Deposit Interest Rates, Asset Risk and Bank Failure in Croatia

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Abstract

During the 1980's and 1990's, financial liberalization became an almost universally-accepted policy prescription. Large numbers of countries eased licensing, deregulated interest rates and dismantled systems of directed lending. However, banking system crises, first in the southern cone of Latin America in the early 1980's and later in the U.S., Scandinavian countries and a large set of emerging market economies, raised questions about the links between financial liberalization and instability. In particular, Hellman, Murdoch and Stiglitz (2000) question the wisdom of complete deregulation of deposit interest rates, arguing that this can facilitate "purchasing market share" to fund "gambling."

The transition countries of Central and Eastern Europe provide an interesting laboratory to test these arguments. Starting in the early 1990's, these countries rapidly liberalized their banking markets, removing restrictions on entry, asset composition and interest rates. For this reason, the experience of such countries may help confirm whether the U.S. experience of the 1980's was typical.

In this paper, we examine the experience of Croatia, which liberalized its banking regulations in the early 1990's. After the end of the wars surrounding the break-up of former Yugoslavia, Croatia experienced rapid growth in the number of banks, strong deposit growth and substantial increases in deposit interest rates in the period 1995-98. This buoyant period was punctuated by the failures of numerous medium-sized banks in 1998 and 1999.

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Our argument is that high deposit interest rates helped fund the expansion of risk-loving banks, and had important negative external effects on healthy banks, thus making a strong contribution to the banking crisis of 1998-99. We proceed in two steps. First, using panel regression techniques, we show that banks were able to increase deposit growth, and thus fund rapid expansion, by raising interest rates in the pre-crisis period. We also show that the interest-elasticity of deposits completely vanished during the banking crisis.

Second, we provide a set of predictive models of bank failures. These models show that deposit interest rates were one of the most significant variables predicting bank failures. High risk banks—the ones that eventually failed—often offered higher deposit interest rates than low risk banks.

Having shown that high deposit interest rates were a source of funding for risky banks, and that high deposit interest rates are correlated with eventual failure, we end the paper with a discussion of policy implications.

Keywords: interest rate regulation, banking crisis, bank failure models, financial liberalization
JEL Classification: G21, G28

1 Introduction

During the 1980's and 1990's, financial liberalization became an almost universally-accepted policy prescription. Large numbers of countries eased licensing, deregulated interest rates and dismantled systems of directed lending. However, banking system crises, first in the southern cone of Latin America in the early 1980's (Diaz-Alejandro, 1985), and later in the U.S., (White, 1991; Kane, 1989) Scandinavian countries (Nyberg and Vihriala, 1994; Vihriala, 1996) and a large set of emerging market economies, raised questions about the links between financial liberalization and instability (for cross-country econometric evidence see Demirguc-Kunt and Detriagache, 1998; 1999). While there are strong arguments and some evidence to argue that financial liberalization is beneficial in the long-term (Allen and Gale, 2003; Ranciere, Tornell and Westermann, 2003) there is much controversy about the medium-term costs and the optimal approach to regulation under liberalized conditions.

A crucial component of financial liberalization is the liberalization of interest rate setting. With the lifting of Regulation Q in 1980 in the United States, intellectual fashion moved against the regulation of deposit interest rates. However, in the decade that followed the lifting of regulation Q, the U.S. experience provided considerable anecdotal evidence about the negative effects of unlimited freedom to set deposit interest rates. Some aggressive banks used high deposit interest rates to fund their risky lending strategies. And the high deposit interest rates of these banks created a negative externality by forcing less risk-loving banks to raise their deposit rates to retain deposits, thus squeezing bank profits and creating a secondary impulse for less risky banks to actually increase the riskiness of their portfolio. Despite this, deregulation of deposit interest rates became a standard element of the financial liberalization package adopted by large numbers of countries.

Keeley (1990) argues that the increase in risk-taking following deregulation was the result of the combination of unrestricted competition with fixed-premium deposit insurance. Increased competition erodes franchise value. Under fixed-premium deposit insurance, this increases the attractiveness of added risk, since greater probability of failure is not reflected in higher premia and thus does not increase the extent of losses suffered by the owner under failure. At the same time, added risk implies higher earnings under favorable outcomes, and thus increases the bank's capital conditional upon survival. Keeley demonstrates that banks with greater market power maintain higher market-value capital-asset ratios and enjoyed lower interest rates on large, uninsured certificates of deposit. Reversing this, the erosion of franchise value caused by deregulation would lead to higher deposit interest rates.

Hellman, Murdoch and Stiglitz (2000) provide a theoretical argument to show that, in an environment with only capital adequacy regulation and no regulation of interest rates, banks may have an incentive to bid up deposit interest rates so as to gain the funding to "gamble" (increase asset risk). Only a combination of capital adequacy regulation and deposit interest rate limitations can implement the Pareto-optimal allocation under all circumstances. Capital adequacy regulation alone tends to fail when competition is strong, i.e precisely in deregulated banking systems. Hellman et al consider systems with and without deposit insurance, but they only consider fixed-premium insurance, and acknowledge that "sophisticated fee schemes can be used to reduce moral hazard".

This leaves open the question of whether the levying of risk-adjusted deposit insurance premia could eliminate incentives to excessive risk-taking. Chan, Greenbaum and Thakor (1992) argue that both incentive and information problems make fairly-priced deposit insurance unfeasible. This question has been hotly debated since then, but the thrust of the literature seems to lean against the feasibility of completely eliminating risk-taking via risk-adjusted deposit insurance premia (see, for example, Flannery, 1991; John and John, 1991; Crane, 1995; Kupiec and O'Brien, 1997; and Freixas and Rochet, 1998; Galac, 2004 provides an overview). Based on this, we hold that risk-adjusted premia, although possibly desirable, cannot be a panacea that wholly eliminates the problem of "market-stealing" increases of deposit interest rates to fund "gambling."

Taken together, all this points to a connection between "excessive" competition in the deposit market and suboptimal increases in risk taking. The transition countries of Central and Eastern Europe provide an interesting laboratory to test these arguments. Starting in the early 1990's, these countries rapidly liberalized their banking markets, removing restrictions on entry, asset composition and interest rates. For this reason, the experience of such countries may help confirm whether the U.S. experience of the 1980's was typical.

In this paper, we examine the experience of Croatia, which enacted rather liberal regulations regarding entry, asset composition and interest rates in the early 1990's. After the end of the wars surrounding the break-up of former Yugoslavia, Croatia experienced rapid growth in the number of banks, strong deposit growth and substantial increases in deposit interest rates in the period 1995-98. This buoyant period was punctuated by the failures of numerous medium-sized banks in 1998 and 1999.

Our argument is that high deposit interest rates helped fund the expansion of risk-loving banks, and had important negative external effects on healthy banks, thus making a strong contribution to the banking crisis of 1998-99. We proceed in two steps. First, using panel regression techniques, we provide evidence to show that banks were able to increase deposit growth, and thus fund rapid expansion, by raising interest rates in the pre-crisis period. We show that the interest-elasticity of deposits was positive and significant, so that "market-stealing" behavior a la Hellman et al was feasible. We also show that the interest-elasticity of deposits completely vanished during the banking crisis as a flight to quality occurred.

Second, we provide a set of predictive models of bank failures. These models show that high deposit interest rates were one of the most significant variables predicting bank failures. That is, high risk banks – the ones that eventually failed – often offered higher deposit interest rates than low risk banks.

Having shown that high deposit interest rates were a source of funding for risky banks, and that high deposit interest rates are correlated with eventual failure, we end the paper with a discussion of policy implications. We argue that some form of market-conforming regulations to prevent "market-stealing" would be an appropriate safeguard.

