

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

Martin Knaup

Wolf Wagner

December 9, 2009

Introduction

Traditional Measures

This Paper

The Credit Risk
Indicator

Empirical Evidence

Conclusions

Introduction

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

Introduction

Traditional Measures

This Paper

The Credit Risk
Indicator

Empirical Evidence

Conclusions

- Existing literature mainly focuses on balance sheet (BS) data (e.g. non-performing loans (NPL) or loan loss provisions (LLP))
- Shortcomings:
 - ◆ backward-looking, low frequency, under discretion of banks, miss non-traditional sources of credit risk

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

- Credit risk (CR) should be reflected in a banks share price, as it aggregates all information from a variety of sources in a very timely and forward looking manner
- Lehar et al. (2007) "Most studies encourage the use of market information arguing that regulatory assessments will become more precise"

Introduction

The Credit Risk Indicator

Idea

Derivation

Derivation (2)

Identification

Regression

Regression (2)

CRI Discussion

CRI Discussion (2)

Empirical Evidence

Conclusions

The Credit Risk Indicator

Introduction

The Credit Risk
Indicator

Idea

Derivation

Derivation (2)

Identification

Regression

Regression (2)

CRI Discussion

CRI Discussion (2)

Empirical Evidence

Conclusions

Suppose: two types of loans, high-risk (H) and low-risk (L) and suppose a bank's portfolio contains mostly high-risk loans

- Share price should react relatively strongly to news about default risk of H loans, but less so to news about L loans

⇒ Bank's relative share price sensitivity to either type of news gives information about the perceived quality of its loan portfolio

- Introduction
- The Credit Risk Indicator
- Idea
- Derivation
- Derivation (2)
- Identification
- Regression
- Regression (2)
- CRI Discussion
- CRI Discussion (2)
- Empirical Evidence
- Conclusions

■ Value of bank equity

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

■ Two prototypical loans in economy: high risk and low risk loans with outstanding volumes H and L

■ Value of the bank's loan portfolio

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

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

- To obtain CRI, consider a change in $V(E)$ from $t - 1$ to t :

$$\Delta V(E) = \Delta V(Loans) + \Delta V(Oth.Assets) - \Delta V(D) \quad (3)$$

- Assuming constant book values, we get

$$\begin{aligned} \Delta V(E) &= \Delta V(Loans) + \Delta V(Oth.Assets) - \Delta V(D) \\ &= -H\Delta EL^H - L\Delta EL^L + \Delta V(Oth.Assets) - \Delta V(D) \end{aligned} \quad (4)$$

- Introduction
- The Credit Risk Indicator
- Idea
- Derivation
- Derivation (2)
- Identification
- Regression
- Regression (2)
- CRI Discussion
- CRI Discussion (2)
- Empirical Evidence
- Conclusions

- Identification happens through variations in EL^H and EL^L , which are proxied by CDS indices
- The price of a CDS should reflect expected loss from default (EL) of underlying exposure
- We thus write

$$CDS^H \approx EL^H \text{ and } CDS^L \approx EL^L$$

Hence,

$$\Delta V(E) \approx -H\Delta CDS^H - L\Delta CDS^L + \Delta V(Oth.Assets) - \Delta V(D) \tag{5}$$

We can then estimate the following regression at the bank level:

$$\Delta p_{i,t} = \alpha_i + \gamma_i \Delta CDS_t^H + \delta_i \Delta CDS_t^L + \phi_i \Delta Z_t + \epsilon_{i,t} \quad (6)$$

- where i denotes the bank
- Z is a vector of control variables \Rightarrow to correct for changes in $V(\text{Oth. Assets})$ and $V(D)$

Introduction

The Credit Risk Indicator

Idea

Derivation

Derivation (2)

Identification

Regression

Regression (2)

CRI Discussion

CRI Discussion (2)

Empirical Evidence

Conclusions

- We define our *Credit Risk Indicator* (CRI) as the relative share of high risk loans in the loan portfolio:

$$CRI = \frac{H}{H + L}$$

- We estimate $\hat{\gamma}_i$ and $\hat{\delta}_i$ and calculate the CRI of bank i as:

$$CRI_i = \frac{\gamma_i}{\gamma_i + \delta_i} = \frac{H_i}{H_i + L_i}$$

Introduction

The Credit Risk Indicator

Idea

Derivation

Derivation (2)

Identification

Regression

Regression (2)

CRI Discussion

CRI Discussion (2)

Empirical Evidence

Conclusions

- 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)
- It 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 \Rightarrow relates to the composition of a bank's credit exposure

Introduction

The Credit Risk Indicator

Idea

Derivation

Derivation (2)

Identification

Regression

Regression (2)

CRI Discussion

CRI Discussion (2)

