



ANNUAL STATEMENT STUDIES

**INDUSTRY DEFAULT PROBABILITIES AND
CASH FLOW MEASURES**

2016

2017

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Founded in 1914, The Risk Management Association is a not-for-profit, member-driven professional association whose sole purpose is to advance the use of sound risk principles in the financial services industry. RMA promotes an enterprise approach to risk management that focuses on credit risk, market risk, and operational risk.

Headquartered in Philadelphia, Pennsylvania, RMA has 2,500 institutional members that include banks of all sizes as well as nonbank financial institutions. They are represented in the Association by 18,000 risk management professionals who are chapter members in financial centers throughout North America, Europe, and Asia/Pacific. Visit RMA on the Web at www.rmahq.org.

**RMA ACKNOWLEDGES AND THANKS THE FOLLOWING
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DATA SUBMISSION PROGRAM.**

Alabama

BBVA Compass
Regions Bank

California

Bank of Napa, N.A.
Central Valley Community Bank
Pacific Enterprise Bank
Presidio Bank
Wells Fargo Bank, N.A.

Colorado

Alpine Bank
Centennial Bank & Trust
CoBank, ACB
First National Bank of Omaha
Wells Fargo

Connecticut

The Milford Bank
Windsor Federal Savings

Florida

CenterState Bank
Gateway Bank of Southwest Florida
MidWestOne Bank
Seacoast Bank
The Bank of Tampa

Georgia

SunTrust Banks

Hawaii

Central Pacific Bank
Finance Factors Ltd.
First Hawaiian Bank

Idaho

Columbia State Bank
Idaho First Bank
Washington Trust Bank

Illinois

First National Bank of Omaha
Northern Trust Corporation

Iowa

American Trust & Savings Bank
Dubuque Bank & Trust
Farmers State Bank - Marion
MidWestOne Bank

Kansas

Alliance Bank
Carson
Emprise Bank
First National Bank of Omaha
INTRUST Bank, NA
Midland National Bank

Kentucky

Community Trust Bank, Inc.

Louisiana

Iberia Bank
South Louisiana Bank
Whitney Bank

Maine

First National Bank
Gorham Savings Bank
Kennebunk Savings

Maryland

First United Bank & Trust
Sandy Spring Bank
The Columbia Bank

Massachusetts

BankFive
Pittsfield Cooperative Bank

Michigan

Commercial Bank
First National Bank of Michigan
First State Bank
Huron Community Bank
Mercantile Bank of Michigan
Talmer Bank & Trust

Minnesota

AgriBank, FCB
AgStar Financial Services
Anchor Bank, N.A.
BankCherokee
Citizens Independent Bank
Community Resource Bank
Fidelity Bank
First Minnetonka City Bank
KleinBank
MidWestOne Bank
North Star Bank
Roundbank
Stearns Bank N.A.

Mississippi

BancorpSouth
Hancock Bank
The Peoples Bank

Missouri

Cass Commercial Bank
Central Bancompany
Enterprise Bank & Trust
Hawthorn Bank
Royal Banks of Missouri

Nebraska

First National Bank of Omaha
Union Bank & Trust Company

New Jersey

Fulton Bank of NJ
TD Bank, N.A.

New Mexico

Los Alamos National Bank
New Mexico Bank & Trust

New York

Adirondack Bank
Canandaigua National Bank & Trust
CIT Group
Community Bank, N.A.
Lake Shore Savings Bank
NBT Bank, N.A.
Steuben Trust Company

North Carolina

Bank of America
BB&T
HomeTrust Bank
North Dakota
Bell Bank

Ohio

First Financial Bank
The Huntington National Bank

Oklahoma

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Oregon

Columbia State Bank
Pacific Continental Bank
Umpqua Bank
Washington Trust Bank

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AmeriServ Bank
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Company
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Republic Bank
S&T Bank
Swineford Bank
Univest Corporation of
Pennsylvania
Washington Financial Bank
York Traditions Bank

Rhode Island

Citizens Financial Group Inc
Coastway Community Bank

South Dakota

First PREMIER Bank
The First National Bank in
Sioux Falls

Tennessee

First Farmers and Merchants Bank
First Tennessee Bank, N.A.
Pinnacle Bank
Tennessee State Bank

Texas

American Bank of Texas
Comerica Bank
Frost Bank
Independent Bank
Southwest Bank
Weststar Bank

Utah

First Utah Bank
Zions Bancorporation

Vermont

Community National Bank
Mascoma Savings Bank
Union Bank

Virginia

Access National Bank
EVB
First Community Bank
United Bank
Virginia National Bank

Washington

Columbia State Bank
Riverview Community Bank
Washington Federal
Washington Trust Bank

West Virginia

United Bank, Inc.
WesBanco

Wisconsin

Associated Bank N.A.
Bank of Sun Prairie
First National Bank and Trust
Company
Horicon Bank
Johnson Bank
MidWestOne Bank
State Bank Financial
Wisconsin Bank & Trust

Introduction to Annual Statement Studies: Industry Default Probabilities and Cash Flow Measures, 2016-2017 and General Organization of Content

The notes below will explain the presentation of *Annual Statement Studies: Industry Default Probabilities and Cash Flow Measures*, show formulas and ratio interpretations, and answer most of your questions.