The paper proceeds as follows. Section 2 provides a brief overview of the liberalization of the banking market in Croatia in the 1990's and the dynamics of growth and crisis. Section 3 offers an econometric analysis of deposit growth. Section 4 presents models of failure and elucidates the role of deposit interest rates in failures. Section 5 provides a discussion of policy options and conclusions.

2 Liberalization, Growth and Crisis in the Croatian Banking Sector

The liberalization of the banking system in Croatia started while Croatia was still part of the former socialist Yugoslavia in 1989-90. A new banking law was enacted, allowing relatively free entry, and interest rates were deregulated. Bank supervision was established, but its effectiveness in the early years was limited.

Liberalization took place under conditions of war, accompanied by high inflation and sharp declines in output. A macroeconomic stabilization program implemented in October 1993 succeeded in bringing inflation under control, and real GDP growth began in 1994. Decisive military actions in May and August 1995, and the signing of the Dayton Peace Agreement in neighboring Bosnia and Herzegovina in November 1995 and the Erdut Agreement in late 1996 ended the period of conflict and brought about a sharp decline in political risk.

The number of banks grew rapidly, even during the war, rising from 22 in 1991 to some 61 in 1997. In addition, by 1997, 36 savings banks, with limited licenses, were also operating. Deposits began growing strongly in 1995. Growth came partly as a result of the return of deposits placed in foreign banks by Croatian citizens during the war. In addition, growing confidence in the banking system began to attract deposits held “in mattresses”.

Table 1. **Banking and macroeconomic overview**

	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
Number of banks	22	54	58	60	60	53	46	44	46	42
Foreign banks	0	1	5	7	10	13	20	24	23	19
Foreign bank assets share	0	1.0	1.0	4.0	6.7	39.9	84.1	89.3	90.2	91.0
Real GDP growth, %		6.8	6.0	6.8	2.5	-0.9	2.9	4.4	5.2	4.3
Inflation, %		3.8	3.4	3.8	5.4	4.4	7.4	2.3	1.9	1.7

1996 in particular witnessed a substantial increase in deposit interest rates at some banks. Interest rates on domestic currency deposits rose dramatically in late 1995 and early 1996 (see Figure 1). However, it should be noted that these deposits accounted for a very small portion of the total. Interest rates on fx deposits, the bulk of deposits, rose substantially later in the year. A number of banks offered interest rates on deposits in Deutschmarks that exceed comparable rates in Germany by some 800 to 1000 basis points (see Kraft, 1999 for details).

Deposits grew explosively in this period, with annual growth rates exceeding 50% through most of 1996 and all of 1997 (see Figure 2). Both kuna and fx deposits grew rapidly.

Figure 1. **Average bank deposit interest rates**

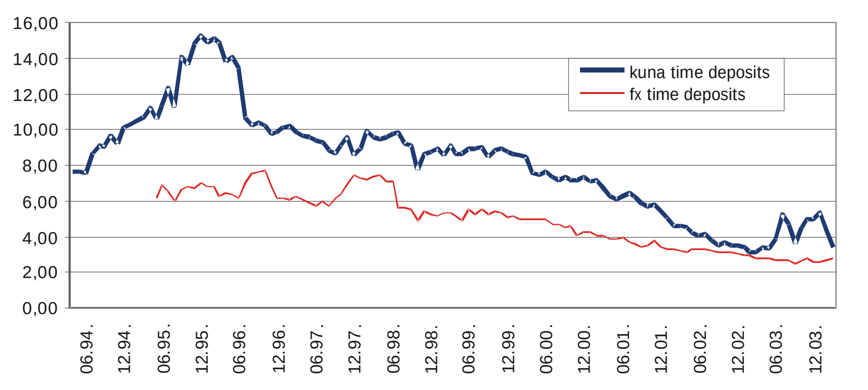
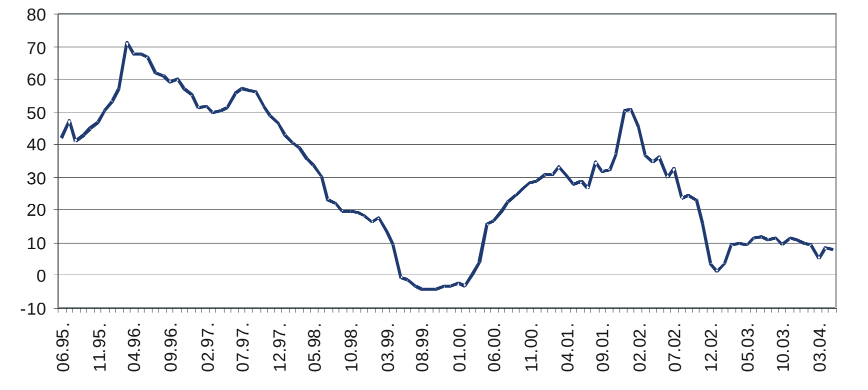


Figure 2. **Rate of growth of non-transactions deposits, % yoy**



At the same time, lending surged, reaching a peak growth rate of 44% in 1997. Such rapid growth suggested the presence of increased risk taking, and indeed, in 1998, several bank failures occurred. The failures continued into 1999, with a total of 16 banks accounting for approximately 20% of 1997 total banking assets failing in 1998-99. Deposit growth came to a halt, and aggregate deposits actually fell during the height of the crisis in February-May 1999. During the crisis, there were signs of a reallocation of deposits towards the foreign banks, as some domestic banks experienced substantial withdrawals.

The crisis was overcome through a combination of bankruptcies, lender-of-last resort actions by the central bank, and a turnaround in the macroeconomic situation starting in the second half of 1999. The sale of four banks that had been seized by the government to foreign strategic partners in late 1999 and early 2000 helped further consolidate the situation.

3 Econometric Analysis of Deposit Growth

The brief background sketched out in section 2 suggests that risk-loving banks used increases in deposit interest rates in the expansionary period of 1995-97 to fund rapid lending growth. However, once bank failures began, a flight to quality occurred, in which interest rates were no longer the decisive factor in deposit allocation.

To test whether this picture is accurate, in this section we build a panel model of depositor behavior and test it on the Croatian data. Our dependent variable is the quarterly rate of growth of deposits at individual banks. Depositors' decision to make deposits in a particular bank should be affected by the interest rate offered by the bank relative to interest rates offered by other banks. For this reason, we use the difference between the interest rate of the individual bank at a given time from the average for all banks at this time, rather than simply the interest rate of the individual bank.

Also, we focus on one particular interest rate, the interest rate of foreign currency time deposits. We do this for two reasons. First, by using a narrow category of deposits, we make sure that shifts in deposit composition do not contaminate the interest rate series. Second, foreign exchange time deposits are overwhelmingly the largest category of deposits, and thus it makes sense that savers would choose to make deposits on the basis of this interest rate (if interest rates are crucial to their choice of bank).

In addition, bank characteristics may affect depositor perceptions. However, it should be noted that disclosure about bank performance was fairly limited in Croatia in the 1990's. Banks were required to publish audited annual reports, and banks offers of interest rates and other deposit conditions were also public knowledge. However, banks were not required to provide any higher frequency information about themselves, and the Croatian National Bank, the regulatory institution, did not publish any further bank data. Central bank analysts did publish two overviews of bank performance during 1997, one of which used peer group data (Kraft and George, 1997) and the other of which pointed out the dangers of rapid growth and singled out a set of rapidly-growing banks (Šonje, 1997).

A crucial element in depositor behavior towards bank risk is the existence of deposit insurance. A Law on Deposit Insurance was passed in 1994 (Government Gazette 44, 3, June 1994). However, enabling legislation was only passed much later, providing for the collection of the first insurance premia in mid-1997 and the introduction of limited insurance (full coverage of all household savings deposits up to 30,000 HRK, and 75% of the amount of deposits between 30,000 and 50,000 HRK) was announced for January 1, 1998. Thus, while insurance was not in place in 1996 and 1997, it was expected in the immediate future.

