INTEREST AND HAZARD RATES OF RUSSIAN SAVING BANKS

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Abstract	The number of (registered) commercial banks in Russia increased at a fast pace after the 1988 banking reform. Many of these banks lacked supervision and operated with dangerously low funding capital. In this paper we investigate the determinants of the hazard rates of banks active on the Moscovian deposits market during the 1994-97 period. We find that market share and duration have had a negative effect on the hazard rate, while the interest rate offered has had a positive effect.	
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Interest and Hazard Rates of Russian Saving Banks

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Abstract

The number of (registered) commercial banks in Russia increased at a fast pace after the 1988 banking reform. Many of these banks lacked supervision and operated with dangerously low funding capital. In this paper we investigate the determinants of the hazard rates of banks active on the Moscovian deposits market during the 1994-97 period. We find that market share and duration have had a negative effect on the hazard rate, while the interest rate offered has had a positive effect.

Keywords: Banking; Hazard rates; Transition economies

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1. Introduction

The banking sector was among the first to be confronted with a privatization process at the start of the transition period in Russia. The Gosbank was split up and privatized except for Sberbank (savings) and Vnesheconombank (international exchange). Many new commercial banks were founded following the 1988 banking reform. The consequence for the Moscovian savings market was a massive entry in the beginning of the 1990s. In the mid 1990s, however, many new banks had to leave the market again, either suddenly or because they failed to pay the claims of depositors. Buchs (1999) reports that the Central Bank of Russia withdrew about 1000 bank licences in the 1995-1998 period. These events had a dramatic impact on the lifes of many Moscovian households loosing their deposits and plans attached to it, such as spending holidays abroad, or rebuilding their appartment.

The occurence of high rates of exit after a period of entry is not uncommon in young industries. Gort and Klepper (1982) and Klepper and Graddy (1990) report on several industries in which such a 'shakeout' of producers has taken place. However, these industry shakeouts were documented only for technologically progressive manufacturing industries. Klepper (1996) explains such shakeouts occuring by stressing the role of economies of scale in R&D while Klepper and Miller (1995) discuss the possible role of 'overshooting'. Although manufacturing industries have been the main focus of research into shakeouts, there are exceptions like Fein (1998) documenting the shakeout in pharmaceutical wholesaling. The key features of a shakeout being a sharp drop in the number of firms and a virtual cessation of entry once the shakeout begins are also found in our data set of the Moscovian saving banking industry.

There have been quite some periods in the early years of capitalism in which financial crises took place and banks went bankrupt (Canova (1994)). The August 1995 interbanking crisis in Russia may be compared to those 'banking panics'. In fact, Canova reports no less than eight crises during the 1880-1914 period, or about one every four years. Each of these episodes were characterized by skyrocketing interest rates. This was also the case in Russia during the interbanking crisis. The crisis was at least partly caused by the low entry barriers (weak enforcement of reserve requirements) for new commercial banks.[1] The question may remain whether it was a consequence of the massive entry of banks and therefore part of an 'endogenous' shakeout process of inefficient saving banks or whether it was a consequence of unprofessional and risky bank policies *per se*. By investigating which banks were the first

[1] The possibility of too much entry in the context of banking in transition economies is also discussed by Schnitzer (1999).

to exit we may gain access to important information concerning the evolution of the Russian banking sector.

In our study into the exit of banks we apply the proportional hazard rate model by Cox (1972) on the development of the 3 months deposits Rouble savings market in Moscow. The number of firms 'active' (licenced) on this market almost halved during the 1995-97 period. This corresponds closely to the figures presented by Buchs (1999) for all licences of commercial banks issued by the Central Bank of Russia. The explaining variables of the length of the life span of a bank are the interest rate and market share of individual banks. The data are derived from a data set, acquired by the ACE-project group "Role of information on Russian individuals' savings market' (Avdasheva, 1998). The data cover the period from the beginning of 1994 till mid-1997. The original source of information is the Central Bank of Russia.

In section 2 we discuss the proportional hazard rate model. This model has been used to predict hazard rates for many kinds of organizations including banks (Wheelock and Wilson (2000)). In section 3 we discuss our data set of the Moscovian three months deposits market. The total number of banks we consider having been at risk during the 1994-1997 period was 74, of which 45 actually exited. The fourth section is used to discuss the empirical results of the hazard rate analysis. Section 5 is used for conclusion.

