

A Market-Based Measure of Credit Quality and Banks' Performance During the Subprime Crisis

Martin Knaup and **Wolf Wagner**

Tilburg University

Traditional measures of asset quality of banks have drawbacks...

- typically based on balance sheet information (e.g., non-performing loans or loan loss provisions)
- disadvantages:
 - backward-looking, low frequency, under discretion of banks, miss non-traditional sources of credit risk

This paper: a *market-based* approach of asset quality

The basic idea

- suppose there are two types of loans in economy: high-risk and low-risk loans
 - consider bank with many high-risk loans: share price should react relatively strongly to news about the default risk of high-risk loans in the economy, but less to news about low-risk loans
 - *Credit Risk Indicator* (CRI): sensitivity of share price to news about high-risk loans, relative to low-risk loans
- ⇒ the CRI measures proportion of high-risk loans, as perceived by the market

Main results

- estimate CRIs for U.S. BHCs
- CRI contains information from a variety of traditional credit risk-measures
- but also seems to capture information beyond: CRI can predict share price performance of banks during subprime crisis (after controlling for traditional factors)
- we can use CRI to track perceived asset quality in financial system: market was aware of (average) credit quality of BHCs well before the crisis

Growing interest in market-based measures...

- evidence that market does well in evaluating the risks at financial institutions (Smirlock and Kaufold 1987, Flannery and Sorescu 1996, Morgan and Stiroh 2000, Hancock and Kwast 2001,...)
- market information has predictive power (Berger, Davies, Flannery 2000, Evanoff and Wall 2001, Lopez and Krainer 2004, ...)
- existing market-based measures of bank risk have focused on the likelihood of failure (e.g., subordinated debt spread) or systemic risk (e.g., CoVAR)
- here: asset quality of banks

The Credit Risk Indicator

- value of bank equity

$$V(\text{Equity}) = V(\text{Loans}) + V(\text{Oth. Assets}) - V(\text{Debt}) \quad (1)$$

- loan portfolio consists of two prototypical loans:
high risk and low risk loans
- outstanding volumes are H and L
- value of the loan portfolio

$$V(\text{Loans}) = \frac{H(1 - EL^H) + L(1 - EL^L)}{1 + r^{\text{Loan}}} \quad (2)$$

where EL ($EL^H > EL^L$) are expected losses from default

The Credit Risk Indicator

Credit Risk Indicator (CRI): the proportion of high risk loans in the loan portfolio

$$CRI = \frac{H}{H + L}. \quad (3)$$

Estimation of the Credit Risk Indicator

- write change in equity (ignoring interest rate, other assets and debt for the moment)

$$\Delta V(\textit{Equity}) = \Delta V(\textit{Loans}) = -H \Delta EL^H - L \Delta EL^L \quad (4)$$

- proxy for expected losses: spread on CDS index for high and low risk names (CDS^H and CDS^L)

$$EL^H \approx CDS^H \text{ and } EL^L \approx CDS^L \quad (5)$$

- we then get

$$\Delta V(\textit{Equity}) \approx -H \Delta CDS^H - L \Delta CDS^L \quad (6)$$

Estimation of the Credit Risk Indicator

- estimates of H and L can be obtained by regressing (daily) bank share price changes on changes in the spread on high and low risk CDS index

$$\Delta p_t = \alpha - \beta \Delta CDS_t^H - \gamma \Delta CDS_t^L + \delta \mathbf{Z}_t + \varepsilon_t. \quad (7)$$

control variables \mathbf{Z}_t proxy for changes in $V(\text{oth. assets})$, $V(\text{debt})$ and interest rates

- CRI is then simply the ratio of the estimated sensitivities: $CRI = \frac{\hat{\beta}}{\hat{\beta} + \hat{\gamma}}$

The CRI: A discussion

- the CRI is a *comprehensive* measure of asset quality: captures credit risk exposure from non-traditional sources (e.g., writing protection in CDS market or buying CDO tranches)
- is the *market's assessment* of bank asset quality: will change as new information about bank assets becomes available
- it is a *relative* risk measure (composition of assets) and thus different from bank's absolute level of risk
- as a relative measure it is robust to mispricing issues such as credit bubbles in market prices