Furthermore, the experience of the early 1990's could easily have lead savers to believe that the government would not tolerate bank failures. The second, third, fourth and fifth largest banks in the country were clearly insolvent as of 1995, and were taken over and recapitalized by the government in 1995 and 1996. This, and the rather politicized banking environment, could well have created expectations either that banks would not be allowed to fail, or that an implicit government guarantee was available. Only in March 1999, when four banks were sent to bankruptcy, did it become entirely clear that failures would happen and that deposit insurance coverage was limited.

Given this situation of a perception of strong government guarantees, one would expect that depositors would be relatively indifferent to bank risk in allocating their deposits. However, it still seems important to control for bank characteristics in modeling deposit allocation. For one thing, bank size could impact on the convenience of making deposits and on name recognition. For another, even if a relatively limited number of depositors chose banks on the basis of perceived soundness, indicators of solvency would be relevant. We therefore include Tier 1 capital to asset ratios as a way of seeing whether this very broad indicator of soundness affected depositors' behavior, with the caveat that depositors would only have had the previous year's end-year figure to work with. However, capital asset ratios change slowly in quarterly data.

We intentionally avoid using asset quality data as an indicator of bank soundness for two reasons. First, such data was not available at all to the public, since it was not disclosed in annual reports or in central bank publications. Second, the data before 1999 was clearly unreliable. In several bank failures, asset quality was found to be very poor upon failure, but previous call reports indicate minimal problems. Bank supervisors had been unable to ensure accurate reporting in many cases.

A last bank characteristic variable is a dummy variable for foreign banks. Casual empiricism suggests that foreign banks enjoyed reputational advantages over domestic banks that allowed them to gather deposits more rapidly.

In addition, we control for macroeconomic conditions that would shift the rate of growth of deposits from quarter to quarter. We use the rate of growth of real GDP and inflation to pick up changes in income and activity.

Finally, we use dummy variables for the period before, during and after the banking crisis. These dummies are interacted with the interest rate differential term to allow us to pick up the changes, if any, in deposit interest elasticity over the three periods.

Before proceeding to describe the regressions, it should be noted that we are testing the interest elasticity of deposits and not the relationship between perceived bank risk and interest rates on uninsured bank liabilities. The latter relationship is indicative of the potential level of market discipline. Martinez Peria and Schmukler (2000) have analyzed this effect for a set of Latin American countries, and Ellis and Flannery (1992), Brewer and Monschean (1994) and Keeley (1990) have analyzed this effect for U.S. banks. We argue that interest rate differentials at Croatian banks in the pre-crisis period were mainly generated by aggressive banks' desire to grow rapidly, and not by depositors' "punishing" perceived risk-takers. However, to test for such "market-discipline" behavior, we have included the bank characteristic variables, log total assets and Tier 1 capital ratio, in our specification. Given the low credibility of deposit insurance in Croatia, we cannot a priori dismiss the hypothesis that depositors "punished" risky banks with higher deposit interest rates even after the introduction of deposit insurance in the beginning of 1998.

The regressions are run on quarterly data spanning the third quarter of 1996 and the third quarter of 2003 using pooled least squares. The bank-by-bank data are taken from Croatian National Bank call reports, while the macroeconomic data are taken from the CNB Bulletin and the Bulletin of the Central Bureau of Statistics. Interest rate variables are contemporaneous, but the bank characteristics variables are lagged one quarter. This effectively means using the value at the end of the previous quarter, immediately before the start of the current quarter.

The results are shown in Table 2 below. Column 1 shows the results without macroeconomic control variables, and Column 2 shows the results with macroeconomic control variables.

Table 2. **Determinants of growth rate of foreign exchange time deposits**		
	(1)	**(2)**
Constant	0.205 (2.74)**	0.213 (2.83)**
Interest differential	0.032 (3.70)**	0.032 (3.81)**
Interest differential x Crisis dummy	-0.062 (5.78)**	-0.062 (5.78)**
Interest differential x Post-crisis dummy	-0.038 (3.86)**	-0.037 (3.82)**
Deposit growth (-1)	0.105 (2.17)**	0.104 (2.14)*
Foreign bank dummy	0.071 (3.77)**	0.072 (3.76)**
Log total assets (-1)	-0.004 (0.85)	-0.004 (0.83)
Tier 1 capital/assets (-1)	-0.011 (0.24)	-0.008 (0.17)
Crisis dummy	-0.054 (2.12)*	-0.057 (2.21)*
Post-crisis dummy	-0.057 (2.72)**	-0.060 (2.87)**
Euro-effect dummy	0.100 (3.29)**	0.096 (2.71)**
Real GDP growth		0.091 (0.99)
Retail price inflation		-0.870 (1.00)
Adjusted R-squared	0.173	0.167
F-statistic	25.81	21.796
(probability)	0.000	0.000

*Note: Number of cross-sections: 29. Total observations: 1243. ** Significant at 1%, * significant at 5%, + significant at 10%.*

The most important message is this: the interest-elasticity of deposits is positive during the rapid expansion period, and then actually becomes negative during the crisis period. This negative value is confirmed by a Wald test, which shows that the estimated value -0.019, and the probability of this value being equal to 0 is p=0.0005. Furthermore, after the crisis, the interest-elasticity rises relative to the crisis period but the point estimate remains slightly negative. A Wald test shows that we cannot reject the hypothesis that the post-crisis elasticity is zero (p = 0.2596).

To complete the picture, note that the dummy for foreign banks is significant for the whole period, indicating that foreign banks showed more rapid deposit growth. We tested for changes in the foreign bank effect by interacting the foreign bank dummy with the crisis and post-crisis dummies (results not shown). During the crisis period, the foreign bank dummy seems to rise, but the interacted crisis-foreign bank dummy is not significant at conventional levels (t=1.29). However, this is not the whole story, since foreign banks offered lower deposit interest rates than domestic ones (Galac and Kraft, 2000). The significant negative interest-elasticity during the crisis period thus implies an even larger differential between deposit growth at foreign banks and that at domestic banks during the crisis period.

The interaction of the foreign bank dummy with the post-crisis dummy was highly insignificant, suggesting that there was no change in the foreign bank effect after the crisis was over.

Thus, the story of a sharp shift from a situation in which deposits had a high positive interest elasticity to one in which high deposit interest rates were taken as a sign of heightened risk is confirmed. In addition, we can note that both the log total assets and capital-adequacy ratio variables proved insignificant, further adding to the argument that depositors did not perceive differences in bank risk as important in their deposit allocations before the crisis.

At the same time, the zero interest elasticity of deposits in the post-crisis period suggests that depositors remained concerned that high deposit rates might signal greater risk. Furthermore, this zero elasticity suggests that deposit insurance was not considered credible. This is hardly surprising, since deposit insurance payouts were extremely slow during the 1998-99 bank failures. In some cases, the period between the blocking of the bank’s accounts and the payment of insurance was almost two and half years. Even if interest were paid on deposit liabilities, liquidity-constrained depositors would certainly not be indifferent to failure in such a situation.

We also tested for changes in depositors’ risk-perceptions by interacting the dummies for the crisis and post-crisis period with the bank characteristic variables, log total assets and tier 1 capital ratio (results not shown). The interacted variables also were insignificant. It would be hasty, however, to conclude from this that Croatian depositors did not “punish” banks perceived to be risk in the crisis and post-crisis periods. Rather, a more plausible interpretation of the findings would be that Croatian depositors presumed foreign banks to be less risky throughout the whole period, and that they perceived banks offering high interest rates to be risky during the crisis and to an extent after it. The continued perception by at least some depositors that high deposit interest rates are a sign of risk could help explain the estimated zero interest elasticity in the post-crisis period.

