

# **Rating Change Timeliness across Rating Agencies**

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## **I. Summary**

Rating Agencies occupy a powerful position in capital markets across the world. Their credit ratings of Sovereigns, Corporates and Structured Finance deals can have a strong affect on the cost and ability to borrow for many organisations. Previous studies have quantified the effect of rating changes on the price of bonds in the secondary market. Event studies have shown a marked influence on price, particularly when a credit downgrade is announced. This effect is even more pronounced when the rating downgrade crosses the Investment/Speculative rating boundary.

However, the timeliness of ratings across agencies is still an unanswered question. Making the assumption that a rating change brings new information to the market, does one rating agency consistently make rating changes earlier?

This paper will compare the timeliness of rating changes across the major rating agencies in three major capital markets: the United States, Canada and Australia.

## **II. Introduction and Motivations**

The concept of rating the creditworthiness of companies and individuals has been around for many years. In the 1860s, Henry Varnum Poor began publishing financial information about railroad and canal companies. By the late 1800's, R. G. Dun & Co had a network of representatives that reported on merchants and companies around the USA.

John Moody provided the first corporate rating for a railway bond in 1909, followed by Standard Statistics in 1916 and Poor's publishing in 1919. Standard Statistics and Poors merged in 1941 to form Standard & Poor's. Fitch rated its first deal in 1924.

Coverage of Municipal Bonds followed in the 1940s, Sovereign Ratings became common in the 1980s and 1990s, and rating of Structured Finance deals also began in the 1980s with residential mortgage backed securities.

The US Securities and Exchange Commission (SEC) created a regulatory category of “Nationally Recognized Statistical Rating Agency” or NRSRO in 1975, and accredited these three major bond rating agencies. In the following decade, 4 new agencies were accredited, but by 1992, mergers led to only three major names remaining: Standard & Poor’s, Moody’s and Fitch.

More recently, in 2003, the SEC accredited Dominion Bond Rating Service (DBRS) and A.M. Best with the NRSRO designation, so that the US market currently features 5 NRSROs.

The corporate rating industry also exists in a number of other countries, particularly Australia, Canada and the UK, and it is growing in many other locations throughout Europe and Asia. The large US based rating firms tend to dominate the markets (for example, S&P bought the largest rating agency in Australia, and recently took a majority interest in the largest in India).

Following the recent corporate collapses of companies like Enron and WorldCom, there has been renewed discussion as to the effectiveness of ratings agencies. There are a number of different ways that their effectiveness can be judged – with the most obvious metric being an examination of occurrence of default for companies that have been assessed at a particular rating level.

Rating agencies state that their analysis is based on all available public information, and they cannot be expected to accurately identify a corporate fraud. This somewhat mitigates the argument that they missed some of the recent corporate failures.

So the next reasonable question is how effective are the rating agencies in predicting corporate distress due to normal economic conditions and competition?

There are a number of different dimensions that can be tested. Rating agencies define a hierarchy of rating levels or “notches”, and although there is some variation between agencies in nomenclature, the philosophy is identical – the highest rated bonds (generally notated “AAA”) should have a very low chance of default, and this chance can be expected to increase as we move down the rating levels through B, C and eventually down to D (default) status. The better rating levels are known as Investment Grade, and the lower levels are known as Non-investment or Speculative grade.

There are two parts to risk of a bond. First, what is the risk that a bond will have a “credit event” such as default, and second, if such an event occurs, what percentage of the principal and accrued interest will be recovered? It is reasonable to assume that risk of default increases and recover rates fall as we move down through the rating level hierarchy. Highest level ratings indicate the best quality borrowers, with stable earnings, a strong capacity to repay loans, and often a history of similar successful repayments. A lower quality rating may indicate a company that has high debt with relatively minimal spare cash flow for contingencies, or a cyclic company or one with volatile earnings. A lower rating generally indicates greater risk.

Studies have been completed both in the academic world and within the agencies that looked at the effect of rating upgrades and downgrades on both the particular bond issues rated and the issuing corporation or sovereign entity.

Of particular interest is the effect of a rating downgrade. Such a downgrade is an indication that the bond may be at greater risk of loss or impairment than previously supposed.

From the Capital Asset Pricing Model (CAPM), if we assume that the pool of fixed income investors is rational, then they will demand greater reward for a higher risk bond.

A rating upgrade, by comparison, is a weaker leading indicator. The risk of the bond may be less than previously expected, but investors tend to react less to a potential gain than the equivalent potential loss. Furthermore, in the case of an upgrade to a bond, the potential payoff to an investor is capped at par, while downside losses can reach 100%.

The theory of efficient markets states that prices of securities should reflect all public knowledge (assuming the semi-strong theory). Rating agencies claim that their ratings are based only upon public knowledge. Thus if we have a secondary market for a bond, and it is downgraded, then we may or may not see a decrease in the market price of the bond (and a corresponding increase in yield). This depends on whether the rating downgrade is truly a new piece of news, or merely a summary of already public information.

In recent years, agencies like Standard & Poor's have become more transparent with their rating intentions, and they now publish warnings about bonds that are on "positive" or "negative" outlook ahead of most actual rating migrations. These warnings are known as putting a rating on "Credit Watch".

With ratings determined from public information and the distribution of credit watch warnings, we would thus expect that when a rating migration actually occurs, it should have already been priced into the bond by the market, and there should be little movement in bond price. Studies have actually found that the rating migration contains new information for the market, and there is a definite movement in bond prices after downgrades (although little if any changes due to an upgrade). Thus the effect of a rating change upon price has been comprehensively studied.

One question currently unanswered is regarding the timeliness of the different rating agencies. Is one agency generally quicker than others at upgrading or downgrading bonds? Does one agency have better insight into particular industries?

This paper investigates the timeliness of rating migrations across rating agencies. While it does not look at the accuracy of rating changes in terms of subsequent price changes, it does look at when rating migrations occurred for bonds that are rated by more than one rating agency.