- **The Quality You Expect from The Risk Management Association (RMA):** RMA is the most respected source of objective, unbiased information on issues of importance to credit risk professionals. For over 97 years, RMA's *Annual Statement Studies*® has been the industry standard for comparison financial data. Material contained in today's *Annual Statement Studies* was first published in the March 1919 issue of the *Federal Reserve Bulletin*. In the days before computers, the *Annual Statement Studies* data was recorded in pencil on yellow ledger paper! Today, it features data for over 700 industries derived directly from more than 260,000 statements of financial institutions' borrowers and prospects.
- **Data That Comes Straight from the Original Source:** The more than 260,000 statements used to produce the composites presented here come directly from RMA member institutions and represent the financials from their commercial customers and prospects. RMA does not know the names of the individual entities. In fact, to ensure confidentiality, company names are removed before the data is even delivered to RMA. The raw data making up each composite is not available to any third party.
- **Organized by the NAICS for Ease of Use:** This edition is organized according to the 2012 North American Industry Classification System (NAICS), a product of the U.S. Office of Management and Budget. At the top of each page of data, you will find the NAICS. Please note, in the revised 2012 catalog some industries were merged to create its new 2012 NAICS. In these instances, RMA recalculated aggregate historical reporting. For detailed 2012 and 2007 NAICS mapping, please visit the RMA site or: <http://www.census.gov/eos/www/naics/>
- **If You Do Not Know the NAICS Code You are Looking for...** Contact the Census Bureau at 1-888-75NAICS or naics@census.gov. Describe the activity of the establishment for which you need an industry code and you will receive a reply. Another source to help you assign the correct NAICS industry name and number can be found at www.census.gov/epcd/www/naics.html.
- **Cannot Find the Industry You Want?** There are a number of reasons you may not find the industry you are looking for (i.e., you know you need industry xxxxxx but it is not in the product). Many times we have information on an industry, but it is not published because the sample size was too small or there were significant questions concerning the data. (For an industry to be displayed in the *Annual Statement Studies: Industry Default Probabilities and Cash Flow Measures*, there must be at least 30 valid statements submitted to RMA.) In other instances, we simply do not have the data. Generally, most of what we receive is published.
- **Composite Data Not Shown?** When there are fewer than 10 financial statements in a particular asset or sales size category, the composite data is not shown because a sample this small is not considered representative and could be misleading. However, all the data for that industry is shown in the All Sizes column. The total number of statements for each size category is shown in bold print at the top of each column. In addition, the number of statements used in a ratio array will differ from the number of statements in a sample because certain elements of data may not be present in all financial statements. In these cases, the number of statements used is shown in parentheses to the left of the array.
- **Presentation of the Data on Each Page-Spread:** For all non-contracting spread statements, the data for a particular industry appears on both the left and right pages. The heading Current Data Sorted by Assets is in the five columns on the left side. The center section of the double-page presentation contains the Comparative Historical Data, with the All Sizes column for the current year shown under the heading 4/1/15-3/31/16. Comparable data from past editions of the *Annual Statement Studies: Industry Default Probabilities and Cash Flow Measures* also appears in this section. Current Data Sorted by Sales is displayed in the five columns to the far right.

- **Companies with Less than \$250 Million in Total Assets:** In our presentation, we used companies having less than \$250 million in total assets. There is no upper limit placed on revenue size for any industry. Its information is found on only one page.
- **Moody's Analytics RiskCalc™:** The *RiskCalc™* Expected Default Frequency (EDF™) is not presented for the finance, insurance, and real estate industries.
- **Page Headers:** The information shown at the top of each page includes the following: 1) the identity of the industry group; 2) its North American Industry Classification System (NAICS) number; 3) a breakdown by size categories of the types of financial statements reported; 4) the number of statements in each category; 5) the dates of the statements used; and 6) the size categories. For instance, 16 (4/1-9/30/15) means that 16 statements with fiscal dates between April 1 and September 30, 2016, make up part of the sample.
- **Page Footers:** At the bottom of each page, we have included the sum of the sales (or revenues) and total assets for all the financial statements in each size category. This data allows recasting of the common size statements into dollar amounts. To do this, divide the number at the bottom of the page by the number of statements in that size category. Then multiply the result by the percentages in the common size statement. Please note: The dollar amounts will be an approximation because RMA computes the balance sheet and income statement percentages for each individual statement in an industry group, then aggregates and averages all the figures.
- **Recommended for Use as General Guidelines:** RMA recommends you use *Annual Statement Studies: Industry Default Probabilities and Cash Flow Measures* data only as general guidelines and not as absolute industry norms. There are several reasons why the data may not be fully representative of a given industry:
 1. **Data Not Random** — The financial statements used in the *Annual Statement Studies: Industry Default Probabilities and Cash Flow Measures* are not selected by any random or statistically reliable method. RMA member banks voluntarily submit the raw data they have available each year with no limitation on company size.
 2. **Categorized by Primary Product Only** — Many companies have varied product lines; however, the *Annual Statement Studies: Industry Default Probabilities and Cash Flow Measures* categorizes them by their primary product NAICS number only.
 3. **Small Samples** — Some of the industry samples are small in relation to the total number of firms for a given industry. A relatively small sample can increase the chances that some composites do not fully represent an industry.
 4. **Extreme Statements** — An extreme or outlier statement can occasionally be present in a sample, causing a disproportionate influence on the industry composite. This is particularly true in a relatively small sample.
 5. **Operational Differences** — Companies within the same industry may differ in their method of operations, which in turn can directly influence their financial statements. Since they are included in the sample, these statements can significantly affect the composite calculations.
 6. **Additional Considerations** — There are other considerations that can result in variations among different companies engaged in the same general line of business. These include differences in labor markets, geographical location, accounting methods, quality of products handled, sources and methods of financing, and terms of sale.