4 Deposit Interest Rates and the Causes of Bank Failures

Now that we have shown that banks were able to gain increased access to funding by raising deposit interest rates, we can examine whether there was a connection between high deposit interest rates and bank failure. Most research suggests that bank failures occur as a result of credit boom and bust cycles (see Logan, 2000), recklessness and fraud, and poor management. All other frequently cited reasons can be classified as belonging to the latter category (see Honohan, 1997).

Furthermore, bank failures are rare events. This makes it hard to study their causes and consequences using econometric techniques. Actually, they appear in clusters during times of political or economic instability or transition, and then they are reasonably referred to as a "banking crisis" (Hardy, 1998). This is why most empirical studies examining causes of bank failures are cross-section analyses of pre-banking crisis bank characteristics that can be reasonably conjectured to have caused the failures during the crisis.

The empirical literature on leading indicators of bank failures suggests that leading indicators can be roughly categorized into five classes: CAMELS grades, international agencies' ratings, market prices of bank stocks and subordinated debt, (standard) balance-sheet and income statements financial ratios, and other (non-standard) measures of bank risk and financial strength.

Regarding the first two classes, there is increasing evidence that traditional CAMELS grades and especially international credit ratings have limited bank failure prediction capabilities in emerging market countries. (Rojas-Suarez, 2001). Furthermore, there is some empirical evidence on the weakness of market prices in predicting bank failures not only in the less developed financial systems such as South-East Asian (Bongini et al., 2001), but also in the most developed banking systems with deep and liquid markets such as that of the US (Gilbert et al., 2001). This evidence contests the logical expectation that CAMELS grades, international agencies' ratings, and market price risk premia - all containing implicit assessments of the probability of a bank's failure by the most informed market participants – should be closely correlated with the probability of bank failure.

In the case of Croatia, this discussion is somewhat academic due to lack of data. Only one Croatian bank had been rated by an international agency prior to 1998, and only a few banks have ever had their stocks or bonds listed on the market. Also, there is no market for CD's. Furthermore, even though the interbank market is active in Croatia, it is concentrated on trading in very short term instruments whose prices carry little information on individual banks' risk premia. Finally, the Croatian National Bank, which supervises commercial banks, had not introduced CAMELS grades prior to the banking failures studied here.

The remaining two classes of potential explanatory variables for our bank failure prediction model are standard balance sheet and income statement ratios and other non-standard indicators of banks' financial condition and risk profile. Among them, the ones most commonly found in empirical studies[1] can further be categorized according to specific risks or strengths that they measure or proxy (see Appendix Table 1). We included most of these indicators in our initial analysis, and added some additional ones to measure or proxy specific risks faced by Croatian banks of the mid-90's (for more information see the detailed discussions of these risks in Kraft, 1999; Šonje and Vujčić, 1999; and Jankov, 2000).

We compiled a list of 38 potential explanatory variables for bank failure prediction, including 33 ratios, 2 interval values, and 3 dummies. The three dummies are: new (founded after 1989), foreign (founded as a foreign subsidiary), and "too big to fail" (by our own expert judgment). Two interval-type variables, eventually to be used for control purposes, are total assets and total off-balance sheet assets. The remaining 33 "ratios" include standard financial ratios for banks, such as return-on- average-assets and Basel-type capital adequacy ratios, but also a number of less standard measures and "quasi-ratios" (see Appendix Table 2).

Choice of the dependent variable required making several expert judgments. The first decision was whether to include both distressed and failed banks. Since the definition of distress is intrinsically subjective, and in practice often based on perceived levels of the very variables that are included in the candidate explanatory variables list, we chose to consider only effectively failed banks, i.e. those banks that eventually entered into a bankruptcy or a liquidation process (14 banks) or had been taken into state receivership

[1] *See for example Logan (2000), Gonzalez-Hermosillo (1999), Hanousek (1999) and Rojas-Suarez (2001).*

and rehabilitated at taxpayers' expense (2 banks). Exceptionally, we also consider one bank as failed that does not formally meet these criteria, but is known to have been insolvent in 1999-2000.[2]

A second, related decision was to extend the time horizon for failure of bankrupt and liquidated banks, since most actually entered into bankruptcy or liquidation only after the 1998-99 crisis period, due to the unusually slow legal process of bank closure in Croatia. To be precise, we labeled as failed all banks operating at the beginning of 1998 that ceased operations before 2003 due to observable effects of the banking crisis.

Since all of the failed banks were in operation by 1996, and all but one were in operation by 1995, all of the failed banks are included in our analysis. Two foreign owned subsidiaries that only started their operations in 1997 and the one foreign branch established were excluded from the analysis, since their operations were unusual enough to produce extreme outliers on most candidate variables. This resulted in a sample of 17 failed and 40 surviving banks. Also, since not all candidate variables were measured in all three years of interest, and some banks started operating during this period, not all variables that are measured in all three years have measurements on all banks for all years.

To develop bank failure prediction models, we began by running normality tests on the candidate explanatory variables. Ex-ante, such ratio variables are expected to be highly non-normal. We used nonparametric methods to select those variables that had statistically significant discriminatory power in separating failed from survived banks. Then, considering the binary nature of the dependent variable, we examined various specifications of logistic (logit) regression models combining the variables from this reduced set, and selected the best model for each year separately, based on statistical properties and parsimony.

We used the Kolmogorov-Smirnov test for normality with Lilliefors' significance correction, and the Shapiro-Wilk test for variables on which there were fewer than 51 observations (see Appendix Table 3). The tests found that normality could not be rejected at the five percent significance level for only 5 of 35 variables tested. Even

[2] *The bank was found to be insolvent by central bank examiners. A central bank administrator was appointed, and the announcement of his appointment led to a bank run. The bank was temporarily closed, and then recapitalized by government payment of back interest on certain government securities held by this bank and others. Later the bank was sold.*

among these variables, this result held true in two years for only 2 variables, and it did not hold for any variable for all three years. Therefore, we concluded that by and large the explanatory variable data set contains variables that are non-normally distributed, and as such require the use of nonparametric techniques in further analysis.

To select variables with statistically significant discriminatory power for bank failure prediction we used the Mann-Whitney U-test (see Table 4 in the Appendix) for the difference in medians between the group of failed banks and the group of survived banks. At the ten percent (two-tailed) significance level, the test found four variables that were statistically significant in every year in which they were measured. It found an additional three variables that were statistically significant in two out of three years, and seven variables that were significant in only one of three years. The seven variables and their group medians with respect to the dependent variable are shown in Table 3.

Table 3. **Bank failure final sample variables**

Year	Group	DR	LIQ	CAR	RLAR	LR	OHER	CM
y=1995	F=0	3.9	0.1			24.5	47.8	103.1
	F=1	6.4	-0.1			26.4	52.6	99.3
	Total	4.4	0.0			24.9	50.2	101.0
Mann Whitney U Test p		0.0001	0.0035			0.1330	0.2755	0.4294
y=1996	F=0	3.2	12.7	35.4	3.8	21.6	52.7	95.4
	F=1	7.4	-13.3	20.2	10.2	26.2	49.9	86.4
	Total	4.4	8.2	31.2	5.5	22.7	50.6	95.1
Mann Whitney U Test p		0.0000	0.0009	0.0126	0.0533	0.0143	0.0752	0.0494
y=1997	F=0	3.0	13.2	26.8	2.9	15.0	55.9	74.2
	F=1	5.8	-2.3	15.2	11.5	18.7	43.4	57.0
	Total	3.5	8.4	24.4	3.6	16.2	50.9	72.6
Mann Whitney U Test p		0.0001	0.0002	0.0024	0.0455	0.0066	0.0396	0.0347

DR represents the annual average of monthly volume weighted average deposit rates on new or renewed foreign currency denominated deposits. LIQ is the annual average of daily ratios of non-borrowed excess reserves to required reserve deposit base. CAR (capital adequacy ratio) is just a year-end standard Basel I type regulatory capital to risk weighted assets ratio. RLAR is a year end risky loans to total assets ratio, where risky loans are defined as large and very large loans as well as total exposure to connected parties. Computed analogously to DR, the LR variable represents the loan rate on domestic currency denominated new loans. The only income statement indicator among the selected variables, OHER is the year-end proportion of overhead expenses in total expenses. Finally, the only balance-sheet variable in the selected group, CM (currency mismatch indicator) is the ratio of total foreign currency assets and foreign currency deposits.