2. The proportional hazard rate model

Hazard rate (or event history) analysis has been used extensively in the study of organizational mortality (Hannan and Carroll (1992), Baum (1996)), new firm survival (Audretsch and Mahmood (1995)) and the probability of product exit (Greenstein and Wade (1998), Lunde et al. (1999)). In the current paper we will apply this method to the discontinuance of licences of Moscow-based saving banks during the period from the third quarter of 1994 to the second quarter of 1997. The life time of a saving bank is assumed to start at the date of issue of the licence and to end when the bank fails to report deposits data, which is followed by withdrawal of the licence by the Central Bank. Banks which still had their licence at the end of the second quarter of 1997 are classified as right-censored. The licence duration data can be characterized in terms of the hazard function. In this section we will discuss the Cox semiparametric proportional hazards regression model and the special parametric cases of the exponential, Weibull and Gompertz regression models.

Let T be a continuous random variable measuring the duration (or age) of a Central Bank licence. Define by $\mathbf{x}$ the vector of covariates and by b a corresponding vector of parameters to be estimated. Denote by $F(t|\mathbf{x}) = P[T \leq t|\mathbf{x}]$ the distribution function of duration T. The density and survivor functions are then equal to f(t|**x**) = ∂F(t|**x**)/∂t and S(t|**x**) = P[T≥t|**x**] = 1–F(t|**x**). The hazard rate h(t|**x**) is then determined by the ratio of the density function and the survivor function:

$$(1)\ h(t|\mathbf{x}) = \lim_{dt \downarrow 0} \frac{P[t \leq T < t + dt\ |T \geq t;\mathbf{x}]}{dt} = f(t|\mathbf{x}) / S(t|\mathbf{x})$$

The proportional hazards model proposed by Cox(1972) has the hazard rate equal to:

$$(2)\ h(t|\mathbf{x}) = l\ (t) \exp(\mathbf{x}^T b\ )$$

The baseline hazard rate l (t) is left unspecified and is estimated nonparametrically. The parameter vector b can be estimated by maximum likelihood. If we assume that l (t) has a Weibull parametric specification with shape parameter *p*, then it equals:

$$(3)\ l\ (t) = p\ t^{\,p-1}$$

In case *p* equals one the base line hazard reduces to a constant (of unity) and we get the exponential parametric specification. An alternative to the one-parameter Weibull specification is the one-parameter Gompertz specification: l (t) = exp(g t). In case of g =0 this reduces again to the exponential specification. The hazard rate is closely related to the time to failure. We show this for the case of the Weibull specification. An expression for the hazard rate can be found by using regression on the natural logarithm of duration *T*. Assume that this regression has the following form:

$$(4)\ \ln T = \mathbf{x}^T q\ +\ s\ W$$

where q is a parameter vector, s is a scale parameter and *W* possesses a standard extreme value distribution, that is:

$$(5)\ f(w) = \exp(w - \exp(w)) \qquad -\infty < w < \infty$$

The 'disturbance term' in equation (4) does not have expectancy zero, because the expected value of *W* equals: E[W] = $\Gamma'(1) \approx -0.5772$. From equation (4) one may derive that the corresponding hazard rate equals:

$$(6)\ h(t|\mathbf{x}) = 1/\sigma\ t^{1/\sigma\ -1} \exp(\mathbf{x}^{T}\theta)^{-1/\sigma}$$

Therefore, the regression approach of equation (4) leads to the Weibull specification case of the proportional hazards model with $1/\sigma = p$ and $\theta = -\beta/p$. The expected values of the duration and its natural logarithm are:

$$(7)\ E[T|\mathbf{x}] = \Gamma(1+\sigma)\exp(\mathbf{x}^{T}\theta)$$

$$(8)\ E[\ln T|\mathbf{x}] = \mathbf{x}^{T}\theta + \sigma\,\Gamma'(1)$$

The linear model (4) is sometimes called the accelerated failure-time model. The likelihoods of the accelerated failure time-model and the Weibull proportional hazards model are identical (except for reparametrization) but the two models differ in interpretation.

3. Data

The data set consists of banks active on the 3 months Rouble deposits market in Moscow during the 1994 – mid 1997 period. A bank is considered 'active' when (i) it has got a licence from the Central Bank allowing customers opening saving accounts for three-months deposits; (ii) it had advertised at least once in one of the Moscow newspapers; (iii) it fulfilled its obligation to report deposits data to the Central Bank. The licency date of a bank is its entry date. The withdrawal of licency date, however, is not identical to the exit date. The exit date is the first date for which the banks fail to report deposits data. Usually the withdrawal of licency follows swiftly thereafter. For example, the quarter with the highest number of licences being ended is the first quarter of 1996. Out of nine licence withdrawals in this quarter in all but two cases the exit was recorded in the last quarter of 1995. The data set was acquired by the ACE-project group 'Role of information on Russian individuals' savings market' (Avdasheva (1998)). The data cover the period of the first quarter of 1994 to the second quarter of 1997. Data on interest rates, personal deposits and licency dates of the registered banks were derived from Finansovije Izvestia and Commersant Rating, based on information of the Central Bank of Russia.