- 150 largest BHCs during February 2006 to February 2008
- daily data: share prices, CDS indices, control variables (e.g., interest rates, stock market index)
- CDS indices:
 - high risk: Markit CDX *Cross-over* index (contains ratings from B to BBB)
 - low risk: Markit CDX *IG* index (contains ratings from BBB to AAA)

⇒ estimated CRIs for the 150 BHCs are available on
<http://people.pwf.cam.ac.uk/ww243/CRI.xls>

How does CRI relate to traditional measures?

Relationship between CRI and Selected Measures of Credit Risk

15.06-31.08.07 excluded	Coefficient
Non-Perform. Loans/TL	4.60598**
Loan Loss Provisions/TL	16.54446***
Loan Loss Allowance/TL	1.99673
Net Charge Offs/TL	7.19843*
Tot. Risk Weight. Assets/TA	0.00844
Loan Growth	0.68211**
Interest from Loans/TL	3.87150**
Real Estate Loans/TL	0.17752***

TL= Total Loans; TA= Total Assets

CRI positively correlated with traditional loan-risk
measures
⇒ CRI contains variety of asset quality information

Can CRI predict performance of banks during crisis?

- first step: estimate CRIs using information up to June 2007
- second step: relate CRI to share price performance between June 2007 and end of sample

$$\text{share price perf. bank } i = \alpha + \beta \widehat{\text{CRI}}_i + \gamma \mathbf{Y}_i + \varepsilon_i \quad (8)$$

control factors (\mathbf{Y}_i): traditional loan risk variables, size, capital structure, securitization activities, share price beta and volatility

Relationship between CRI and Banks' Share Price Performance

Dep.Var.: share price perf.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CRI	-20.66***	-23.44***	-20.07**	-14.05**	-21.32***	-15.04**	-16.83**
Non-Perform. Loans/TL		-2.457					36.40
Loan Loss Provisions/TL		1001					1999
Loan Loss Allowance/TL		-651.9**					-451.6*
Net Charge Offs/TL		-1352					-1591
TRWA/TA			-21.66***				-12.16
Loan Growth			-27.12				-14.98
Interest from Loans/TL			-485.8**				-401.6
ROA			263.4				416.6
Debt/TA				27.19			4.202
Loans/TA				-25.91***			-13.39*
log(TA)				-2.390***			-2.111***
Real Estate Loans/TL					-7.306*		-8.825**
Sec. Real Est. Loans					-5.593***		-2.542
Beta						5.634**	1.170
Vola						-2823	-2494
Constant	-3.972***	4.282	19.78***	26.02	2.383	-11.22***	57.56**
Observations	150	150	150	150	150	150	150

Can CRI predict performance of banks during crisis?

- CRI enters negatively and significantly in all specifications, after controlling for variety of other factors
- CRI thus does contain useful information beyond this factors
- ability to forecast shareprice performance seems noteworthy since not only crisis of asset quality but also liquidity and funding issues which are not captured by the CRI

