return on Equity = Net Income/Equity
SP	Interest Rate Spread = (Interest Income/Average Interest Earning Assets) - (Interest Expense/Average Interest Bearing Liabilities)
TETA	Total Equity to Total Assets = Total Equity/Total Assets
GROA	Gross Return on Assets = Profit before Provisions/Average Assets
PM	Profit Margin = Operating Income/Profit before Provisions

Source: CNB. Note that definition of all variables is based on the CNB notation and on Czech accounting standards.

Table 6. Comparison of average deposit rates (control group vs. problematic banks). Semiannual data from June 1993 to December 1995

Year	Group	checking account	1year term deposit	2 year term deposit
1993.1	"control"	3.48	12.95	14.53
	"problematic"	4.44	13.74	14.36
	p-value (t-tests)	.05**	0.16	0.4
1993.2	"control"	3.97	13.05	14.44
	"problematic"	4.29	13.95	14.72
	p-value (t-tests)	0.27	.03**	0.22
1994.1	"control"	3.61	10.51	13.42
	"problematic"	4.21	11.75	13.6
	p-value (t-tests)	0.18	.05**	.00***
1994.2	"control"	3.4	9.82	12.83
	"problematic"	4.36	10.80	14.51
	p-value (t-tests)	.08*	.10*	.05**
1995.1	"control"	3.17	9.45	11.68
	"problematic"	4.47	10.61	13.67
	p-value (t-tests)	.01***	.03**	.00***
1995.2	"control"	3.56	9.62	11.15
	"problematic"	4.68	10.63	12.92
	p-value (t-tests)	.03**	.01***	.01***

*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level.

Table 7. Comparison of logit models. Standard errors are in parentheses.

Variable	Period 1995/1			Period 1995/2		
	I.	II.	III.	I.	II.	III.
Capital adequacy	.10 (.65)		-.53 (.39)	.17 (.11)		-.54 (.49)
Equity multiplier	-.05 (.09)		2.57 (1.6)	-.04 (.11)		-1.4 (1.2)
Return on assets	-.31 (.22)		-.82 (.61)	-.23 (.56)		-.01 (.88)
Classified loans coverage by provisions	.05 (.07)		-.83 (.70)	-1.9 (1.3)		-3.0 (2.9)
One year term deposit rate (the lowest)		.15 (.11)	2.68 (1.8)		.07 (.14)	1.3 (1.5)
One year term deposit rate (the highest)		-.14 (.18)	-.85 (.84)		-.02 (.22)	.49 (1.1)
R-square	0.1	0.09	0.71	0.35	0.06	0.69
Fraction of correct prediction	0.65	0.7	0.9	0.75	0.63	0.88
Test I. vs. II. (p-value)[+]	Π^2 (1) = 0.20 (.65)			Π^2 (1) = 0.67 (.41)		
Test II. vs. III. (p-value)[+]	Π^2 (1) = 2.67 (.10)*			Π^2 (1) = 2.67 (.10)*		
Test I. vs. III. (p-value)[+]	Π^2 (1) = 3.57 (.06)*			Π^2 (1) = 1.0 (.32)		

** Significant at 5% level, * Significant at 10% level.

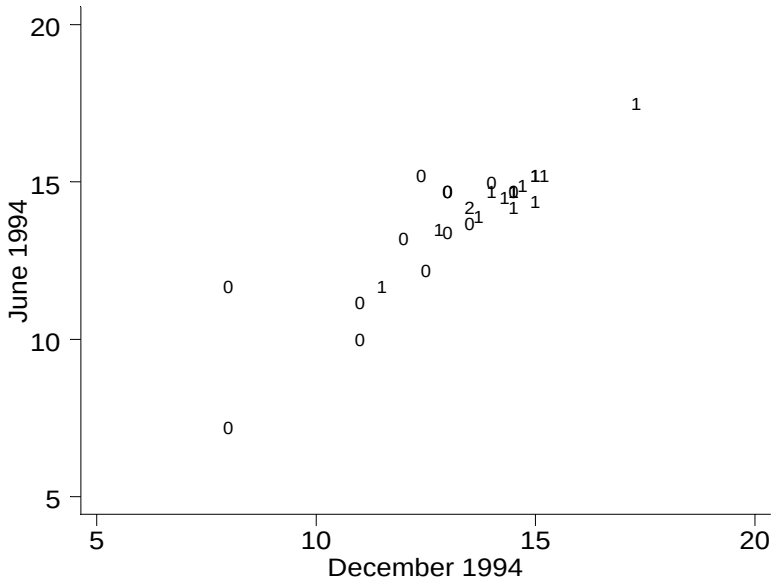
Note: The model presented in this table is the one with the best predicted ability in the space of all available regulatory data. Poor fit of such a model allows us to conclude that from the data point of view the supervisory body has not been an insider and therefore that the cost of hiding has indeed been small.

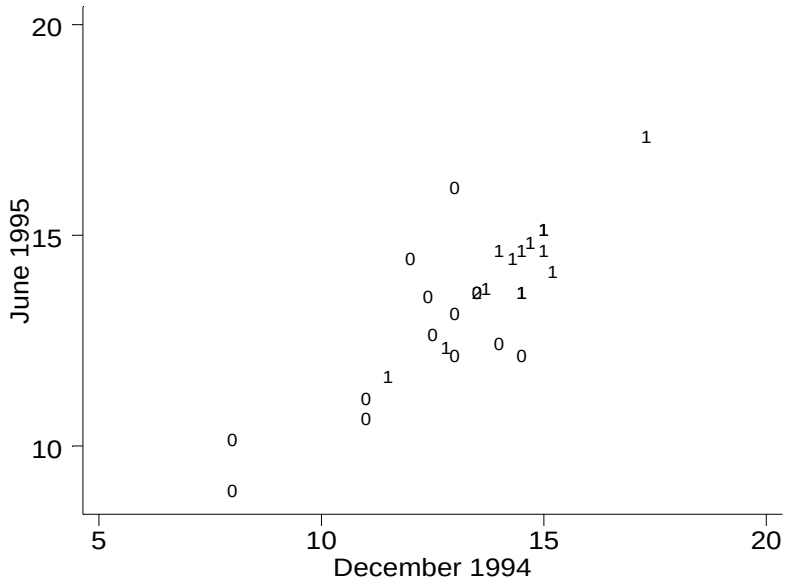
[+] The test reported here is a chi-square test of whether one model dominates the other in predictive accuracy. The null hypothesis is that there is no difference between these models in predictive accuracy. Denote by "+" the cases where models correctly predict the dependent variable, and denote by "–" where they do not. The quality of the prediction can then be summarized in the following table:

		Model I		Γ
		+	–	
Model II	+	n_{11}	n_{12}	$n_{1.}$
	–	n_{21}	n_{22}	$n_{2.}$
Γ		$n_{.1}$	$n_{.2}$	n

Corresponding test statistics $\chi_1^2 = \frac{(n_{12} - n_{21})^2}{n_{12} + n_{21}}$ has a chi-square distribution with 1 degree of freedom. For more details, see Hanousek (2000).

Figure 1.One Year Retail Deposit Rates (the highest)





Symbol “1” indicates the banks that failed during the period 1994-1996, while “0” denotes those banks which “survived”. As a benchmark (denoted by 2) we used “Plzenska banka”, the bank that offered practically no corporate lending, and therefore, whose interest rates should not reflect problems with their loan portfolios.

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