In total there are 81 banks recorded to be or have been active on the Moscovian 3 months deposits market. Six of those banks were active on the deposits market at one time or another, but no information about the size of their deposits portfolio is available. These banks are removed from the sample. The Sber-Bank, being the Central Bank of Russia owned savings bank, is supposed to not have been at risk and is excluded when estimating the hazard rate equations. This leaves 74 banks which were at risk, of which 45 have exited during the sample period. In Figure 1 we show the Kaplan-Meier survival estimate for the Moscovian saving banks industry corresponding to these 74 banks. We find that about 40% of the banks exited within 10 quarters and that about 60% exited within 20 quarters. After 20 quarters of duration no exits are observed and the survivor function is constant at 0.35. In the final quarter, 1997.II, 29 banks (and the Sber-Bank) remain in the market and are right-censored.[2] In Table 1 we report the number of exits and the number of firms at risk in each of the quarters. In addition, we show the mean market share of the firms exiting. The number of firms was still increasing during 1994, but the August 1995 liquidity crisis marked a turning point in the firm numbers. After this crisis the number of banks almost halved in two years time. The average size of the banks that exited was small. There have been two exceptions, though. In 1994.IV the LLD-Bank (6% market share) exited and in 1996.I National Credit (7%) exited.[3] In those two quarters the average market share of exiting firms was higher than the average market share.

Table 1: Summary statistics

Quarter	Exits	N(t-1)	Mean Exit Share	Corr(S,INT)
94.I				-0.56
94.II	0	39	n.a.	-0.40
94.III	3	48	0.001	-0.30
94.IV	3	54	0.035*	-0.27
95.I	5	56	0.015	-0.36
95.II	2	55	0.011	-0.38
95.III	4	56	0.012	-0.30
95.IV	7	53	0.004	-0.36
96.I	2	48	0.038*	-0.31
96.II	3	48	0.019	-0.09
96.III	7	45	0.008	0.06
96.IV	3	39	0.007	-0.10
97.I	5	36	0.005	0.18
97.II	1	31	0.022	-0.06
Total	45	568		

Note: Exits is the number of exits in the quarter. N(t-1) is the number of incumbents in the previous period. The Mean Exit Share is the average of the market shares in the previous quarter of the firms that exit in the quarter. * means that the average size of the exiting firms is larger than the average size of the firms that remain in the market. The last column gives the correlation coefficient between market share and interest rate of incumbents.

[2] The largest eight banks in terms of three months deposits in this last quarter are Incombank, Sber-Bank, East-West Bank, Most-Bank, Stolichniy Saving Bank, Promstroybank, Avtobank and Alfa-Bank. The total share of these eight banks in 1997.II was 75% with a Herfindal index of only 0.080. There was not one bank dominating this market.

[3] Another leading bank which did not survive the sample period was the Tveruniversalbank. It exited in 1996.II.

[Figure 1 about here]

In our hazard rate analysis we require data of interest rates (two quarters lagged) to be available. For five exits there is no information for this variable, so 40 exits remain. Two of these five banks did have some (pre-exit) periods for which the variable is available, though. It implies that for the hazard rate analysis, there have been 71 banks under risk, while 40 actual exits have been recorded.

4. Estimating the time to discontinuation: a hazard rate analysis

The hazard rate is assumed to depend upon four separate factors. The first factor is duration. In the Weibull and Gompertz specification cases the hazard rate can monotonically increase *or* decrease with time present in the market. We expect banks that are present in the market for a longer time to have a lower hazard than banks which have only recently entered. It implies that in case of the Weibull parameterization p is expected to be smaller than one and in case of the Gompertz parameterization g is expected to be negative. The second factor is the time period in which the bank is at risk. The default risk of saving banks will have increased following the August 1995 interbank crisis when it became apparent that many banks failed to meet their obligations. That is, the hazard rate is likely to (temporarily) increase from 1995.III on. We correct for the time-dependence of the hazard rate by incorporating time dummies into the model.