Before analyzing the possible causal relationships between the bank characteristics measured by the selected variables and bank failures, it is surprisingly informative to examine some of the standard bank analysis ratios that did not make it to that list. For instance, in 1996 both the median ratio of (reported) impaired claims to total assets and the median ratio of (reported) nonperforming assets to total assets are actually lower for failed banks than for survived banks. In 1997 this relationship is reversed, but even then, the two ratios are statistically highly insignificant in both years. Similarly, we find the standard measures of profitability also statistically highly insignificant in 1995 and in 1997. At a same time the medians of these ratios, return on average assets (ROA) and on average equity (ROE), are indeed (slightly) lower for the failed banks in those two years, as expected. Surprisingly, both variables are statistically significant in 1996, the only year for which the medians are noticeably different.

On the one hand, these results could indicate that the failed banks split into two camps – banks that reported (more realistic) low profits and banks that reported (unrealistically) high profits, compared to the overall median. If this is correct, then they also point towards overvaluation of asset quality by failed banks as a cause for overestimation of profits. On the other hand, the results could imply that the distribution of profitability measures is similar across the failed and across the survived banks (except in 1996), which would point to factors other than profitability (or asset quality) as responsible for the bank failures.

Another group of standard bank analysis variables that is omitted from the final selection are measures of growth. Unlike the profitability and asset quality measures, all three growth measures from the initial variable set were only mildly insignificant in most years, and two of them were significant in one of three years. However, contrary to expectations, the median credit growth for the failed banks is lower than for the survived banks in 1997, the only year for which the credit growth variable showed discriminatory power. By contrast, the median off-balance sheet asset growth is, as expected, much higher for failed than for survived banks in the only significant year, 1995. Finally, the total balance sheet growth variable has no predictive ability in any period. These results suggest that there is no simple relationship between bank growth and bank failure.[3]

Having eliminated simple explanations of 1998-99 bank failures in Croatia, one must turn to the selected seven variables: DR, LIQ, CAR, RLAR, LR, OHER and CM. Representing the features most closely associated with the observed bank failures, these variables also offer hope of explaining why "natural" candidate predictors of bank failures - low profitability, high levels of bad assets, and rapid growth – are not useful for explaining 1998-99 bank failures in Croatia. Looking back to Table 3 it is easy to see that the first four variables all have the expected relative values in all years. Thus, the failed banks as a group have higher deposit rates, lower non-borrowed excess reserves, lower capital adequacy and higher levels of risky loans. They also have higher loan rates in all three years, which is consistent with the anecdotal evidence that these banks attracted riskier clients and at the same time mispriced their risk. This contrasts with the more prevalent cross-country finding that low spreads are strongly associated with bank failures (Rojas-Suarez, 2001), perhaps because sudden appearance of fierce competition for deposits raises deposit rates, thus squeezing the margins and causing failures of the internally most inefficient banks.

The remaining two variables, OHER and CM, are both insignificant in 1995, and in 1996-97 their relative values are difficult to interpret. It is not clear whether the fact that the failed banks had a lower proportion of overhead expenses in total expenses indicates that their failure is in some way connected with a lower quality of employees and infrastructure. It is perhaps more likely that this result simply mirrors a higher proportion of interest expenses in total expenses at those banks, pointing to inefficient liability management. Even more confusing is the lower coverage of foreign currency denominated deposits with foreign currency assets at the failed banks. This result could reasonably be directly related to bank failure only if conditions existed that prevented banks from transforming domestic currency assets into foreign currency cash in order to meet higher demand for savings deposits during the crisis. Since this was not the case, it is possible that this variable indirectly measures some other risky behavioral pattern of the failed banks, for instance lower holdings of liquid reserves that are often held in the form of foreign currency deposits at foreign banks.

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[3] *For a more detailed discussion of this issue, see Kraft and Jankov (2004).*

Returning to the first four variables, each highly significant and with expected and persistent sign, it is worthwhile to try to interpret possible causal relationships between them and bank failure. The most likely explanation of the causality between high deposit rates and bank failures has already been suggested: aggressive banks used high deposit rates to fund their excessively risky business strategies, which eventually led them to failure. The negative relationship between the narrow measure of liquidity (provided by the non-borrowed reserves ratio) and the failure variable can be explained by a temporary failure of the domestic money market during the early stages of the banking crisis, or in a wider context, by the poor liquidity of all economic agents preceding the 1999 recession (Šonje, Faulend and Šošić, 2001) that made it difficult for illiquid banks to raise funds in those times of need. Alternatively, it can be explained by the generally accepted notion that, for banks, chronic illiquidity is almost always a sign of (hidden) insolvency (De Juan, 1996). For chronically illiquid banks, failure is just a question of "when".

It is worth mentioning that deposit rates and narrow liquidity are by far the most significant predictors of bank failure in our sample, with Mann Whitney U test significance levels well below one percent. The other two important variables are capital adequacy and risky loans, neither of them measured in 1995. Nevertheless, significant expected relationships with the failure variable in 1996 and 1997, and trivial interpretation makes these variables equals with the measures of deposit rates and liquidity.

Further confirmation of an unusually strong connection between deposit rates and bank failures in Croatia comes from the best logit model selection process that was performed separately for each of the three years in the sample. All variables found significant by the Mann Whitney U test for a particular year were considered for inclusion in the final model. All intermediate models were estimated using the approximate proportion of the number of failed banks in the sample (30-35%, depending on the year) as the logit model cutoff probability, emphasizing the importance of correctly predicting as many failed banks as possible. All models were estimated with the constant included, and only those with stable parameters, i.e. with the 95-percent confidence interval for the estimated odds-ratio not including the unity, were considered in the final step of the selection process.

Before the final step in the selection process, both forward and backward automatic selection procedures were performed to select several non-nested alternative specifications with good statistical properties. The automatic procedures were based on the significance of the increase/decrease of the -2LL (log-likelihood) statistic when going from one nested model to another. Variables whose addition resulted in a significant reduction in the -2LL statistic at the 5 percent level were added to the model, and those whose deletion did not result in a significant increase in the -2LL statistic were dropped from the specification. Finally, for choosing between two non-nested models with similar in-sample classification results, the more parsimonious model was chosen, or in the case of a tie, the one with less influential observations or outliers. The best models by year are presented in Table 4.

Table 4. **The "best" logit specifications**

Y=1995									
	Cut = 0.35	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
	DR95	1.13	0.363	9.72	1.00	0.00	3.1	1.5	6.30
	Constant	-6.24	1.827	11.68	1.00	0.00	0.0		
* Total obs. = 57, missing = 12; Total outliers = 1, missclasified = 1; Total error = 24.4%, for failed = 33.3%, for survived = 20%									
Y=1996									
	Cut = 0.3	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
	CAR96	-0.05	0.025	3.94	1.00	0.05	1.0	0.9	1.00
	DR96	1.00	0.293	11.75	1.00	0.00	2.7	1.5	4.84
	Constant	-4.38	1.459	9.01	1.00	0.00	0.0		
* Total obs. = 57, missing = 5; Total outliers = 1, missclasified = 1; Total error = 17.3%, for failed = 11.8%, for survived = 20%									
Y=1997									
	Cut = 0.3	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
	DR97	0.57	0.191	8.79	1.00	0.00	1.8	1.2	2.56
	RLAR97	0.06	0.032	3.55	1.00	0.06	1.1	1.0	1.13
	Constant	-3.85	1.040	13.68	1.00	0.00	0.0		
* Total obs. = 57, missing = 3; Total outliers = 3, missclasified = 3; Total error = 20.4%, for failed = 17.6%, for survived = 21.6%									

The DR variable entered the best model in each of the three years. More importantly, only two other variables contributed to the model fit when added to the DR variable: the CAR variable in 1996 and the RLAR variable in 1997. The second best individual predictor of bank failure, variable LIQ did not enter any of the best models due to its high degree of correlation with the DR variable in each year. This relationship has been already documented and interpreted in earlier studies (Kraft 1999). Furthermore, the DR variable is highly correlated with most of the other variables in most of the years, except for the CAR and RLAR variables. But, CAR and RLAR themselves are highly correlated, which explains why only one of them enters into a single model (see Appendix Table 5).