For these reasons, RMA does not recommend using the *Annual Statement Studies: Industry Default Probabilities and Cash Flow Measures* figures as absolute norms for a given industry. Rather, you should use the figures only as general guidelines and as a supplement to the other methods of financial analysis. RMA makes no claim regarding how representative the figures printed in these reports are.

DEFINITION OF RATIOS

Introduction

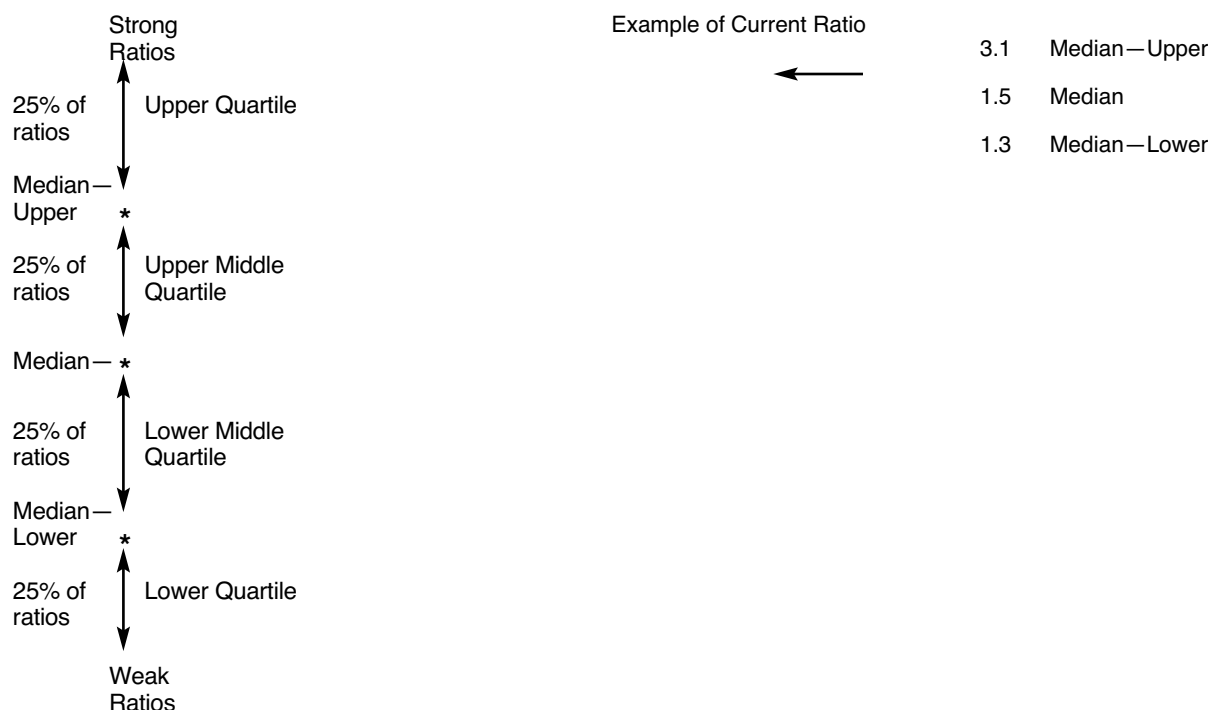
On each data page, below the common-size balance sheet and income statement, you will find a series of ratios computed from the financial statement data. Each ratio has three values: the upper quartile, median, and lower quartile.

Here is how these figures are calculated for any given ratio:

1. The value of the ratio is computed for each financial statement in the sample.
2. These values are arrayed (listed) in an order from the strongest to the weakest. Please note: In the case of the one – and five-year *RiskCalc*[™] expected default frequency (EDF[™]) and the funded debt/EBITDA ratio, the “strongest” is the lowest value and the “weakest” is the highest value.
3. The array of values is divided into four groups of equal size.

What Are Quartiles?

Each ratio has three points, or “cutoff values,” that divide an array of values into four equal-sized groups called quartiles, as shown below. The quartiles include the upper quartile, upper-middle quartile, lower-middle quartile, and the lower quartile. The upper quartile is the cutoff value where one-quarter of the array of ratios falls between it and the strongest ratio. The median is the midpoint; that is, it is the middle cutoff value where half of the array falls above it and half below it. The lower quartile is the point where one-quarter of the array falls between it and the weakest ratio. In many cases, the average of two values is used to arrive at the quartile value. You will find the median and quartile values on all *Annual Statement Studies* data pages in the order indicated in the chart below.