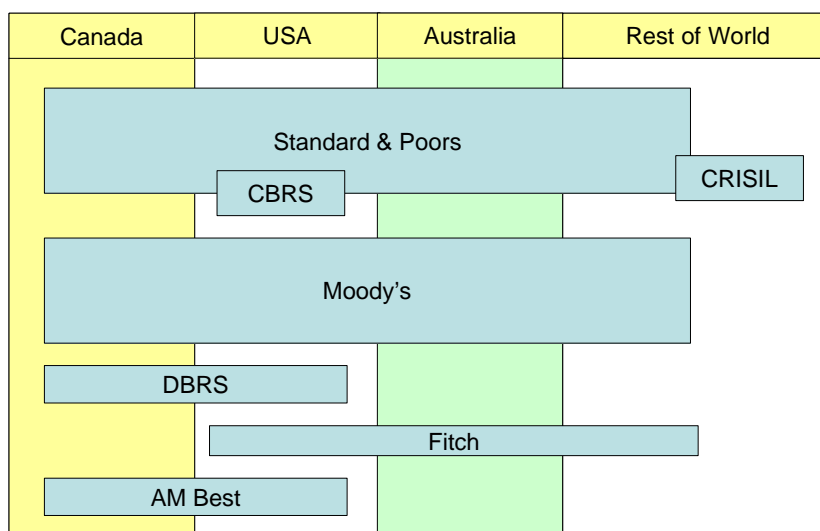
The universe for this study will be corporate bonds. Structured finance data was difficult to obtain, and similar studies to this have already been performed in the sovereign rating space. Bonds in three markets will be examined, as described in Table 1. The three markets were chosen as they are relatively liquid markets with more than one sizable rating agency in operation. Data was obtained from Bloomberg (more detail on this later in the paper).

Table 1: Dataset

| <b>Location</b>        | <b>USA</b>              | <b>USA</b>                                  | <b>Canada</b>                  | <b>Australia</b>        |
|------------------------|-------------------------|---|--------------------------------|-------------------------|
| <b>Dataset</b>         | S&P 500                 | All Corporates                              | All Corporates                 | All Corporates          |
| <b>Date Range</b>      | 1980 – 2005             | 2004-2005                                   | 1980-2005                      | 1980-2005               |
| <b>Rating Agencies</b> | Fitch<br>Moody's<br>S&P | A.M.Best<br>DBRS<br>Fitch<br>Moody's<br>S&P | CBRS<br>DBRS<br>Moody's<br>S&P | Fitch<br>Moody's<br>S&P |

The selected agencies have a large number of published rating migrations within the particular location (large means within one order of magnitude of the largest agencies in that location).

Diagram 1: Geographic spread of rating agencies



### III. The Rating Agencies

The big three US rating agencies have recently been joined by two other smaller NRSROs. Table 2 provides some information about each of the rating agencies.

Table 2: Rating Agency Information

| Agency                                     | Size / Locations                                | Owner   | Other brands  | Affiliations  |
|--|---|---|---|---|
| Standard & Poor's                          | 6,300 people, 20 countries                      | McGraw Hill (Public US Company) since 1966.                                 | CBRS (Canadian Bond Rating Service)<br>CRISIL (India) 2005          |   |
| Moody's                                    | 2,900 people, 22 countries                      | Public US Company since 2001, previously part of Dun & Bradstreet           | Operates economy.com & Moody's KMV                                  |   |
| Fitch Ratings                              | Not known                                       | Subsidiary of Fimalac (France) since 1997                                   | IBCA (London) 1997<br>Duffs & Phelps 2000<br>Thomson BankWatch 2000 | Clasificadora de Riesgo Humphreys Limitada (Chile)<br>ICRA Ltd (India)<br>Moody's Interfax (Russia)<br>Korea Investor Service, Inc.<br>Middle East Ratings & Investor Services (MERIS – Egypt)<br>Midroog Limited (Israel). |
| <b>Dominion Bond Rating Service (DBRS)</b> | 117 Analysts listed on Website.                 | Privately owned, founded 1976. based in Toronto, now expanding into the US. |   |   |
| A. M. Best                                 | Founded 1899, Offices in USA, UK and Hong Kong. | Private Company   |   |   |

#### **IV. Ratings Categories<sup>1</sup>**

Each of the rating agencies uses a set of different corporate credit “ratings”. While the wording of definitions varies across agency, they each follow a similar philosophy, with around 26 possible rating levels (or “notches”) for a long-term credit. Additionally, the rating agencies sometimes offer guidance about expected future rating migrations – for example, they may indicate that a rating is at risk, and may be soon downgraded.

The rating agencies offer a number of different types of ratings, including:

- Long term ratings
- Short term ratings
- Outlooks

This paper looks at long term ratings and migrations in these ratings. Short term ratings are labelled in a different manner and will be outside the scope of this paper. In order to discuss the ratings for individual rating agencies, we first need to define the ratings levels for each agency.

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<sup>1</sup> From Wikipedia and Rating Agency websites. See References for details



## V. S&P Long Term Credit Ratings:

S&P rates companies on a scale from AAA to D. Intermediate ratings are offered at each level between AA and B (i.e., BBB+, BBB and BBB-). For some companies, S&P may also offer guidance (termed a "credit watch") as to whether it is likely to be upgraded (positive), downgraded (negative) or uncertain (neutral)

Table 3: S&P Ratings

| Investment Grade     |   |
|----------------------|---|
| AAA                  | the best quality companies, reliable and stable   |
| AA                   | quality companies, a bit higher risk than AAA   |
| A                    | economic situation can affect finance   |
| BBB                  | medium class companies, which are satisfactory at the moment  |
| Non-Investment Grade |   |
| BB                   | more prone to changes in the economy  |
| B                    | financial situation varies noticeably   |
| CCC                  | currently vulnerable and dependent on favorable economic conditions to meet its commitments             |
| CC                   | highly vulnerable, very speculative bonds   |
| C                    | highly vulnerable, perhaps in bankruptcy or in arrears but still continuing to pay out on obligations   |
| CI                   | past due on interest  |
| R                    | under regulatory supervision due to its financial situation   |
| SD                   | has selectively defaulted on some obligations   |
| D                    | has defaulted on obligations and S&P believes that it will generally default on most or all obligations |
| NR                   | not rated   |

Note that **CBRS** and **DBRS** use a very similar scale to S&P, although DBRS has 'H' and 'L' in place of '+' and '-'.