The third factor is the market share of the bank. We expect large banks to be less likely to exit when compared to their smaller counterparts. This liability of newness is a common finding in empirical studies.[4] We incorporate the reciprocal market share in the previous period, RSHA, as the covariate measuring the liability of newness.[5] The fourth factor is the interest rate offered by the bank. Banks that offer rates much higher than average are likely to either have a low profit margin or resort to high risk investment projects. These banks are likely to have dangerously low funding capital. The last column of Table 1 shows that small banks were, on average, offering higher interest rates than their larger counterparts except after the first quarter of 1996 when there was little difference between banks with low and high market shares. We incorporate the ratio of the interest rate offered over the average interest rate offered, two periods lagged, RINT, as the covariate measuring the risk of

[4] See for studies into the liabilities of newness and smallness, for instance Freeman et al. (1983), Evans (1987), Dunne et al. (1989), Audretsch and Mahmood (1995) and Davis et al. (1996).

[5] We have used different measures for the effect of market share (S). The variable RSHA = 1/S performed better in the Cox proportional hazards regression model than alternatives like S, $1/S^{½}$ and $1/S^2$, though. Using the reciprocal implies that very small firms have very high values for the covariate RSHA.

offering high rates. We lag the relative interest rate two quarters because lagging it one quarter would cost an extra eight exit observations. Banks that offer rates much lower than average do not have risks similar to the high interest rate banks but their low rates may express lack of interest in attracting customers in the deposits market. It may signal that the bank is intending to exit the market. In order to investigate this possibility, we incorporate RINT in a quadratic form into the hazard rate equation.

The summary statistics for the two explanatory variables for the 536 observations are as follows. The mean of the reciprocal market share (in the previous period), RSHA, is 279.75. The variable has a minimum of 4.365 and a maximum of 4198.97 and has a standard deviation of 507.37. The mean of the relative interest rate (two periods before), RINT, is 1.0026. It ranges from 0.556 to 1.231 and has a standard deviation of 0.1112.

Table 2: Hazard rate estimation results

	Exponential	Weibull	Gompertz	Gompertz
RSHA	0.00060	0.00058	0.00058	0.00058
	(0.00019)	(0.00019)	(0.00019)	(0.00019)
RINT	5.113	5.034	4.801	-26.897
	(1.753)	(1.782)	(1.832)	(16.683)
$RINT^2$				15.517
				(8.159)
p		0.644 (0.233)		
1/p		1.553 (0.562)		
g			-0.103 (0.040)	-0.115 (0.042)
LogL	-47.770	-47.030	-44.865	-43.711
$c^{2}_{(dummies)}$	30.40	27.39	36.06	37.90

Note: Standard errors between brackets. The standard errors have been calculated using the robust method of Lin and Wei (1989). This is recommended if the same subjects appear repeatedly in the risk pools. Time dummies are included in all estimations. The $c^{2}_{(dummies)}$ is the likelihood ratio statistic for all constant time effects to be equal across the quarters. The corresponding number of degrees of freedom is 11. The number of banks that have been at risk is 71, of which 40 actual exits are recorded.

The Grambsch and Therneau (1994) chi-square test on the proportional hazards assumption has a value of 3.19 (2 degrees of freedom) when time dummies are excluded. The corresponding p-value is 0.20. When time dummies are included the value of the test statistic is 10.57 (13 degrees of freedom) with a corresponding p-value of 0.65. In both cases the null hypothesis of proportional hazards cannot be rejected. This implies that we can proceed with the Cox proportional hazards framework as expressed in equation (2). The maximum likelihood ratio estimates of the parameter vector b and the parameters of the baseline hazard rate can be found in Table 2. The results were computed using the STREG-procedure of Stata 6.0 for Windows.

The estimation results show that the Gompertz parameterization is the preferred assumption for the baseline hazard. The estimate for the parameter g is significantly (at a 5% level) smaller than zero. This implies that the hazard is monotonically declining with duration. This is also found in case of the Weibull parameterization because p is estimated to be below unity. The estimate is not significantly different from one, though. The results confirm that there was a liability of newness in the Moscovian Rouble deposits market for the period under investigation. Time dummies are important in explaining the hazard rate as well. The likelihood ratio test for the hypothesis that time dummies can be excluded from the model is 36.06 for the Gompertz case (11 degrees of freedom). The lowest coefficients for the time dummies are for the first quarters of the sample before the 1995 liquidity crisis as expected.

The results also confirm the liability of smallness. The reciprocal of market share, RHSA, has a significantly (at 5% level) positive effect on the hazard rate. The mean exit share data of Table 1 were already a strong indication for this finding. The relative interest rate, RINT, has a significant (at a 5% level) effect as well. Banks that offer high rates are more likely to leave the market than those that offer lower rates. We fail to find evidence for this relation to have a quadratic component. Leaving this aside for a moment, the estimates presented in the last column of Table 2 suggest that the hazard rate would decrease up to a relative interest rate of (-26.897)/(2*15.517) = 0.867 and increase beyond that figure. This confirms that for the large majority of observations the effect of RINT on the hazard rate is positive.