Why Use Medians/Quartiles Instead of the Average?

There are several reasons why medians and quartiles are used instead of an average. Medians and quartiles eliminate the influence of an “outlier” (an extremely high or low value compared to the rest of the values). They also more accurately reflect the ranges of ratio values than a straight averaging method would.

It is important to understand that the spread (range) between the upper and lower quartiles represents the middle 50% of all the companies in a sample. Therefore, ratio values greater than the upper quartile or less than the lower quartile may begin to approach “unusual” values.

Linear versus Nonlinear Ratios:

An array that is ordered in ascending sequence or in descending sequence is linear. An array that deviates from true ascending or true descending when its values change from positive to negative (low to high positive, followed by high to low negative) is non-linear.

For example, the Funded Debt/EBITDA ratio is nonlinear. In other words, when the Funded Debt/EBITDA ratio is positive, then the top quartile would be represented by the *lowest positive* ratio. However, if the ratio is negative, the top quartile will be represented by the *highest negative* ratio! In a nonlinear array such as this, the median could be either positive or negative because it is whatever the middle value is in the particular array of numbers.

Nonlinear Ratios

Funded Debt/EBITDA

Linear Ratios

RiskCalc EDF (1 yr)

RiskCalc EDF (5 yr) with Moody's EDF rating

Cash from Trading

Cash after Operations

Net Cash after Operations

Cash after Debt Amortization

Debt Service P&I Coverage

Interest Coverage (Operating Cash)

Change in Inventory

Total Current Assets (TCA)

Total Assets (TA)

Retained Earnings (RE)

Net Sales (NS)

Cost of Goods Sold (CGS)

Profit before Interest & Taxes (PBIT)

Depreciation/Depletion/Amortization (DDA)

Sustainable Growth Rate

Important Notes

Whenever there were fewer than 10 statements in a sample, the ratio values have been omitted throughout. Occasionally, the number of statements used in a ratio array will differ from the number of statements in a sample because certain elements of data may not be present in all financial statements. In these cases, the number of statements used is shown in parentheses to the left of the array.

Inventory presentations are based on point-in-time balances at the end of the fiscal year, not averages. In addition, the data that we capture does not permit us to know what method of inventory accounting (LIFO or FIFO, for instance) was used.

The following ratios are contained in the *Annual Statement Studies: Industry Default Probabilities and Cash Flow Measures*:

Within the data pages, Δ stands for percent change from year to year.

RiskCalc™ Expected Default Frequency Measure:

The *RiskCalc* algorithm is used to create the industry-level probabilities of default. This algorithm employs 10 financial ratios, including firm size. The output is then mapped into an *Expected Default Frequency* (EDF) at one- and five-year horizons.

Cash Flow and Debt Service Ratios:

All of the following cash flow composite figures are expressed as a percentage of net sales. This is the standard presentation we use for balance sheet and income statement figures. So, in the text of this document you will see a series of figures (quartiles), each of which represents a percentage of net sales for that respective cash flow line item.

For example:

	20	←	The upper quartile is 20%
Cash after Operations/Sales	15		of net sales.
	10		

At the bottom of each page, the sum of sales and total assets for all the financial statements in each size category are shown.

1. Cash from Trading

How to Calculate: Subtract cash production costs from cash from sales.

(Cash from sales (Net sales + Change in current receivables) -
Cash production costs (CGS + Change in inventories + Change in accounts payable))/Sales

How to Interpret: This is the money left over after a company produces its goods for sale. In other words, it is the portion of the present year's sales collected in the present year, *plus* any amounts from previous years' sales collected during the year, *minus* the cash expended during the present year to produce goods for sale (manufacturer) or to acquire merchandise (wholesaler or retailer).

2. Cash after Operations

How to Calculate: Subtract cash operating costs from cash from trading.

(Cash from trading - Cash operating costs (selling, general, & administrative, expenses + other operation expenses + changes in prepaids + change in accrued expenses + change in other current assets/liabilities))/Sales

How to Interpret: This ratio shows how efficiently the industry operates. In other words, it is the cash derived from trading *minus* the actual cash spent during the present year for selling, general, and administrative expenses.

3. Net Cash after Operations

How to Calculate: Add changes in income taxes to changes in miscellaneous assets and liabilities. Then, subtract from cash after operations.

(Cash after operations
- Taxes paid & other Inc/Exp (Other income (exp)+change in other liabilities + income tax expense + change in deferred income taxes + change in income taxes payable))/Sales

How to Interpret: This ratio reflects the amount of cash available for servicing interest on bank debt. In other words, it adjusts the cash after operations to reflect net cash outflows or inflows arising from changes in income taxes and miscellaneous assets and liabilities.

4. Cash after Debt Amortization

How to Calculate: Subtract the current maturities of debt outstanding at the end of the previous year from net cash income.