## VI. Moody's Long Term Obligation Ratings

Moody's long-term obligation ratings are opinions of the relative credit risk of fixed-income obligations with an original maturity of one or more years. They address the possibility that a financial obligation will not be honored as promised. Such ratings reflect both the likelihood of default and any financial loss suffered in the event of default.

Table 4: Moody's Ratings

|                   |  |
|-------------------|--|
| Investment Grade  |  |
| Aaa               | Obligations rated Aaa are judged to be of the highest quality, with minimal credit risk.   |
| Aa1, Aa2, Aa3     | Obligations rated Aa are judged to be of high quality and are subject to very low credit risk.   |
| A1, A2, A3        | Obligations rated A are considered upper-medium grade and are subject to low credit risk.  |
| Baa1, Baa2, Baa3  | Obligations rated Baa are subject to moderate credit risk. They are considered medium-grade and as such may possess certain speculative characteristics. |
| Speculative Grade |  |
| Ba1, Ba2, Ba3     | Obligations rated Ba are judged to have speculative elements and are subject to substantial credit risk.   |
| B1, B2, B3        | Obligations rated B are considered speculative and are subject to high credit risk.  |
| Caa1, Caa2, Caa3  | Obligations rated Caa are judged to be of poor standing and are subject to very high credit risk.  |
| Ca                | Obligations rated Ca are highly speculative and are likely in, or very near, default, with some prospect of recovery of principal and interest.          |
| C                 | Obligations rated C are the lowest rated class of bonds and are typically in default, with little prospect for recovery of principal or interest.        |
| Special           |  |
| D                 | In Default   |
| WR                | Withdrawn Rating   |
| NR                | Not Rated  |
| P                 | Provisional  |

**VII. Fitch Long-Term Credit Ratings**

Fitch's long-term credit ratings are set up along a scale almost identical to that used by S&P. Moody's also uses a similar scale, but names the categories differently. Like S&P, Fitch also uses intermediate ratings for each category between AA and B (i.e., BBB+, BBB and BBB-).

Table 5: Fitch Ratings

|   |   |
|---|---|
| Investment Grade                          |   |
| AAA                                       | the best quality companies, reliable and stable   |
| AA  | quality companies, a bit higher risk than AAA   |
| A   | economic situation can affect finance   |
| BBB                                       | medium class companies, which are satisfactory at the moment  |
| Non-Investment Grade (Also known at Junk) |   |
| BB  | more prone to changes in the economy  |
| B   | financial situation varies noticeably   |
| CCC                                       | currently vulnerable and dependent on favorable economic conditions to meet its commitments             |
| CC  | highly vulnerable, very speculative bonds   |
| C   | highly vulnerable, perhaps in bankruptcy or in arrears but still continuing to pay out on obligations   |
| CI  | past due on interest  |
| R   | under regulatory supervision due to its financial situation   |
| SD  | has selectively defaulted on some obligations   |
| D   | has defaulted on obligations and S&P believes that it will generally default on most or all obligations |
| NR  | not rated   |

When comparing ratings across agencies, we will make the assumption that rating levels are readily comparable between the agencies. For long term credit ratings, each has the same number of rating levels, and when performing an analysis we will be assigning a code to each rating level as detailed in Appendix 4.

## VIII. Obtaining a dataset

Data was obtained from a Bloomberg terminal, using the RATC rating changes command.

Bloomberg has the following rating-related commands available:

Table 6: Bloomberg commands

| <b>Command</b> | <b>Use</b>             | <b>Notes</b>   |
|----------------|------------------------|--|
| RATE           | Credit Ratings         | GOVT, CORP, MTGE, M-MKT, PFD, EQUITY                         |
| RATC           | Rating Changes         | Historical rating changes for a given market and date range. |
| RCHG           | Rating History         | CMO – Collateralized Mortgage Obligations only               |
| RATD           | Rating Definition      | Rating categories for a particular rating agency.            |
| CSDR           | Sovereign Debt Ratings |  |

The RATC command provided useful data for corporate ratings. It lists rating migrations across a specified date range for a given country and agency. It can be further specified by a subset of all securities (such as SPX for members of the S&P 500 in the following result set):

Diagram 2: Screen Capture from Bloomberg RATC Command

| COMPANY CREDIT RATING REVISIONS   |            |                          |        |                |             |         | RATC                    |
|---|------------|--------------------------|--------|----------------|-------------|---------|-------------------------|
| Select Security List: Index: SPX Date: 1/ 1/2005 - 11/26/2005               |            |                          |        |                |             |         |                         |
| Search Criteria: Rating Type: ALL ; Agency: S&P ; Grade: ALL Direction: ALL |            |                          |        |                |             |         |                         |
| Country: US;  |            |                          |        |                |             |         |                         |
| Industry Type: All  |            |                          |        |                |             |         |                         |
| Company Name  | Date       | Rating Type              | Agency | Current Rating | Last Rating | Country | Industry Type           |
| Progress Energy Inc   | 11/23/2005 | Outlook                  | S&P    | STABLE         |             | US      | Electric-Integrated     |
| Progress Energy Inc   | 11/23/2005 | ST Local Issuer Credit   | S&P    | A-2            | A-3         | US      | Electric-Integrated     |
| Progress Energy Inc   | 11/23/2005 | ST Foreign Issuer Credit | S&P    | A-2            | A-3         | US      | Electric-Integrated     |
| Calpine Corp  | 11/22/2005 | LT Local Issuer Credit   | S&P    | B- *-          | B-          | US      | Independ Power Producer |
| Calpine Corp  | 11/22/2005 | LT Foreign Issuer Credit | S&P    | B- *-          | B-          | US      | Independ Power Producer |

In this table, we can see that Progress Energy has an outlook, and upgrades for Short Term local issuer credit and foreign issuer credit. Calpine has changed from B- to B- with a negative credit watch for both Long Term local issuer credit and foreign issuer credit.