Furthermore, it seems that deposit rate variable DR is not only the best individual predictor of 1998-99 failures of Croatian banks, but it is a better predictor than all viable combinations of other good individual predictors. To test this we repeated the logit model selection process, this time without the DR among the variables considered. The comparison of the model specification containing only the DR variable, and the specification containing the best model not containing the DR variable, for each year separately, shows that the DR model is superior to all non-nested alternatives, as is evident from Table 5 (actually, the best model for 1997 has a lower -2LL statistic, but it lacks parsimony, it has two more outliers, and it is only better in identifying survived banks, so it can be considered inferior to a simple DR model). Though seemingly extreme, this result is not unprecedented, but rather it is strikingly similar to a similar finding from a study of bank failures during mid-nineties in the Czech Republic (Hanousek, 1999).

Table 5. **Comparison of DR models with "best" non-nested alternatives**

Variables in the model	No. of obs.		Outliers		Class. error, %			-2LL
	Total	Missing	Total	Miscl.	Total	for Failed	for Survived	
Y=1995								
DR	45	12	1	1	24.4	33.3	20.0	33.62
LIQ	48	9	1	1	31.3	43.8	25.0	52.62
Y=1996								
DR	52	5	2	2	19.2	23.5	17.1	40.20
ROA, LR	52	5	2	2	25.0	23.5	25.7	45.45
Y=1997								
DR	54	3	3	3	24.1	23.5	24.3	53.64
LR, OHAR, RLAR, CAR	56	1	5	3	19.6	23.5	17.9	44.89

In the last step, we verified that the DR variable measures a unique characteristic of bank behavior in the 1995-97 period, by reestimating the DR model for each year and for each of the five control variables (balance sheet size BS, off-balance sheet size OBS, foreign subsidiary dummy FOR, too-big-to-fail dummy TBTF, and new bank dummy NEW). As expected, including any of the size variables in the regressions was fruitless. Their individual Wald statistics were highly insignificant, while the overall model fit did not change. Also, all interactions between the DR variable and the three dummies were highly insignificant, as were the main effects of the dummies in those regressions.

These findings strongly suggest that high bank deposit rates in the 1995-97 period are the most powerful predictors of bank failures during the 1998-99 banking crisis in Croatia. Moreover, their individual predictive power cannot be exceeded even by a carefully chosen combination of other strong individual predictors of bank failure. Also, no other strong individual predictor can significantly contribute to the predictions based solely on deposit rate levels. Finally, there are no interactions between deposit rates and other important measurable qualitative bank characteristics that can further contribute to bank failure predictions.

5 Conclusions

The findings in this paper lead us to the following conclusions:

1) "Market-stealing" via high deposit interest rates can be an effective strategy in banking markets characterized by substantial competition. In Croatia, depositors appear to have been relatively slow to link high deposit rates with increased portfolio risk. We suggest that this was due to perceptions of an implicit government guarantee, along with depositor inexperience. We would stress that such circumstances are common in newly-liberalized financial markets and are unlikely to have been unique to Croatia.

2) Gaining credibility for deposit insurance after a bank crisis can be difficult. In the Croatian case, where long delays in deposit insurance payout caused substantial problems for depositors, it is clear that credibility has not been fully restored even four years after the bank crisis, as is suggested by zero interest elasticity of deposits.

3) Foreign banks from advanced countries enjoy a reputational advantage that allows them to raise deposits despite offering lower interest rates. They were perceived by Croatian depositors as "safe havens" during the 1998-99 banking crisis. This, of course, is one of the reasons for the rapid expansion of foreign banks' market share in Croatia and almost all of the transition countries.

4) The link between high deposit interest rates and portfolio risk predicted by theory is confirmed in Croatia. Although deposit interest rates are not the only predictor of failure, they are in fact the best predictor of failure in the Croatian case.

5) Our findings therefore lend strong support to the Hellman-Murdock-Stiglitz argument for deposit interest rate control. The Croatian case confirms the effectiveness of "market-stealing" and the links between this and risk-taking.

6) At the same time, the Croatian case shows the inability of newly created supervisory authorities to effectively limit risk-taking. Deposit interest rate limitations are much easier to implement than sophisticated supervisory assessments of portfolio risk, and thus seem to be a theoretically justified and practically feasible means to limit the dangers of financial liberalization without preventing reforming countries from enjoying the benefits.

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Appendix

Table 1. **Typical leading indicators in bank failure prediction research**
Credit risk indicators: • loan growth, provisions to assets ratio, balance sheet growth, classified to total assets, non-performing loans to total loans
Liquidity risk indicators: • short term assets to short term liabilities, inter-bank loans to total liabilities, loans to deposits, loans to assets
Concentration risk indicators: • large exposures to total assets, large deposits to total deposits, sectoral loan shares, net interest income to total income
Capital strenght: • total assets, capital adequacy ratio, capital to assets, return on assets, return on equity
Efficiency: • net-interest margin, interest rate spreads, overhead expenses to assets
Other strengths and hazards: • age, «too big to fail» dummy, strong «parent» dummy, «foreign» dummy, deposits rates, loan rates, insider loans to assets

Table 2. **Definition of variables**				
Type	**No. Code**	**Description**	**Measured risk**	**Expected sign**
Dependent	FNAR	Narrow failure indicator – bankrupt, liquidated, rehabilitated	----	----
Dummy	1 NEW	Founded after 1989 indicator	Control	+
	2 FOR	Founded as foreign daughter indicator	Control	-
	3 TBTF	Too big to fail by expert judgement indicator	Control	-
Interval	4 BS	Total balance sheet size	Control	-
	5 OBS	Total size of off-balance sheet items	Control	+
Ratio	6 CAR	Basel 1 capital adequacy ratio	Capital strength	-
	7 RLAR	Very risky loans/total BS assets	Risk-aversion	+
	8 RIAR	Very risky investments/total BS assets	Risk-aversion	+
	9 ROBAR	Uncollateralized off-bs assets/total BS assets	Risk-aversion	+
	10 RMBAR	Mortgage backed BS&OBS claims/total BS assets	Risk-aversion	+
	11 NPAR	Non-performing BS&OBS assets/total BS assets	Asset quality	+
	12 IMPAR	Imapired BS&OBS assets/total BS assets	Asset quality	+
	13 CM	Foreign currency assets/fc deposits	Foreign exchange	-
	14 MM	Short term assets/st deposits	Liquidity	-
	15 SDI	1 – Sum (sector ass. square)/Total ass. square	Sectoral	-
	16 NCSSR	Non-core sources/sources	Liquidity	+
	17 FAAR	Fixed assets/assets	Liquidity	+
	18 PIAR	Permanent investment/assets	Liquidity	+
	19 AARER	Accruals&arrears/revenues&expenses	Liquidity	+
	20 ROA	Return on end-year assets	Profitability	-
	21 ROE	Return on end-year equity	Profitability	-
	22 PAR	Provisions/assets	Asset quality	+/-
	23 PCR	Provisions/equity	Asset quality	+/-
	24 LTIAR	Long-term investment/assets	Liquidity	+
	25 LDR	Loans/deposits	Liquidity	+
	26 DLR	Deposit placements/loan sources	Liquidity	+
	27 MGPPR	Money & gov. paper/core sources	Liquidity	-
	28 NIM	Net interest margin	Efficiency	-
	29 OHAR	Overhead exp./assets	Efficiency	+
	30 OHER	Overhead exp./expenses	Efficiency	+
	31 OBBR	Off-bs assets/bs assets	Control	+/-
	32 BSAG	Annual balance sheet growth rate	Growth	+
	33 OBSAG	Annual off-balance sheet growth rate	Growth	+
	34 LR	Interest rate on credits in national currency, ann. avg.	Adverse selection	+
	35 DR	Deposit rate on foreign currency savings, ann. avg.	Moral hazard	+
	36 SPR	LR-DR	Efficiency	-
	37 LIQ	Non-borrowed excess reserves/req. res. deposit base	Liquidity	-
	38 CRAG	Annual loan growth rate	Growth	+