(Cash after financing costs - Current portion of long-term debt (dividends or owners withdrawals + change in dividends payable + interest exp. + change in interest payable))/Sales

How to Interpret: If there is a positive figure after this deduction, it means a company has generated sufficient cash from its internal operations to meet all its obligations to bank lenders, including interest and principal payments on its bank debt. On the other hand, if the figure is negative, the company must resort to external sources of financing to meet these obligations as well as to make any capital expenditure payments.

5. Debt Service P&I Coverage

How to Calculate: Divide net cash after operations by the sum of current debt obligations.

Net cash after operations (current period) / (Interest + noncash interest + current portion LTD & current portion of capital leases)

How to Interpret: This ratio is a measure of a firm's ability to service its debt with internally generated cash flow. It helps you determine whether a business can meet all its operating needs and has sufficient funds remaining to meet principal and interest debt-service requirements and to cover dividends. If the ratio is less than 1:1, this indicates a company must borrow funds to meet some or all of its financing obligations.

6. Interest Coverage (Operating Cash)

How to Calculate: Divide net cash after operations by cash and noncash interest expenses.

Net cash after operations (current period) / (Interest expense + noncash interest expense)

How to Interpret: This ratio is a measure of a firm's ability to service debt by generating cash to meet interest payments. It is an alternative to the earnings coverage return. This ratio also serves as an indicator of a company's capacity to incur additional debt.

Yearly Change in Selected Balance Sheet and Income Statement Accounts:

(Note: Within the data pages, D stands for percent change from year-to-year.)

1. Δ Inventory

How to Calculate: Subtract prior period's inventory from the current period's inventory. Then, divide by the inventory for the prior period.

(Inventory current period - inventory prior period) / Inventory prior period

How to Interpret: Inventory is anything constituting inventory for the firm. Inventory presentations are based on point-in-time balances at the end of the fiscal year, not averages. In addition, the data that we capture does not permit us to know what method of inventory accounting (LIFO or FIFO, for instance) was used. The figures presented are the yearly percent change in the inventory level of the industry.

2. Δ Total Current Assets (TCA)

How to Calculate: Subtract the prior period's total current assets from the current period's total current assets. Then, divide by those for the prior period.

(TCA current period - TCA prior period) / TCA prior period

How to Interpret: TCA includes cash and equivalents, trade receivables (net), inventory, and all other current assets excluding prepaid items. The figures presented are the yearly percent change in total current asset level of the industry.

3. Δ Total Assets (TA)

How to Calculate: Subtract the prior period's total assets from the current period's total assets. Then, divide by those for the prior period.

(TA current period - TA prior period) / TA prior period

How to Interpret: Total assets includes *total current assets* as well as fixed assets (net), intangibles (net), and all other

noncurrent assets. The figures presented are the yearly percent change in the total asset level of the industry.

4. Δ Retained Earnings (RE)

How to Calculate: Subtract the prior period's retained earnings from the current period's retained earnings. Then, divide by those for the prior period.

$$(RE \text{ current period} - RE \text{ prior period}) / RE \text{ prior period}$$

How to Interpret: Retained earnings are profits that have not been distributed to shareholders. The figures presented are the yearly percent change in the retained earnings of the industry.

5. Δ Net Sales (NS)

How to Calculate: Subtract the prior period's net sales from the current period's net sales. Then, divide by those for the prior period.

$$(NS \text{ current period} - NS \text{ prior period}) / NS \text{ prior period}$$

How to Interpret: Net sales equals gross sales minus returns and discounts allowed, if there are any. The figures presented are the yearly percent change in the net sales of the industry. Although a firm's advertising and pricing policies affect the variability of sales, the major cause is the industry in which the firm operates. Sales in a cyclical industry will be volatile over the business cycle compared to sales of a firm in a noncyclical industry.

6. Δ Cost of Goods Sold (CGS)

How to Calculate: Subtract the cost of goods sold for the prior period from those for the current period. Then, divide by cost of goods sold for the prior period.

$$(CGS \text{ current period} - CGS \text{ prior period}) / CGS \text{ prior period}$$

How to Interpret: CGS is the actual amount it takes to produce the good or service. The figures presented are the yearly percent change in the industry's cost of goods sold.

7. Δ Profit before Interest & Taxes (PBIT)

How to Calculate: Subtract the prior period's profit before interest and taxes from the current period's. Then, divide by the profit before interest and taxes for the prior period.

$$(PBIT \text{ current period} - PBIT \text{ prior period}) / PBIT \text{ prior period}$$

How to Interpret: The figures presented are the yearly percent change in the profit before interest and taxes of the industry.

8. Δ Depreciation/Depletion/Amortization (DDA)

How to Calculate: Subtract the prior period's depreciation/depletion/amortization from the current period's. Then, divide by the depreciation/depletion/amortization for the prior period.

$$(DDA \text{ current period} - DDA \text{ prior period}) / DDA \text{ prior period}$$

How to Interpret: DDA is the sum of all such noncash expenses incurred during the year covered by the statement. The figures presented are the yearly percent change in the DDA of the industry.

Other Ratios:

The following ratios should be interpreted in conjunction with all other analytical ratios to supplement and highlight different aspects of the company's financial condition. They should not be used alone as the sole indicator of the industries' status.