Four different datasets were analysed:

- All USA Corporations for the period 1 January 2004 to 26 November 2005
- USA Corporations belonging to the S&P 500 from 1980 to 26 November 2005,
- All Australian corporations from 1980 to 26 November 2005
- All Canadian corporations from 1980 to 26 November 2005.

Bloomberg data was very sparse before 1 January 1980, so this determined a natural start date for the datasets. The data collection date was 26 November 2005, and all datasets are current up until that date.

Getting data for all US corporate bonds would result in a huge dataset that would be hard to manipulate. For example, the year 2004 returned 16,243 records, so it was impractical to use an exhaustive list of ratings for the US market. Instead, the US data is analysed in two ways:

- first with a deep slice – all S&P members from 1980 to 26 November 2005
- second, with a wide slice – all USA corporate bonds for 2004/2005 up until 26 November 2005.

Table 7: Raw Data Available

| Data Set                     | Date Range                     | Total Set Size | Set Size by Agency   |   | Set Size by Rating Type  |
|------------------------------|--------------------------------|----------------|--|---|--|
|                              |                                |                | (Large)  | (Small)   |  |
| <b>USA S&amp;P 500</b>       | 01/01/1980<br>to<br>26/11/2005 | 17,909         | <b>Fitch 2,686</b><br><b>Moodys 7,292</b><br><b>S&amp;P 7,365</b>  | <i>AMBest 69</i><br><i>CBRS 45</i><br><i>CRISIL 2</i><br><i>DBRS 441</i><br><i>R&amp;I 9</i>  | <b>Changes 12,861</b><br><i>New Ratings 3,878</i><br><i>Negative Outlook 153</i><br><i>Positive Outlook 112</i><br><i>Stable Outlook 905</i>                                     |
| <b>USA All Ratings</b>       | 01/01/2004<br>to<br>26/11/2005 | 35,828         | <b>AMBest 3,757</b><br><b>DBRS 1,016</b><br><b>Fitch 5,098</b><br><b>Moody's 13,636</b><br><b>S&amp;P 12,246</b> | <i>Care 1</i><br><i>CRISIL 1</i><br><i>JCR 22</i><br><i>KR 7</i><br><i>Mikuni 3</i><br><i>NICE 2</i><br><i>R&amp;I 37</i><br><i>RAM 2</i> | <b>Changes 21,508</b><br><i>New Ratings 5,538</i><br><i>Negative Outlook 1,270</i><br><i>Positive Outlook 777</i><br><i>Stable Outlook 6,673</i><br><i>Developing Outlook 62</i> |
| <b>Australia All Ratings</b> | 01/01/1980<br>to<br>26/11/2005 | 6,128          | <b>Fitch 364</b><br><b>Moody's 1,921</b><br><b>S&amp;P 3,732</b>   | <i>AMBest 7</i><br><i>CBRS 2</i><br><i>DBRS 41</i><br><i>JCR 23</i><br><i>MARC 1</i><br><i>PEFIN 1</i><br><i>R&amp;I 36</i>               | <b>Changes 4,032</b><br><i>New Rating 1,721</i><br><i>Developing Outlook 1</i><br><i>Negative Outlook 26</i><br><i>Positive Outlook 22</i><br><i>Stable Outlook 325</i>          |
| <b>Canada All Ratings</b>    | 01/01/1980<br>to<br>26/11/2005 | 14,005         | <b>CBRS 3,248</b><br><b>DBRS 2,844</b><br><b>Moody's 3,404</b><br><b>S&amp;P 3,968</b>                           | <i>AMBest 75</i><br><i>CRISIL 1</i><br><i>Fitch 433</i><br><i>JCR 12</i><br><i>R&amp;I 20</i>   | <b>Changes 8,954</b><br><i>New Rating 4.069</i><br><i>Negative Outlook 124</i><br><i>Positive Outlook 50</i><br><i>Stable Outlook 808</i>  |

The total set size is the total number of ratings found for the particular dataset. This includes rating migrations (upgrades and downgrades), changes to credit watch, credit outlooks, rating initiations and termination of rating coverage. Furthermore, from table 7, it can be seen that the rating agencies that have substantial numbers of rating changes are a subset of all

agencies operating in each particular location. Table 8 lists the agencies that have sufficient data to allow comparisons of a large number of rating changes. The potential size of the dataset for each agency is also given.

Table 8: Chosen Data

| <b>Data Set</b>              | <b>Date Range</b>              | <b>Set Size<br/>(These Agencies only)</b> | <b>By Agency</b>   | <b>By Rating Type</b> |
|------------------------------|--------------------------------|---|--|-----------------------|
| <b>USA S&amp;P 500</b>       | 01/01/1980<br>to<br>26/11/2005 | 17,909                                    | <b>Fitch 2,686</b><br><b>Moody's 7,292</b><br><b>S&amp;P 7,365</b>   | <b>Changes 12,861</b> |
| <b>USA All Ratings</b>       | 01/01/2004<br>to<br>26/11/2005 | 35,828                                    | <b>AMBest 3,757</b><br><b>DBRS 1,016</b><br><b>Fitch 5,098</b><br><b>Moody's 13,636</b><br><b>S&amp;P 12,246</b> | <b>Changes 21,508</b> |
| <b>Australia All Ratings</b> | 01/01/1980<br>to<br>26/11/2005 | 6,128                                     | <b>Fitch 364</b><br><b>Moody's 1,921</b><br><b>S&amp;P 3,732</b>   | <b>Changes 4,032</b>  |
| <b>Canada All Ratings</b>    | 01/01/1980<br>to<br>26/11/2005 | 14,005                                    | <b>CBRS 3,248</b><br><b>DBRS 2,844</b><br><b>Moody's 3,404</b><br><b>S&amp;P 3,968</b>                           | <b>Changes 8,954</b>  |

## **IX. Analysis**

The data is naturally broken into the 4 different datasets. Each of these datasets was analysed in the same manner that will be described below. Data was initially obtained from a Bloomberg terminal.