Empirical Evidence

Conclusions

- As a relative measure derived from sensitivities it is *robust* to mispricing issues such as bubbles in credit markets or to risk premia in CDS prices
- Difference to individual CDS spread
 - ◆ CDS measures overall default risk - identify banks currently in trouble
 - ◆ CRI measures credit risk exposure - identify banks prone to downturn

Introduction

The Credit Risk
Indicator

Empirical Evidence

Data

Implementation

Results 1

Results 2

Results 2

Results 3

Results 3

Results 4

Conclusions

Empirical Evidence

Introduction

The Credit Risk
Indicator

Empirical Evidence

Data

Implementation

Results 1

Results 2

Results 2

Results 3

Results 3

Results 4

Conclusions

- 150 largest BHCs during February 2006 to February 2008
- Daily data: share prices, CDS indices, control variables (e.g., interest rates, stock market index)
- Balance sheet variables: FR Y-9C Reports
- CDS indices:
 - ◆ high risk: Markit CDX *Cross-over* index (contains ratings from BBB to B)
 - ◆ low risk: Markit CDX *IG* index (contains ratings from AAA to BBB)

$$\Delta p_{i,t} = \alpha_i + \gamma_i \Delta CDS_t^H + \delta_i \Delta CDS_t^L + \phi_i \Delta Z_t + \epsilon_{i,t}$$

- The market return (S&P500) is orthogonalized with CDS prices to take out the credit risk information
- Moreover, changes in IG and XO will be highly correlated \Rightarrow coefficients are not estimated precisely due to multicollinearity
- This issue is addressed by orthogonalizing the CDS prices with each other \Rightarrow two possibilities (turns out: choice does not matter)

FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION

1. *Aggregate and Individual CRIs*

Introduction

The Credit Risk
Indicator

Empirical Evidence

Data

Implementation

Results 1

Results 2

Results 2

Results 3

Results 3

Results 4

Conclusions

1. CRI on aggregate level: Coefficients of interest are highly significant and have correct (negative) sign
2. Individual CRIs: Reasonable cross-sectional variation, only few outliers, no clear pattern emerges

2. How does CRI relate to traditional measures of asset quality?

Introduction

The Credit Risk Indicator

Empirical Evidence

Data

Implementation

Results 1

Results 2

Results 2

Results 3

Results 3

Results 4

Conclusions

Relationship between CRI and Selected Measures of Credit Risk

Period 15.06-31.08.07 excluded

Coefficient

Measure	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

2. How does CRI relate to traditional measures of asset quality?

- Introduction
- The Credit Risk Indicator
- Empirical Evidence
- Data
- Implementation
- Results 1
- Results 2
- Results 2**
- Results 3
- Results 3
- Results 4
- Conclusions

⇒ CRI contains variety of asset quality information

3. Can CRI predict the share price performance of banks during the crisis?

Introduction

The Credit Risk Indicator

Empirical Evidence

Data

Implementation

Results 1

Results 2

Results 2

Results 3

Results 3

Results 4

Conclusions

- 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

$$\text{share price perf bank } i = \alpha + \beta C \hat{R}I_i + \gamma Y_i + \epsilon_i \quad (7)$$

- Control factors (Y_i): traditional asset quality variables, size, capital structure, securitization activities, beta and share price 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-Performing 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
Risk Weight. Assets/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**
Dum Sec. Real Estate L.					-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
R^2	0.072	0.138	0.211	0.267	0.155	0.113	0.381

3. Can CRI predict performance of banks during crisis?

- Introduction
- The Credit Risk Indicator
- Empirical Evidence
 - Data
 - Implementation
 - Results 1
 - Results 2
 - Results 2
 - Results 3
 - Results 3**
 - Results 4
- Conclusions

- CRI is negatively and significantly related to subprime performance, after controlling for variety of other factors
- CRI thus contains useful information beyond these factors

4. *The CRI and failed banks*

- Introduction

- The Credit Risk Indicator

- Empirical Evidence

- Data
- Implementation
- Results 1
- Results 2
- Results 2
- Results 3
- Results 3
- Results 4

- Conclusions

- Compute CRI of failed banks (in total five banks with complete data and liquid share prices)

- Two methods for computing CRI: use information
 - ◆ up to one month before failure
 - ◆ up to drop in share price (visual inspection)

- Results: for either method
 - ◆ all failed banks have a higher CRI than the average CRI
 - ◆ their mean CRI is 2-3 the average CRI

Introduction

The Credit Risk
Indicator

Empirical Evidence

Conclusions

Conclusions

Conclusions

- We propose a new market-based measure of bank asset quality
- CRI can be easily estimated (only need market data)
- 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

Introduction

The Credit Risk
Indicator

Empirical Evidence

Conclusions

Conclusions

Thank You!