1. Sustainable Growth Rate

How to Calculate: Follow the formula below to compute the SGR.

How to Calculate: Follow the formula below to compute the SGR.

$$\text{SGR} = \frac{p(1-d)(1+L)}{t - [p(1-d)(1+L)]}, \text{ where}$$

p = Net Income/Total Sales

d = (Cash Dividends+Stock Dividends)/Net Income

L = Total Liabilities/(Net Worth - Intangibles)

t = Total Assets/Total Sales

How to Interpret: The Sustainable Growth Rate (SGR) is a single number representing the annual percentage increase in sales that is consistent with a stable debt and capital structure (i.e., where total debt/net worth ratios do not change significantly or materially, from year to year). If a company's sales expand at a rate greater than the SGR, the company's debt/worth ratio will rise and result in an "out-of-equilibrium situation." When this happens, the firm approaches an over-leveraged position that raises the possibility of liquidity and debt repayment problems.

2. Funded Debt/EBITDA

How to Calculate: Follow the formula below to compute this measure of a firm's ability to service its debt.

$$\frac{((\text{Notes Payable} + \text{Current Maturities LTD} + \text{LTD}))}{(\text{Profit before Taxes} + \text{Interest Expense} + \text{Depreciation, Depletion, Amortization Expense})}$$

How to Interpret: This ratio is a general measure of a firm's ability to retire its funded debt with earnings. As the calculated ratio grows larger, it may indicate that a borrower would have more difficulty in meeting the debt obligations. The use of EBITDA ratios without consideration of other factors can be misleading.

Please note — The Funded Debt/EBITDA ratio is a nonlinear array. In other words, an array that is NOT ordered from highest positive to highest negative as is the case for linear arrays. The values for the Funded Debt/EBITDA ratio are arrayed from the lowest to highest positive, undefined, and then from the lowest to highest negative.

If the Funded Debt/EBITDA ratio is positive, then the top quartile would be represented by the *lowest positive* ratio. If the ratio is negative, the top quartile will be represented by the *lowest negative* ratio! In a nonlinear array such as this ratio, the median could be either positive or negative because it is whatever the middle value is in the particular array of numbers.

Introduction to Moody's Analytics RiskCalc™ and Industry Probabilities of Default

An Introduction to Moody's Analytics RiskCalc

RiskCalc offers the next generation default prediction technology for private, middle market companies. The RiskCalc model incorporates financial statement data and equity market based information to produce probability of default credit measures that reflect a forward-looking assessment of credit risk. Probability of default credit measures generated by RiskCalc are referred to as Expected Default Frequency (EDF™).

EDF credit measures indicate more than just default risk; they provide a quantitative means to better assess pricing, regulatory, compliance and benchmark issues. EDF credit measures are used by underwriters, risk managers and portfolio managers at financial institutions and corporations to:

1. Monitor and identify early credit deterioration;
2. Accurately price and set limits based on risk factors;
3. Provide consistent loss provisions, valuations and capital allocation;
4. Meet regulatory requirements with forward-looking recovery values and stressed analytics;
5. Manage and report on trading risk, portfolio risk and vendor risk (i.e. choosing suppliers or service providers based on credit quality);
6. Benchmark, calibrate and validate internal rating systems and models.

RiskCalc is a statistically powerful model for private firm default modeling because it is estimated on private, not public, firm data. Public and private firms differ in significant ways. Private firms are typically smaller in terms of asset size, exhibit lower leverage, higher retained earnings, higher short-term debt, higher current ratios and lower inventories than do public firms with similar risk. The relationships between certain financial ratios and default probability display significantly different behavior between public and private firms. To evaluate the credit risk of private firms, it is better to use a model designed specifically for private rather than public firms. RiskCalc is designed for this purpose because it targets private, middle market and small companies.

RiskCalc is complementary to, not a substitute for, subjective judgment. Many factors not reflected in balance sheets and income statements are relevant to gauging loan risk. The EDF score produced by RiskCalc alone cannot answer the deeper question of whether the credit adds value from a portfolio and relationship perspective. It does, however, efficiently summarize the quantitative aspect of the issue so that analysts can focus their expertise more productively.

RiskCalc consists of a global network of over 30 region and industry-specific models covering most of the world's GDP. Each RiskCalc model is developed and tested on native middle market borrowers. RiskCalc predictive analytics are based on the Moody's Analytics Credit Research Database (CRD), the world's largest and cleanest database of private firm financial statements and default information. Built in partnership with over 50 leading financial institutions around the world, the CRD contains 68 million financial statements from 15 million private firms and over 800,000 worldwide company defaults, providing unique insight into private firm default probability.

The latest RiskCalc offering to focus on private corporate credit risk is the United States Corporate Model, Version 4.0. This model uses 11 financial ratios, including firm size, that serve as inputs to a probit model.

Many ratios — in fact, too many — are correlated with credit quality. Given how these variables correlate with each other, Moody's Analytics selects a subset in order to generate a stable statistical model. Statistically, we are forced to choose among many potentially useful inputs. Table 1 shows the final variables and ratios used in RiskCalc for private companies.