The development of the Russian financial sector into a system with hundreds of very young and very small banks barely bothered by enforcement of reserve requirements contributed to its vunerability as became clear in the 1995 liquidity crisis. The small participants on the three months deposits market offered interest rates higher than the ‘safe’ larger banks to attract customers but it increased the likelihood of their default. Many of the new commercial banks had their portfolios being dominated by risky loans made to unprofitable Russian enterprises (Buchs (1999)). The shakeout of almost half of the operating banks in Russia in the 1995-1998 period showed the extent of the instability that resulted from entry barriers for commercial banking being too low.

5. Conclusion

Holding deposits at Russian saving banks has not been without hazards. Many of the commercial banks which had entered only recently went bankrupt or failed to return the saving money to their clients within a short term. In the current analysis we perform a hazard rate analysis to investigate which banks were the first to exit. We find that the duration of lifetime of saving banks has been very limited for banks with small market shares. Saving banks which offered relatively high interest rates on the saving market were likely to be among the first to exit. People anxious to get high deposits interest rates were, therefore, confronted by a high hazard rate of loosing their money. The relation between default probability and interest rates goes two ways: banks offering high rates are more likely to default, but banks which are in a category with relatively high default probabilities are forced to offer high rates to attract customers.

The strategy of newly entered banks to offer high interest rates was quite popular before the August 1995 interbank crisis. However, this changed strongly after the crisis. People became more aware of the risks of banks offering high interest rates. Many small and medium-sized banks could not survive the aftermath of the avalanche of bad loans. The entry of new banks was also deterred because of the grown public suspicion with respect to banks. The financial crisis has, therefore, fastened the evolution process towards a more concentrated structure of the Moscovian saving market. The number of firms decreased and the spread in the interest rates of the saving banks diminished as well.

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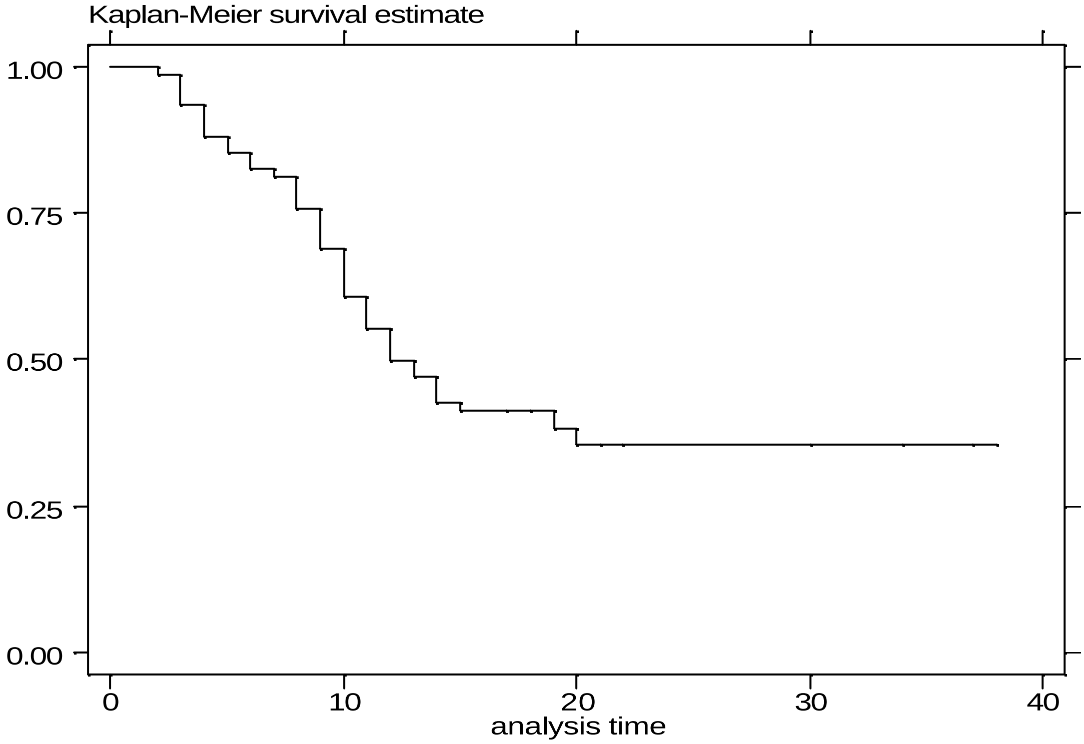
Figure 1: Kaplan-Meier survival curve



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