Journal of Banking & Finance 33 (2009) 1520–1530

Contents lists available at ScienceDirect

Journal of Banking & Finance

journal homepage: www.elsevier.com/locate/jbf

Bank credit risk and structural credit models: Agency and information asymmetry perspectives

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ARTICLE INFO

Article history:
Received 20 May 2008
Accepted 28 February 2009
Available online 9 March 2009

JEL classification:
G21

Keywords:
Bank credit risk
Structural form credit models
Agency problems
Information asymmetry

ABSTRACT

This work investigates the effects of agency and information asymmetry issues embedded in structural form credit models on bank credit risk evaluation, using American bank data from 2001 to 2005. Findings show that both the agency problem and information asymmetry significantly cause deviations in the credit risk evaluation of structural form models from agency ratings. Five independent factors explain a deviation of 42.6–78.3% and should be incorporated into future credit risk modeling. Additionally, both the effects of information asymmetry and debt-equity agency positively relate to the deviation while that of management-equity agency relates to it negatively.

1. Introduction

Bank risk evaluation traditionally focuses on a bank's quantitative and qualitative factors according to the following aspects: capital adequacy, asset quality, management, earnings, and liquidity and funds management.[1] Though these approaches shed some understanding on bank risk, a bank's credit risk is mainly obtained from external credit ratings, which are not able to supply direct and immediate credit information about a bank's default probability and loss given default.[2] Structural form credit models (as they are able to endogenously generate default probability and, for some, loss given default) seem to be good candidates to fill this gap.[3]

The Merton-type structural form models share a common foundation (they all use equity value to estimate firm asset values), and may only reflect valuation from the viewpoint of equity holders rather than debt holders. Any effects that lead to mispricing of equity value may also influence structural form model performance. When estimating a firm's asset value, agency and information asymmetry issues most likely cause the major discrepancy between equity and debt holders. Due to conflict of interest, the agency issue indicates that equity and debt holders value equity differently, which causes a different firm (or firm's assets) valuation and consequently a different credit assessment of a firm. The information asymmetry between informed and un-informed traders, results in deviation from a firm's correct credit risk assessment.[4] Using American bank data from 2001 to 2005, this research empirically examines the effects of agency and information asymmetry issues embedded in structural form credit models on bank credit risk evaluation.

Several corporate finance literatures have studied manager-equity and debt-equity agency issues. Subsequent studies on manager-equity issues widely employ and develop Jensen's (1986) free cash flow hypothesis and its related measures on two major issues: cost efficiency and profit efficiency.[5] The debt-equity agency issue

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[1] These aspects combined are usually called the CAMEL approach (e.g. Goddard et al., 2008; Curry et al., 2008). Under this approach, two banks with the same BIS ratio may have different default probabilities and loss given default.

[2] Credit ratings are revised infrequently and therefore are not able to provide immediate credit information of a corporate borrower.

[3] Although option-based structural models face many challenges, they incorporate equity market valuation and other market factors (such as interest rate factor) or corporate characteristics (such as capital structure and payout policy) into recently developed models. The models are therefore able to include more comprehensive and up to date information for estimating a firm's credit risk. This ability gives structural form models high potential to supply useful credit information for the bank industry.

[4] Information asymmetry between equity and debt holders has become one of the causes for agency problems.

[5] To evaluate managers' performance, the literature employs financial ratios as proxies for cost efficiency, such as those in Ang et al. (2000) and Kauko (2009). The literature also popularly applies profit efficiency variables (sometimes called X-efficiency or managerial efficiency), such as Berger and Bonaccorsi di Patti (2006), and Fung (2006).

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doi:10.1016/j.jbankfin.2009.02.016

indicates that equity holders deprive debt holders of wealth through activities such as issuing debt or investing in high-risk assets. Manager-equity and debt-equity agency issues have interactions. Jensen and Meckling (1976) mention that issuing debts reduces agency costs of outside equity and increases firm value by constraining or encouraging managers to act more on behalf of shareholders.[6] Greater financial leverage may reduce management agency costs through the threat of liquidation (e.g. Williams, 1987) or through pressure to generate cash flow to pay interest expenses (e.g. Jensen, 1986). However, the opposite effect may occur to debt holders arising from conflicts between debt and equity holders, worsening the debt-equity agency problem and mitigating the manager-equity agency problem when financial leverage rises (Stulz, 1990). This study empirically investigates the cause and effect of differing perspectives in bank valuation and credit risk assessment between equity and debt holders.

Odders-White and Ready (2006) propose a model of credit rating and adverse selection, contending that a firm with lower information asymmetry has a higher credit rating when controlling for other variables. Their work reveals that a firm with higher information asymmetry requires rating agencies to lay extra concerns (relative to equity holders) on its credit risk. This study empirically investigates the influence of information asymmetry on divergence in credit risk assessment between equity and debt holders.