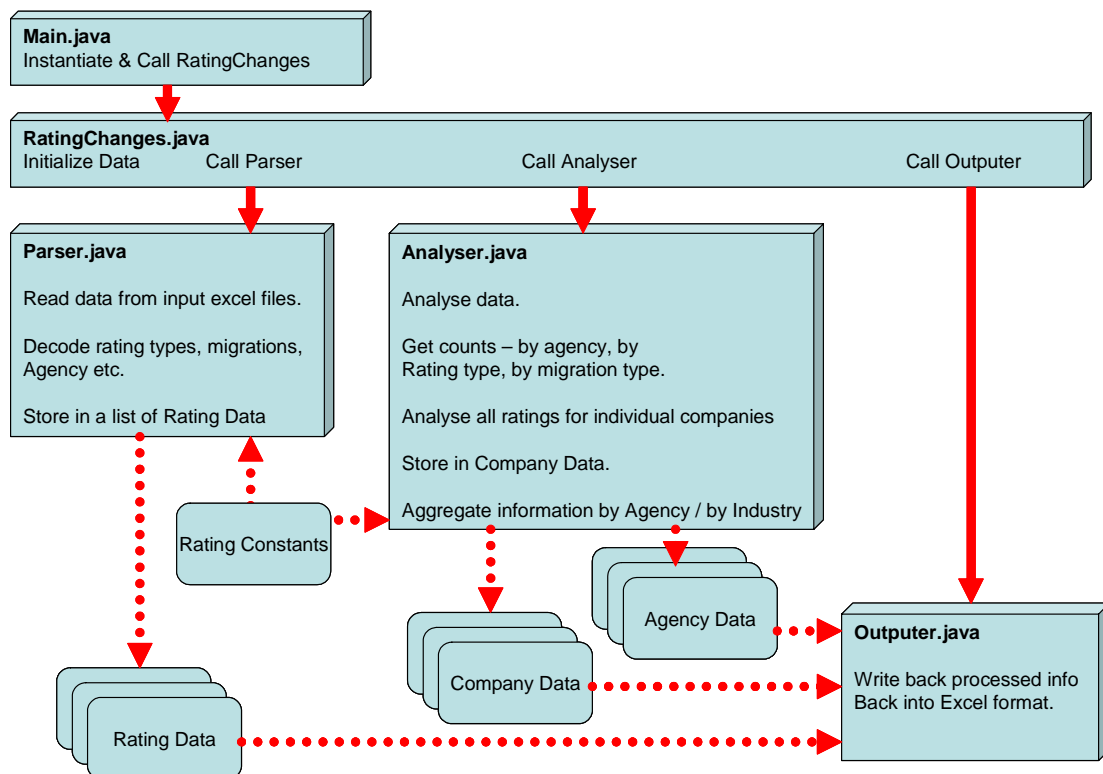
The analysis was performed using a java application custom written for this paper. The structure of the application is shown in Diagram 3.

The following steps were followed during the analysis:



- Obtain rating data from Bloomberg.
- Obtain data about rating levels and other inputs.
- Read all data into application
- Convert dates to days after start of period so dates are now an easily compared number.
- Sort into groups of ratings by individual company
- Analyse each particular company's ratings – comparing rating changes. This is the crucial step, and will be described in greater detail below.
- Aggregate results by company
- Aggregate results by industry.
- Aggregate results by dataset.

Diagram 3: Software Structure



Before analysis can begin, rating data needs to have rating levels, rating types and industries translated into numerical codes in order to compare between markets and between Rating Agencies. The translation data that was used is provided in Table 6 (rating level equivalencies) and Appendices 1 & 2 (rating types & industry assignments).

Once data was loaded into the application and stored by company, the next step was to assess which rating changes can be meaningfully compared.

The sample selection process involves only looking at ratings that occur in a period of time with joint ratings coverage. Thus we need at least two rating agencies to be covering the stock at the time of the rating action.

Rating actions that are either upgrades or downgrades were considered. The simplest example is a change in rating level (for example, from AAA to AA), but for the purpose of this paper, the addition or removal of a credit watch was also included (so we might see a rating of “AAA” move to “AAA \*-” which is an introduction of a negative credit watch). A change in credit watch provides real information to the market, and it was felt that discarding credit watch information would unnecessarily shrink the dataset.

This paper will not assess initiation of ratings by an agency since this is more likely to be a function of the size of the analyst pool in the rating agency rather than a function of the agency’s effectiveness in producing timely ratings. This paper will also not assess rating withdrawals by agencies.

The initial pass will look at all rating transitions. Later passes will further divide the dataset into investment grade (BBB/Baa and above) and speculative grade (BB/Ba and below) ratings, considering ratings migrations within these different data sets, and rating migrations that cause a company to transition from one of these subsets to the other. A rating downgrade that

cross the investment/speculative grade boundary are associated with larger reactions than downgrades in general, so this particular case will also be examined.

We also need to define a time window within which ratings can be said to be “concurrent”. If S&P did an upgrade on 1 January 2004, Moody’s upgraded on 1 March 2004, and Fitch upgraded on 1 November 2004, can it be stated that all 3 events are related?

Previous research in the sovereign area<sup>2</sup> used a 20 day time period. Thus they would only describe two rating actions as related if they occurred within 20 days of each other.

We feel this constraint is too restrictive. This paper is not an event study and does not look at price effects of ratings. Rather, it is only looking at the relative timeliness of ratings. We feel that ratings that are up to 92 days (approximately 3 months) may still be related to each other, and will use a window of this length. The decision to use a 3 month window is somewhat arbitrary, but we feel that rating changes that occur further apart than this are probably not responses to the same corporate news. A second pass using a 31 day window will be performed as well.

The next issue concerns a comparison between two rating events. Are we going to only compare upgrades with upgrades? What happens if S&P upgrades twice, and then Moody’s later does one upgrade? Furthermore, what should we do if the rating change is not the same (i.e. S&P moves from rating level 26 to 24, and Moody’s moves from 25 to 20)?