Table 3. **Median descriptives for initial predictors**

	Median statistics						Tests of Normality* (Pooled)		
	N	**Total**	**N**	**F=0**	**N**	**F=1**	**Statistics**	**df**	**Sig.**
NIM95	51	14.03	35	13.96	16	15.64	0.10	51.00	0.200
OHAR96	57	9.32	40	9.02	17	9.57	0.07	57.00	0.200
OHER95	52	50.24	36	47.78	16	52.56	0.09	52.00	0.200
OHER96	57	50.60	40	52.75	17	49.92	0.06	57.00	0.200
DR96	52	4.38	35	3.25	17	7.38	0.11	52.00	0.154
MBAR96	57	25.04	40	23.40	17	31.40	0.11	57.00	0.087
DR97	54	3.51	37	2.98	17	5.78	0.12	54.00	0.066
PAR95	52	7.47	36	8.76	16	4.88	0.12	52.00	0.044
LR96	54	22.74	37	21.56	17	26.21	0.13	54.00	0.035
SPR97	54	12.17	37	12.04	17	14.00	0.13	54.00	0.029
MGPPR95	51	20.89	35	19.64	16	21.60	0.13	51.00	0.026
LR97	56	16.17	39	14.97	17	18.66	0.13	56.00	0.024
MBAR97	57	26.78	40	27.88	17	21.52	0.13	57.00	0.022
SPR96	52	18.38	35	18.31	17	18.45	0.14	52.00	0.013
SDI96	57	56.31	40	54.09	17	61.09	0.13	57.00	0.012
BS94	48	245,573	32	313,404	16	188,477	0.39	48.00	0.010
OBS94	48	41,187	32	47,763	16	31,251	0.33	48.00	0.010
CM95	50	100.96	34	103.11	16	99.35	0.45	50.00	0.010
DLR95	44	131.22	29	124.00	15	138.44	0.42	44.00	0.010
DLR96	46	118.87	30	111.86	16	150.13	0.75	46.00	0.010
BSAG95	48	15.90	32	12.93	16	42.95	0.54	48.00	0.010
OBSAG95	48	95.79	32	65.82	16	214.96	0.50	48.00	0.010
DR95	47	4.40	32	3.95	15	6.44	0.91	47.00	0.010
SPR95	48	20.24	33	20.20	15	20.93	0.77	48.00	0.010
CRAG95	48	21.58	32	19.23	16	44.98	0.58	48.00	0.010
PAR96	57	5.87	40	6.57	17	4.60	0.14	57.00	0.010
OBBR96	56	26.08	39	29.08	17	18.83	0.14	56.00	0.008
IMPAR97	57	7.38	40	7.09	17	10.20	0.14	57.00	0.005
SDI97	57	62.87	40	64.27	17	58.43	0.15	57.00	0.003
ROBAR97	57	7.48	40	7.04	17	12.38	0.15	57.00	0.003
FAAR95	52	4.92	36	4.92	16	4.63	0.16	52.00	0.003
IMPAR96	57	8.50	40	9.26	17	7.21	0.15	57.00	0.003
NCSSR97	57	8.01	40	6.83	17	10.57	0.15	57.00	0.002
OBBR95	52	25.07	36	27.32	16	22.67	0.16	52.00	0.002
PAR97	57	4.80	40	4.60	17	4.80	0.16	57.00	0.001
MGPPR96	55	24.46	38	29.62	17	19.47	0.16	55.00	0.001
RIAR96	57	7.82	40	8.18	17	7.00	0.16	57.00	0.001
RIAR97	57	7.45	40	6.87	17	7.51	0.16	57.00	0.001
MGPPR97	57	16.56	40	16.56	17	16.24	0.17	57.00	0.000
OHAR95	52	9.30	36	9.13	16	10.12	0.17	52.00	0.000
OHAR97	57	7.32	40	6.95	17	8.22	0.18	57.00	0.000
FAAR96	57	5.65	40	6.06	17	5.07	0.18	57.00	0.000
FAAR97	57	5.09	40	5.02	17	5.09	0.18	57.00	0.000
AARER97	57	25.39	40	24.27	17	28.68	0.18	57.00	0.000
NPAR96	57	3.10	40	3.18	17	2.72	0.18	57.00	0.000
ROA95	52	1.29	36	1.29	16	1.28	0.20	52.00	0.000
OBBR97	57	30.66	40	29.55	17	30.95	0.19	57.00	0.000
CAR97	57	24.38	40	26.79	17	15.16	0.19	57.00	0.000
ROBAR96	57	6.81	40	6.56	17	6.82	0.20	57.00	0.000
ROE95	52	5.26	36	5.26	16	4.67	0.21	52.00	0.000
PCR97	57	25.56	40	22.93	17	28.31	0.20	57.00	0.000
PCR96	57	24.09	40	25.57	17	22.97	0.20	57.00	0.000
ROE96	57	4.09	40	5.06	17	1.32	0.21	57.00	0.000
PCR95	52	31.35	36	45.69	16	18.54	0.22	52.00	0.000
OHER97	57	50.88	40	55.92	17	43.40	0.21	57.00	0.000