Researchers have developed several varieties of the original option theory-based structural credit model by Merton (1974) to overcome several major challenges the model faces in practice. These problems include an exogenous default boundary, default occurrence in maturity, and assuming non-stochastic interest rates. The models address the above issues by allowing for coupons, defaulting before maturity (the so-called first passage default), and stochastic interest rates, or incorporating a dynamic leverage ratio.[7] Besides the baseline Merton model (M, 1974), the current work employs Leland and Toft (LT, 1996), Longstaff and Schwartz (LS, 1995) and Collin-Dufresne and Goldstein (CDG, 2001) models in empirical analyses.

This investigation employs the corresponding historical 10-year cumulative default frequency of each firm's credit rating as a proxy for actual credit risk of a firm, estimated by rating agencies. Several studies suggest that rating agencies act as "information gathering agencies", "screening agents" or "information-processing agencies" that specialize in information gathering and evaluation, thereby providing a more reliable measure of a firm's creditworthiness (e.g. Kisgen, 2006). This work uses absolute prediction differences in default probabilities between structural form credit models and those implied by agency ratings (later denoted as APD) to measure the performance of structural form models in empirical investigations. The historical default frequency estimates the rating implied probability of default under physical measure rather than risk-neutral measure under which Merton-type structural form models estimate the default probabilities. This work utilizes three risk premium proxies to obtain estimated probabilities of default under physical measure from Merton type models.

Empirical results show five independent factors related to agency and information asymmetry issues that are able to explain the absolute predicting differences (APD) of various models from 42.6% to 78.3%. The factors include "management-equity agency effect-free cash flow", "debt-equity agency effect", "information asymmetry", "management-equity agency effect-cost efficiency", and "debt-equity agency effect-reverse wealth transfers". The literature rarely discusses these factors, which should be incorporated into credit modeling. This work also finds that information asymmetry and debt-equity agency effects, positively relate to APD while management-equity agency effects relate negatively to APD.

The remainder of this paper is organized as follows: Section 2 describes the data. Section 3 gives estimation details of the four models. Section 4 presents the hypotheses. Section 5 shows empirical evidence and hypotheses examination. Section 6 discusses the implications of empirical results. Section 7 concludes the study.

2. Data

To avoid digression caused by large variations in operating characteristics within the banking industry, this investigation concentrates only on relatively pure lending and depository institutions such as commercial banks and savings and loans. Sample banks for this study are collected from those belonging to Standard Industrial Classification Codes (SIC Codes) 6021, 6022, 6029, 6035 and 6036 according to the following criteria.[8]

2.1. Selection criteria

2.1.1. Banks are publicly traded

Banks must be publicly traded during our sample period from 2001 to 2005 in order to estimate asset values and asset volatilities needed for performing Merton type structural form models. Banks must also have 150 daily stock price data prior to the observation date (the year-end date) of the sample period for calculating stock volatility. The current research applies this criterion with information obtained from the Center for Research in Security Prices (CRSP) database. Three hundred and eighty-nine American banks meet these requirements.

2.1.2. Banks are with credit ratings

This study uses Standard & Poor's cumulative default rates as the benchmark for evaluating the performance of the four structural models.[9] The banks' S&P long-term domestic issuer credit ratings are obtained from COMUPSTAT. Banks that do not have credit ratings by the observation date are not included in the sample. Eighty-five banks remain in the sample screened using this criterion.

2.1.3. Banks are with sufficient market and financial data

The current work collected book values of debts from COMPUSTAT BANK, and selected only those banks with both stock price data and corporate financial data. Fifty-one banks remain after meeting the above requirements.

2.1.4. Banks are with non-ADR or non-missing value

This work eliminates banks with ADR (American depository receipt) and those with missing values.

2.2. Final sample

Thirty-eight banks remain in the final sample, after screening using the above criteria. These banks are included in the SIC codes 6021, 6022 and 6035. Table 1 shows the sample distribution and related characteristic information of sample banks. Bond rating in Table 1 is the Standard & Poor's long-term domestic issuer credit rating in a point system, where 2 is assigned to AAA raring, 4 is AA+, 5 is AA, etc.[10] Asset market value is estimated by an option theory-based method developed by Black and Scholes (1973) and Merton (1974). Equity volatility is annualized and derived from

[6] It could be also referred to Harris and Raviv (1991).

[7] See, for example, Longstaff and Schwartz (1995), Leland and Toft (1996) and Collin-Dufresne and Goldstein (2001).

[8] Industry group 602 and 603 represent commercial banks and savings institutions.

[9] The details can be referred from the Financial Risk Management Handbook (Jorion, 2003).

[10] The details can be referred to the definitions in COMPUSTAT database.