Table 1: RiskCalc 4.0 for Private Company Inputs and Ratios

Ratio	Description
Activity Ratios	Measures a firm's efficiency. These ratios typically involve working capital items such as inventory, accounts receivable or accounts payable. A large stock of inventory relative to sales may indicate operation difficulties and high probability of default; other activity ratios have different relationships to default.
Debt Coverage	The ratio of cash flow to interest payments or another measure of liabilities. High debt coverage reduces the probability of default.
Growth Variables	Measures the stability of a firm's performance. Typically includes sales growth. Growth variables behave like a double-edged sword: both rapid growth and rapid decline (negative growth) tend to increase a firm's default probability.
Leverage Ratios	Measures the firm's level of debt and includes liabilities to assets or debt to assets. High leverage increases default probability.
Liquidity Variables	Measures the extent to which the firm has liquid assets relative to the size of its assets or liabilities. Typically includes the current ratio and the quick ratio. High liquidity reduces the probability of default.
Profitability Ratios	Measures a firm's ability to generate earnings compared to expenses. Numerator typically includes net income, net income less extraordinary items, profit before tax and operating profit while the denominator typically includes total assets, tangible assets, fixed assets and sales. High profitability reduces the probability of default.
Size	Measures total assets or sales deflated to a specific base year to ensure comparability. Large firms default less often.

These ratios were selected for their univariate power and tested within a multivariate framework on private firm data.

These inputs are transformed and estimated within the probit model to generate EDF credit measures. The model provides two methods to determine EDF credit measures.

Financial Statement Only (FSO) mode serves as the base case level of analysis. The resulting EDF value considers the health of a company based on its financial statement information. The FSO mode provides a stable estimate of a firm's default risk throughout the credit cycle and captures the firm's long term performance. FSO mode also provides an industry adjustment factor through a dummy variable for each industry sector, which ensures that the model captures the difference in the default rates among sectors.

Credit Cycle Adjusted (CCA) mode combines the company financials with the economy's general credit cycle to create a more accurate probability of a default estimate at any given point in time. Benefiting from forward-looking equity markets, RiskCalc uses the Distance-to-Default (DD) calculation from the Moody's Analytics Public Firm model. For example, if the DD factor for public firms in an industry indicates a level of risk is below the historical average, the FSO EDF level is adjusted downward to arrive at the CCA EDF level. Conversely, if the risk level is higher than the historical average, the FSO EDF level is adjusted upward to arrive at the CCA EDF level. In short, CCA EDF credit measures provide greater insight into the susceptibility of a firm during different economic cycles.

One year and five year EDF credit measures generated through either EDF mode are then mapped to Moody's bond default rates. A term structure is also included to provide EDF measures for any point between one and five years.

Additional Information

To obtain more comprehensive information about RiskCalc, please visit us at <http://www.moodyanalytics.com/> or contact us at ma_support@moody.com.

How the EDF (Expected Default Frequency) Measures Were Generated

The probabilities of default produced in RMA's *Annual Statement Studies: Industry Default Probabilities and Cash Flow Measures* were generated using the Moody's Analytics RiskCalc default model for U.S. private firms. We obtained the EDF credit measures by submitting the financial statements received from our member institutions in batch form to the RiskCalc model. EDF credit measures were computed based on the Credit Cycle Adjustment (CCA) mode. The model produced one and five year defaulted credit measures, which we then aggregated by assets and sales size using the same methods and aggregation categories we use to produce the financial statistics in our *Annual Statement Studies: Financial Ratio Benchmarks* publication.

Quartiles and the Probability of Default

This publication lists the upper quartile, second quartile (or median), and lower quartile one and five year probabilities of default by each industry and sales size for which sufficient information was available. For any given industry's probability of default, these figures are calculated by first computing the probability of default for each financial statement in the sample. These values are then "listed" in order from the lowest to the highest.

A quartile is determined by three points or "cut-off values" that divide an array of values into four equal-sized groups, as shown previously. The quartiles include the upper quartile, the median, and the lower quartile. The upper quartile is the cut-off value where one-quarter of the array of ratios falls between it and the lowest EDF. The median is the mid-point; that is, the middle cut-off value where half of the array falls above it and half below it. The lower quartile is the point where three-quarters of the array falls between it and the highest EDF. In many cases, the average of two values is used to arrive at the quartile value.

How to Use This Data

Data published herein may provide some insight into the relative default risk and credit quality for various industries and the firms that operate in those industries. The following sections include information to help you better understand the data.

EDF and Implied Ratings

RiskCalc calculates an EDF measure, which is the probability of default for each obligor. Table 2 maps the RiskCalc EDF measures to implied ratings, or historical bond default rates. Each Corresponding EDF Cut-off column represents EDF values less than or equal to that displayed in the table for the applicable one year and five year EDFs.