Table 3. **continued**									
	Median statistics						**Tests of Normality*** **(Pooled)**		
	N	**Total**	**N**	**F=0**	**N**	**F=1**	**Statistics**	**df**	**Sig.**
CAR96	57	31.17	40	35.37	17	20.18	0.21	57.00	0.000
SDI95	52	55.41	36	55.07	16	59.02	0.23	52.00	0.000
NIM96	55	12.08	38	13.03	17	10.58	0.23	55.00	0.000
LR95	51	24.90	35	24.50	16	26.40	0.24	51.00	0.000
NCSSR95	52	9.41	36	8.91	16	10.96	0.24	52.00	0.000
ROA96	57	1.01	40	1.30	17	0.20	0.23	57.00	0.000
BSAG97	57	28.36	40	28.56	17	28.36	0.24	57.00	0.000
MM97	57	107.43	40	111.76	17	100.83	0.24	57.00	0.000
CRAG96	52	33.24	36	29.24	16	53.11	0.25	52.00	0.000
BSAG96	52	21.76	36	17.22	16	34.71	0.26	52.00	0.000
LIQ97	57	8.39	40	13.23	17	-2.35	0.25	57.00	0.000
LIQ95	51	0.03	35	0.08	16	-0.10	0.26	51.00	0.000
PIAR95	52	0.69	36	0.59	16	1.35	0.26	52.00	0.000
NPAR97	57	3.56	40	2.76	17	4.12	0.25	57.00	0.000
OBSAG96	51	25.84	35	26.30	16	24.61	0.27	51.00	0.000
RLAR96	57	5.52	40	3.81	17	10.22	0.27	57.00	0.000
LIQ96	54	8.18	37	12.73	17	-13.27	0.28	54.00	0.000
PIAR97	57	0.53	40	0.43	17	1.60	0.27	57.00	0.000
NIM97	57	9.53	40	9.74	17	8.36	0.27	57.00	0.000
LTIAR95	52	1.08	36	9.48	16	0.06	0.28	52.00	0.000
CM96	54	95.08	37	95.37	17	86.44	0.28	54.00	0.000
AARER95	52	27.17	36	27.17	16	27.12	0.29	52.00	0.000
LTIAR96	57	0.07	40	1.33	17	0.01	0.28	57.00	0.000
PIAR96	57	1.27	40	0.65	17	2.09	0.28	57.00	0.000
NCSSR96	57	8.58	40	7.66	17	9.72	0.29	57.00	0.000
LDR97	57	89.72	40	92.65	17	89.15	0.29	57.00	0.000
LTIAR97	57	0.20	40	0.59	17	0.00	0.30	57.00	0.000
MM95	51	122.81	35	124.63	16	115.37	0.32	51.00	0.000
ROE97	57	6.99	40	7.20	17	6.30	0.31	57.00	0.000
ROA97	57	1.46	40	1.47	17	1.40	0.31	57.00	0.000
RLAR97	57	3.61	40	2.91	17	11.52	0.31	57.00	0.000
DLR97	52	86.36	35	73.60	17	88.37	0.33	52.00	0.000
MM96	55	115.55	38	116.58	17	112.45	0.32	55.00	0.000
LDR96	55	78.42	38	75.25	17	85.52	0.32	55.00	0.000
AARER96	57	25.26	40	23.67	17	25.64	0.32	57.00	0.000
BS97	57	483,398	40	471,783	17	528,424	0.33	57.00	0.000
CM97	56	72.57	39	74.15	17	57.03	0.35	56.00	0.000
BS96	57	397,932	40	366,306	17	463,360	0.35	57.00	0.000
BS95	52	320,517	36	322,598	16	320,171	0.37	52.00	0.000
OBS97	56	182,435	39	136,373	17	228,946	0.39	56.00	0.000
OBS96	57	98,492	40	93,492	17	129,509	0.40	57.00	0.000
OBS95	52	76,421	36	69,706	16	93,469	0.42	52.00	0.000
CRAG97	57	70.67	40	72.57	17	55.47	0.41	57.00	0.000
LDR95	51	74.28	35	72.06	16	75.09	0.43	51.00	0.000
OBSAG97	55	47.25	38	45.28	17	57.24	0.51	55.00	0.000

* *Kolmogorov-Smirnov w/ Lilliefors Significance Correction, i. e. Shapiro – Wilk for N<51*

Table 4. **Mann Whitney U-test results for initial predictors**					
Year (2 x 1–sided p-value)					
Variable	**94**	**95**	**96**	**97**	**Total**
DR		0.000	0.000	0.000	0.0
LIQ		0.003	0.001	0.000	0.0
CAR			0.013	0.002	0.0
RLAR			0.053	0.045	0.1
LR		0.133	0.014	0.007	0.2
OHER		0.276	0.075	0.040	0.4
CM		0.429	0.049	0.035	0.5
PIAR		0.253	0.179	0.116	0.5
CRAG		0.143	0.383	0.060	0.6
ROBAR			0.364	0.320	0.7
MBAR			0.443	0.250	0.7
BSAG		0.131	0.204	0.530	0.9
MM		0.320	0.259	0.287	0.9
SDI		0.416	0.320	0.191	0.9
LTIAR		0.440	0.332	0.215	1.0
OHAR		0.500	0.496	0.072	1.1
ROA		0.606	0.020	0.453	1.1
AARER		0.322	0.475	0.329	1.1
NPAR			0.541	0.760	1.3
MGPPR		0.792	0.202	0.364	1.4
PAR		0.108	0.303	0.958	1.4
IMPAR			0.577	0.855	1.4
NCSSR		0.905	0.530	0.078	1.5
NIM		0.855	0.051	0.625	1.5
OBSAG		0.069	0.745	0.729	1.5
PCR		0.226	0.794	0.542	1.6
SPR		0.815	0.495	0.407	1.7
RIAR			0.917	0.821	1.7
DLR		0.259	0.653	0.930	1.8
ROE		0.984	0.057	0.875	1.9
LDR		0.776	0.799	0.519	2.1
OBBR		0.428	0.866	0.931	2.2
FAAR		0.706	0.807	0.986	2.5
OBS	0.168	0.751	0.794	0.979	2.7
BS	0.304	0.937	0.650	0.903	2.8
Total	**0.472**	**12.586**	**13.461**	**15.213**	**41.7**

Table 5. **Correlations among final predictors**

Y = 1997

CRAG	LIQ	DR	LR	OHER	OHAR	NCSSR	CM	RLAR	CAR	
1.00	0.34	-0.09	-0.29	0.06	-0.05	-0.09	-0.20	-0.28	0.25	CRAG
	0.01	0.52	0.03	0.63	0.69	0.49	0.14	0.03	0.06	
	1.00	-0.42	-0.38	0.39	-0.02	-0.20	0.23	-0.34	0.55	LIQ
		0.00	0.00	0.00	0.89	0.13	0.09	0.01	0.00	
		1.00	0.55	-0.49	0.15	0.30	-0.47	-0.04	-0.18	DR
			0.00	0.00	0.28	0.03	0.00	0.77	0.19	
			1.00	-0.18	0.10	0.25	0.10	0.07	-0.11	LR
				0.19	0.46	0.07	0.45	0.58	0.43	
				1.00	0.30	-0.19	0.52	-0.11	0.48	OHER
					0.02	0.15	0.00	0.43	0.00	
					1.00	0.09	-0.07	0.06	0.13	OHAR
						0.49	0.61	0.68	0.32	
						1.00	-0.04	0.13	-0.06	NCSSR
							0.78	0.33	0.67	
							1.00	0.07	0.32	CM
								0.60	0.02	
								1.00	-0.44	RLAR
									0.00	
									1.00	CAR

Y = 1996

LIQ96	DR96	LR96	OHER96	NIM96	ROE96	ROA96	CM96	RLAR96	CAR96	
1.00	-0.31	-0.24	0.37	0.12	0.12	0.26	0.38	-0.28	0.63	LIQ96
	0.03	0.08	0.01	0.39	0.40	0.06	0.00	0.04	0.00	
	1.00	0.51	-0.43	-0.10	0.08	-0.04	-0.28	0.05	-0.08	DR96
		0.00	0.00	0.49	0.56	0.81	0.05	0.74	0.56	
		1.00	-0.19	0.28	0.17	0.17	0.07	0.12	-0.16	LR96
			0.16	0.04	0.22	0.21	0.61	0.38	0.26	
			1.00	0.04	-0.29	-0.14	0.30	0.00	0.51	OHER96
				0.79	0.03	0.30	0.03	0.98	0.00	
				1.00	0.29	0.41	0.44	-0.15	0.09	NIM96
					0.03	0.00	0.00	0.28	0.52	
					1.00	0.91	0.12	-0.53	0.00	ROE96
						0.00	0.37	0.00	0.99	
						1.00	0.21	-0.52	0.18	ROA96
							0.13	0.00	0.17	
							1.00	-0.10	0.44	CM96
								0.48	0.00	
								1.00	-0.39	RLAR96
									0.00	
									1.00	CAR96

Y = 1995

LIQ95	DR95	OBSAG95	
1.00	-0.30	0.14	LIQ95
	0.04	0.35	
	1.00	0.00	DR95
		0.98	
		1.00	OBSAG95

*Note: * Shaded areas mark correlations significant at the 10-percent (2-tailed) significance level.*