In order to resolve this issue, the rating changes will be assessed in a more simplistic manner by comparing rating changes in the same direction. Initially, we will not worry about the size of the transition or the start and end rating levels – but instead only the direction. If there are multiple rating events by one agency, we will consider the rating event closest to a rating event

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<sup>2</sup> Emawtee Bissoondoyal-Bheenick (2004) Rating timing differences between the two leading agencies: Standard and Poor’s and Moody’s

by another agency – an example of this is if S&P downgraded twice, then Fitch downgrades, the second S&P rating event will be compared with the Fitch event, and if S&P downgraded once followed by two Fitch downgrades, then the S&P downgrade will be compared with the first Fitch downgrade.

Another issue is choosing which rating types should be used. There are 54 different types of rating within our 4 datasets (listed in Appendix 5). However, only long term ratings are being considered in this paper, and also require rating types with large amounts of information. Note that some rating types are only used by one rating agency, but are equivalent to other rating types for other agencies. For example, the following rating types are used by the different rating agencies for equivalent credit ratings:

Table 9: Rating Type equivalence examples

| <b>S&amp;P</b>                                     | <b>Moody's</b>          | <b>Fitch</b>          |
|--|-------------------------|-----------------------|
| Financial Strength                                 | Bank Financial Strength | Financial Strength    |
| LT Foreign Issuer Credit<br>LT Local Issuer Credit | Senior Unsecured Debt   | Senior Unsecured Debt |

We will compare rating transitions across the agencies and rating types. We will also consider credit watch changes in cases in which the rating itself did not change. Rating types that are utilized are listed in Appendix 5.

Rating migration types are defined based on the present and previous rating. There may or may not be a value for current rating and old rating. Both need to be defined for this rating entry to be a rating migration. If only one is present and the other is blank, then there is a rating initiation or withdrawal.

Table 10: Rating Migration Types – obtained from current rating versus previous rating

| Previous Rating | Current Rating               | Migration Type    |
|-----------------|------------------------------|-------------------|
| Undefined       | Defined                      | Rating Initiation |
| Defined         | Undefined                    | Rating Withdrawal |
| In AAA to D     | In AAA to D above Old Rating | Upgrade           |
| In AAA to D     | In AAA to D below Old Rating | Downgrade         |
| In AAA to D     | Same as Old Rating           | No Change         |

The logical flow for comparison of ratings:

Sort all rating entries for a given company by date.

Loop through the ratings to look at each individually.

For a given rating, it is a rating change if it is one of the following:

- An upgrade
- A downgrade
- No rating change, but with a creditwatch change upwards or downwards (For example, a rating change from “AAA \*+” to “AAA” is a “downgrade” from creditwatch positive to no credit watch).

Each rating migration is provided by one particular rating agency. For each rating migration, the most recent rating from each other rating agency needs to be compared, if it exists.

If the two ratings have changed in the same direction, and are close enough in time (which is defined in this study as being within 92 days for the first pass of analysis, and within 31 days for a second pass), then we will consider them related, and record this relationship. Such a pair of ratings indicates that one of the agencies has “lagged” the other agency in performing this rating change.

As we iterate across all ratings for a company, we will keep track of the most recent rating from each agency. When looking at a valid rating change, it will be compared with each of the most recent ratings from other agencies if they exist. This rating will then be stored as the most recent rating for its particular agency.

The lead/lag between agencies is aggregated for each company, and then aggregated for each industry and for each dataset.

This study will assess the mean and median of the lead and lags, the raw number of each, and present histograms to illustrate whether particular agencies seem to consistently lead or lag compared to other agencies with their rating changes in a particular industry or data set.

## **X. Results**

From Table 8, we have 4 datasets, namely

- USA S&P500 Members from 1980 to 2005,
- USA All Corporates from Jan 2005 to November 2005
- Canada All Corporates from 1980 to 2005
- Australia All Corporates from 1980 to 2005.

We will perform the same analysis on each dataset.

## XI. Australia: All Corporates from 1 January 1980 to 26 November 2005

The complete analysis for the Australian data is included in the body of this paper; similar analysis for the other 3 datasets is included in Appendices 1-3.

Table 11: Initial Data for Australia:

|  | <b>Fitch</b> | <b>Moody's</b> | <b>S&amp;P</b> | <b>Other Agencies</b> | <b>Total</b> |
|--|--------------|----------------|----------------|-----------------------|--------------|
| <b># Companies Covered</b>             | 75           | 276            | 308            | -                     | -            |
| <b>Total Ratings Records</b>           | 364          | 1921           | 3732           | 0                     | 6017         |
| <b>Other/Not useful<sup>3</sup></b>    | 148          | 533            | 1409           | -                     | 2090         |
| <b>Useful</b>                          | 216          | 1388           | 2323           | -                     | 3927         |
| <b>Initiations</b>                     | 89           | 371            | 609            | -                     | 1069         |
| <b>Upgrades</b>                        | 29           | 230            | 316            | -                     | 575          |
| <b>Downgrades</b>                      | 49           | 358            | 535            | -                     | 942          |
| <b>Withdrawals</b>                     | 6            | 97             | 220            | -                     | 323          |
| <b>No Change</b>                       | 43           | 332            | 643            | -                     | 1018         |
| <b>Creditwatch upgrade<sup>4</sup></b> | 14           | 156            | 220            | -                     | 390          |
| <b>Creditwatch unchanged</b>           | 10           | 22             | 47             | -                     | 79           |
| <b>Creditwatch downgrade</b>           | 19           | 154            | 376            | -                     | 549          |

The count of companies is all companies that have at least one rating entry by the Rating Agency. If only the potentially Useful Rating Data are considered from the table above, we have the following information.

Table 12: Comparable Data for Australia.