Table 2: EDF Ranges for RiskCalc Model Versions 3.1 and 4.0

Moody's Implied Rating	1 Year EDF Corresponding Cut-off (%)	5 Year EDF Corresponding Cut-offs (%)
Aaa	0.0185	0.2845
Aa1	0.0308	0.3841
Aa2	0.0514	0.5185
Aa3	0.0857	0.7000
A1	0.1428	0.8600
A2	0.1785	1.0000
A3	0.2231	1.3454
Baa1	0.2789	2.0029
Baa2	0.4290	2.9676
Baa3	0.6600	4.3667
Ba1	1.1000	5.8950
Ba2	1.6500	7.6635
Ba3	2.4750	9.9626
B1	3.7125	12.9513
B2	5.5688	16.8367
B3	8.3531	21.8877
Caa/C		

How Do EDF Measures and .edf Ratings Relate to Moody's Long-term Bond Ratings?

RiskCalc EDF measures and Moody's long-term bond ratings are not directly comparable. They are two different, though related, credit risk measures. Table 3 compares various aspects of the two systems, highlighting similarities and differences.

Table 3: Similarities and Differences between EDFs and Moody's Long-Term Bond Ratings

Characteristic	RiskCalc Probabilities	Moody's Long-term Bond Ratings
Unit of Study	Obligor	Obligation and/or Obligor
Time Horizon	Specific, one to five years	Non-specific, long term
Risk Dimension	One dimensional: Probability of default	Multi-dimensional: Probability of default and severity of loss
Information Requirements	Large, reliable electronic datasets	Flexible as situation may require; robust to poor quality or missing data
Obligor Participation	None	Generally
Volatility	High	Low — maintained through the cycle
Scale	Continuous/Absolute	21 Risk Buckets/Relative
Scope of Influence	Private; available via subscription	Available to all users of public market information
Structure	Simple, codified analysis of few variables	Flexible as situation may require

Important Notes

Despite the important differences between RiskCalc EDF measures and Moody's long-term bond ratings, some users of one or both risk nomenclatures find it helpful to compare them. Moody's bond default study provides a basis for such a comparison. This study rigorously correlates Moody's long-term corporate bond ratings (Aaa, Aa1, etc.) with ex-post default frequency, allowing us to calculate historical average bond default rates for each rating category. By mapping a firm's RiskCalc default probabilities into the historical average bond default rates, we create dot EDF ratings (e.g., Aaa.edf, Aa1.edf, Aa2.edf, Caa2.edf, Caa3.edf, Ca.edf, C.edf), which facilitate comparison with long-term bond ratings.

Dot EDF ratings carry no additional information beyond the default probabilities and are not long-term bond ratings for all of the reasons highlighted in Table 3. However, they are a restatement of the EDF measures and provide a shorthand nomenclature for default probabilities. For example, for many, the difference between two companies with 0.0075 and 0.0131 probabilities of default is not as easily understood as the difference between an A3.edf company and a Baa1.edf company.

The correlation between dot EDF ratings and long-term bond ratings is also imperfect because they are derived through different processes and are based on different datasets. EDF measures are produced by a multi-factor model that empirically relates selected financial ratio values to default probabilities. Long-term bond ratings are based on a wide variety of qualitative and quantitative factors that include accounting and market information, data on industry and competitive trends, and generally, input from the obligor. The information is then distilled by an analyst and a rating committee with sector-specific expertise and in-depth understanding of an issuer's competitive position and strategic direction.

The intent of Moody's Analytics RiskCalc models is not to predict Moody's bond ratings. They are designed to calculate probabilities of default for defined time horizons. Recovery models, such as Moody's Analytics LossCalc™, are used to calculate loss in the event of default. The output of these models, combined with correlation estimates, will facilitate quantification of risk at the obligor and portfolio level. Despite the structural difficulties in directly comparing EDF measures with long-term bond ratings, many of our customers will find the systems complementary and valuable in different ways as part of a risk management solution.

Definitions of Default

Once a default event is detected, we aggregate the data to create a single default for each borrower who has a default event of 90 days past due with a non-pass rating or more severe. The defaulted borrower is then assigned a date of the earliest default event and the most severe default type detected over time.

Ideally, we would like to predict loss rates – the severity of losses associated with those loans that not only default through missed payments but do not eventually pay back in full principal and accrued interest. Unfortunately, such information is rare. In practice, once a credit is identified as defaulted, it moves to a different area within the lending unit (workout or collections), making it impractical for analysts to tie the original application data to the eventual recovery amount. Therefore, we ignore the recovery issue and choose a default definition that is relatively unambiguous, easy to measure, and highly correlated with our target—loss of present value compared to the original loan terms.

Summary

Given the evolution of credit risk management, RMA, in alliance with Moody's Analytics, is pleased to provide our constituency with industry-level probability of default measures. We hope that this benchmark will be helpful to lenders, analysts, portfolio managers, and risk professionals when assessing concentration risk, setting limits, allocating capital, and developing risk-mitigating strategies for both obligors and portfolios.

Trademark Information

“RiskCalc” carries the pending trademark symbol during the first mention, and should always be used as an adjective followed by a noun, such as model, software or solution (e.g. RiskCalc™ models).

“EDF” carries the pending trademark symbol and its unabbreviated form during the first mention, and should always be used as an adjective followed by a noun, such as credit measures (e.g. Expected Default Frequency (EDF™) credit measures).

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