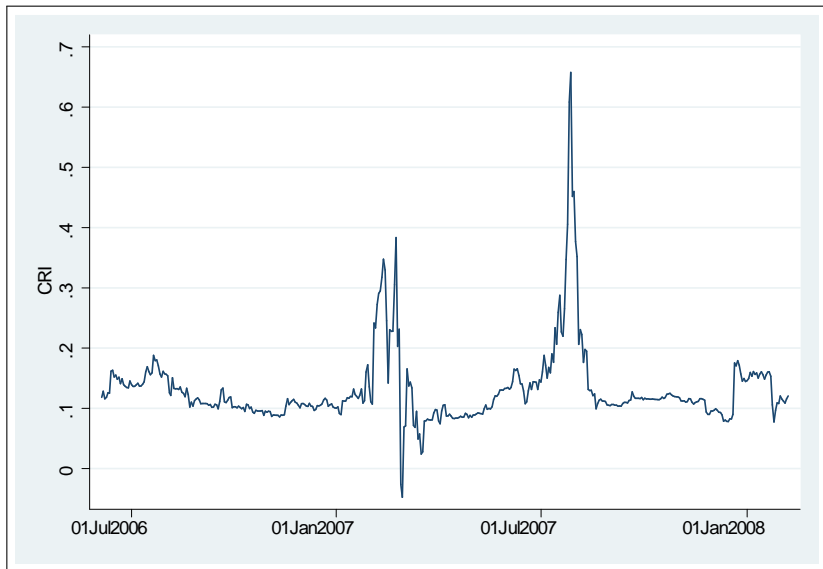
The CRI and failed banks

- some of the banks from our sample failed after the sample period (in total 5 banks)
- mean CRI among those banks is 0.28 (0.21), compared to 0.11 for entire sample

The development of the CRI of the BHCs

⇒ instead of individual CRIs, we can also estimate average CRI of BHCs

Average BHC CRI (Rolling window analysis)



The development of the CRI of the BHCs

- main message: CRI at end of sample not significantly different from beginning of sample
- thus, no significant update about average asset quality at banks since start of crisis
- suggests that market was aware of asset quality of banks before crisis

A puzzle?

- seems to contradict the fact that share prices declined substantially during crisis
- explanation: market was aware of composition of portfolios in financial system (investment grade versus cross-over exposures) but not of the absolute level of risk of each loan type

Conclusions

- we propose a new market-based measure of bank asset quality
- CRI can be easily estimated (only need share prices)
- independent assessment of a bank's risk
- CRI comprehensive measure of asset quality
 - ① incorporates many sources of information
 - ② measures also credit risk arising from non-traditional sources
- CRI seems to contain information not contained in traditional asset quality measures

Extension: Perceived tail-risk

- method can be extended to measure perceived tail-risk of financial institutions
- analogous to CRI, perceived tail-risk can be quantified by estimating sensitivities to tail-risk news (prices of index put options or senior tranches of securitizations)
- advantages:
 - forward-looking measure
 - in order to quantify tail-risk exposure, we do not actually need to observe tail-risk observations

CDS indices over time

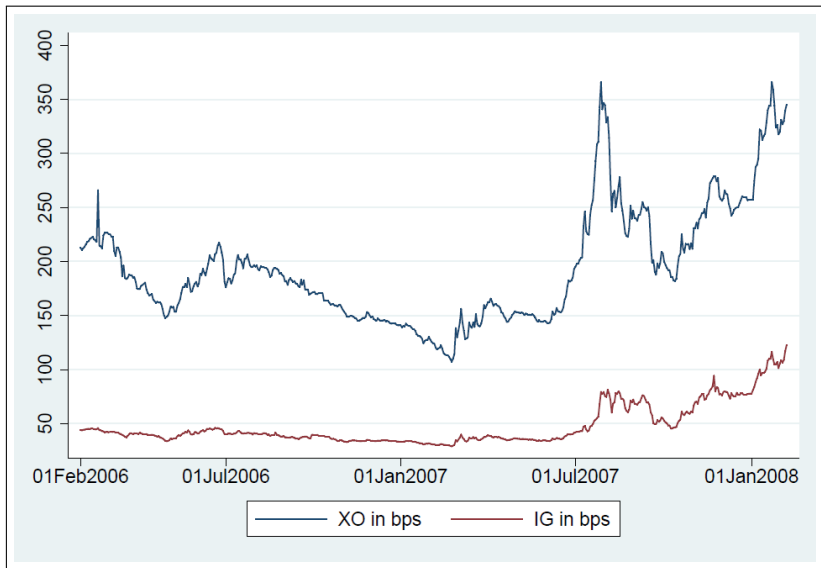


Table 2 Descriptive Statistics for Individual CRIs

Variable	Observations	Mean	Median	Min	Max	St.Dev.
CRI	150	0.1143	0.1082	-0.0329	0.4433	0.0626