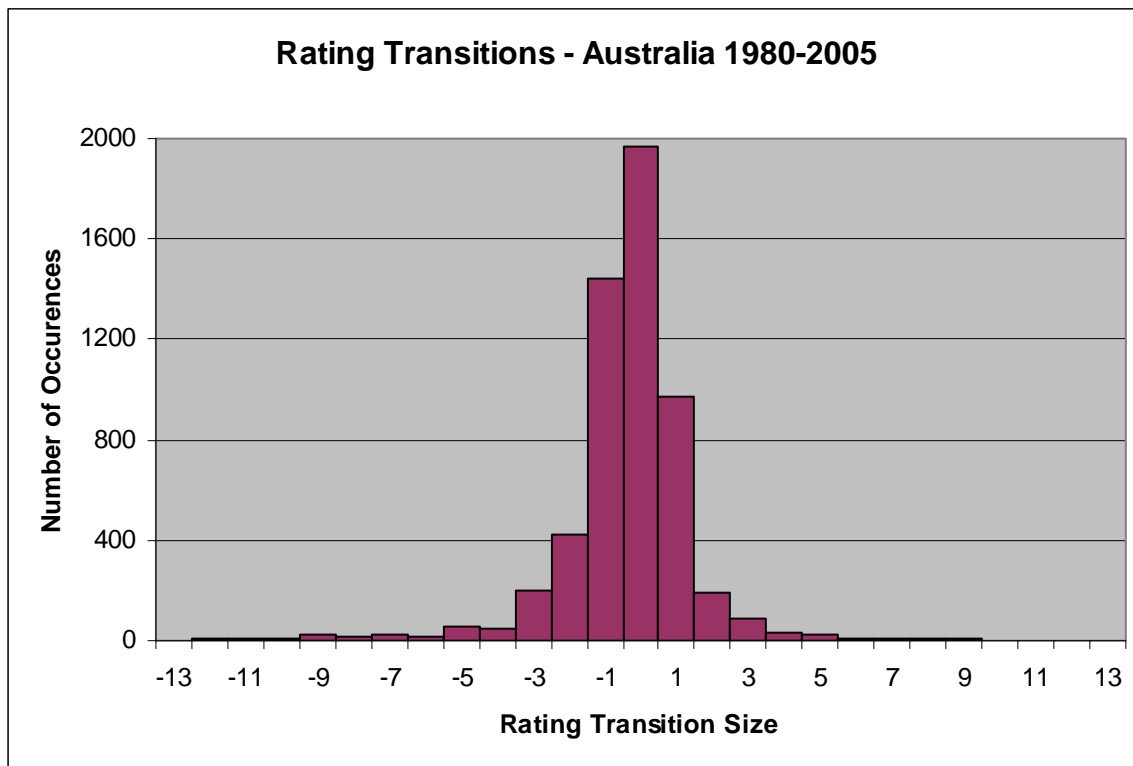
|                              | <b>Fitch</b> | <b>Moody's</b> | <b>S&amp;P</b> | <b>Total</b> |
|------------------------------|--------------|----------------|----------------|--------------|
| <b>Upgrades</b>              | 29           | 230            | 316            | 1344         |
| <b>Downgrades</b>            | 49           | 358            | 535            | 2279         |
| <b>Creditwatch upgrade</b>   | 14           | 156            | 220            | 705          |
| <b>Creditwatch downgrade</b> | 19           | 154            | 376            | 305          |

<sup>3</sup> Other/Not useful includes “outlooks” or short term ratings. This study is only looking at long term ratings.

<sup>4</sup> Creditwatch upgrades and creditwatch downgrades involve a change of creditwatch level without any rating notch change (for example, from AA to AA \*-). The “No Change” category is a sum of the creditwatch categories.

Upgrades and Creditwatch upgrades are both considered upward movements in a rating by an agency, and Downgrades and Creditwatch downgrades are both considered downward movements in a rating by an agency. When ratings are compared, upward movements will be compared with upward movements only, and downward movements with downward movements.

Figure 1: The size of rating transitions in Australia:



The largest grouping is a zero notch rating migration – which may still be useful data as we can have a credit watch change. The next most common events are a one notch downgrade and a one notch upgrade. Note that the range of possible rating upgrades and downgrades is from -26 (a rating change from AAA to D) to +26 (D to AAA). Extreme rating migrations like this are unlikely, and indeed our distribution shows that by far the most common events involve a 1 or two notch migration.



If we then look at only the ratings that involve an upgrade or downgrade, we get the following set of data:

Table 13: Number of Ratings Transitions in Australia by Type:

|                                | <b>Fitch</b> | <b>Moody's</b> | <b>S&amp;P</b> | <b>TOTAL</b> |
|--------------------------------|--------------|----------------|----------------|--------------|
| <b><i>I / Upgrade</i></b>      | 29           | 211            | 286            | 526          |
| <b><i>I / Downgrade</i></b>    | 43           | 295            | 430            | 768          |
| <b><i>I / CW upgrade</i></b>   | 14           | 121            | 170            | 305          |
| <b><i>I / CW downgrade</i></b> | 19           | 125            | 332            | 476          |
|                                |              |                |                |              |
| <b><i>S / Upgrade</i></b>      | 0            | 12             | 13             | 25           |
| <b><i>S / Downgrade</i></b>    | 4            | 44             | 65             | 113          |
| <b><i>S / CW upgrade</i></b>   | 0            | 35             | 50             | 85           |
| <b><i>S / CW downgrade</i></b> | 0            | 29             | 44             | 73           |
|                                |              |                |                |              |
| <b><i>I → S Downgrade</i></b>  | 2            | 19             | 40             | 61           |
| <b><i>S → I Upgrade</i></b>    | 0            | 7              | 17             | 24           |

I = Investment Grade (BBB or better)    CW Upgrade = credit watch was increased

S = Speculative Grade                      CW Downgrade = credit watch was decreased.

Rating migrations by different agencies were compared using a 92 day window and a 31 day window. The window determines the maximum number of days that can separate two different rating migrations that are still considered related. Thus the 92 day window implies that a Fitch rating upgrade 3 months after an S&P rating upgrade are related and should be compared. The 31 day window implies that only rating migrations by different agencies that occurred within 1 month should be compared. The 92 day window may be more comprehensive, allowing

comparison of a greater number of rating changes, but it also has the potential risk that rating changes close to three months apart would heavily influence the mean lead or lag.

In table 14, we also note that a negative value for the Mean / Median means that the Rating Agency on the left is leading the Rating Agency at the top. A positive value means that the Agency at the left is lagging the Rating Agency at the top

Table 14: Number of Leading / Lagging rating migrations versus other rating Agencies in Australia:

|                 |                | Moody's |        |           |        | S & P   |        |           |        |
|-----------------|----------------|---------|--------|-----------|--------|---------|--------|-----------|--------|
|                 |                | Upgrade |        | Downgrade |        | Upgrade |        | Downgrade |        |
|                 | Fitch          | 92 day  | 31 day | 92 day    | 31 day | 92 day  | 31 day | 92 day    | 31 day |
| <b>#Leading</b> |                | 6       | 4      | 5         | 3      | 11      | 5      | 7         | 5      |
| <b>#Same</b>    |                | 0       | 0      | 5         | 5      | 0       | 0      | 2         | 2      |
| <b>#Lagging</b> |                | 3       | 1      | 11        | 5      | 5       | 4      | 13        | 5      |
| <b>Mean</b>     |                | -11     | -22    | 8         | 0      | -31     | -5     | 18        | -2     |
| <b>Median</b>   |                | -28     | -14    | 1         | 0      | -6      | -14    | 5         | 0      |
|                 | <b>Moody's</b> |         |        |           |        |         |        |           |        |
| <b>#Leading</b> |                |         |        |           |        | 24      | 6      | 58        | 32     |
| <b>#Same</b>    |                |         |        |           |        | 7       | 7      | 15        | 15     |
| <b>#Lagging</b> |                |         |        |           |        | 21      | 12     | 69        | 26     |
| <b>Mean</b>     |                |         |        |           |        | -2      | 9      | 6         | -1     |
| <b>Median</b>   |                |         |        |           |        | 0       | 0      | 0         | 0      |

The rating agency at left are compared with the rating agency at the top. For the first intersection: Fitch vs Moody's, the values are leading=6, same=0, lagging=3, mean=-11, median=-28 for the 92 day window.

This means that Fitch leads Moody's in 6 ratings, and lags Moody's in 3 ratings. The mean time between related ratings from Fitch and Moody's is -11 days, and the median time between ratings for Fitch and Moody's is -28 days. It can be stated that Fitch leads Moody's for

timeliness of ratings in Australia, both from the number of leading versus lagging rating changes, and also from the mean and median difference between ratings from these agencies.

The table is a matrix, and it can be transposed. Thus, from this table it can also be seen that Moody’s lags Fitch by a median of -28 days using 92 day data.

This comparative timing information was aggregated into an indicator of how many other Agencies each particular Agency leads or lags. The number of leading ratings versus number of lagging ratings is one indicator. The mean is useful as well. The Median is related to number of leading and lagging ratings (for example, if there are more leading ratings, then the median should be a leading number). Then scoring 1 point for a clear lead, 0.5 points for a mixed message between count of rating changes and mean, and 0 for a clear lag, we get the following table:

Table 15: Summary of Leading versus Lagging in Australia

| <b>Agency</b>            | <b>Upgrade Lead/Lag</b>      | <b>Downgrade Lead / Lag</b>  |
|--------------------------|------------------------------|------------------------------|
| Fitch                    | 2 / 0                        | 0 / 2                        |
| Moody’s                  | 0.5 / 1.5                    | 1.5 / 0.5                    |
| S&P                      | 0.5 / 1.5                    | 1.5 / 0.5                    |
| <b>Timeliness Order:</b> | <b>Fitch Moody's S&amp;P</b> | <b>S&amp;P Moody's Fitch</b> |

This suggests S&P and Moody’s appears the timeliest in Australia for downgrades, but the least timely for upgrades. This implies that S&P and Moody’s are more conservative or cautious in their ratings than is Fitch in Australia.

One other dimension was analysed – the timeliness of Rating Agencies on an industry by industry basis. Table 16 details an industry breakout of rating comparisons. The industry groups are defined in Appendix 6.

Table 16: Summary of Leading and Lagging Rating Agencies for Upgrades and Downgrades by Industry in Australia

| Category            | Upgrades |         |         |     | Gap Size (days) | Total # Ratings | Downgrades |         |       |     | Gap Size | Total # Ratings |
|---------------------|----------|---------|---------|-----|-----------------|-----------------|------------|---------|-------|-----|----------|-----------------|
|                     | First    | Second  | Third   | 4th |                 |                 | First      | Second  | Third | 4th |          |                 |
| #N/A                |          |         |         |     |                 |                 |            |         |       |     |          |                 |
| Advertising         |          |         |         |     |                 |                 |            |         |       |     |          |                 |
| Aerospace           |          |         |         |     |                 |                 |            |         |       |     |          |                 |
| Agriculture         |          |         |         |     |                 |                 |            |         |       |     |          |                 |
| Beverages           |          |         |         |     |                 |                 | Moody's    | S&P     |       |     | 81       | 1               |
| Chemical            |          |         |         |     |                 |                 |            |         |       |     |          |                 |
| Clothing            |          |         |         |     |                 |                 |            |         |       |     |          |                 |
| Commercial          | Moody's  | S&P     |         |     | 29              | 3               | Moody's    | S&P     |       |     | 12       | 9               |
| Commodity           | Moody's  | S&P     |         |     | 36              | 2               | S&P        | Moody's |       |     | 16       | 13              |
| Construction        | Fitch    | S&P     |         |     | 3               | 2               | Fitch      | Moody's | S&P   |     | 27       | 5               |
| Education           |          |         |         |     |                 |                 |            |         |       |     |          |                 |
| Entertainment & Rec |          |         |         |     |                 |                 |            |         |       |     |          |                 |
| Finance             | Fitch    | S&P     | Moody's |     | 13              | 39              | S&P        | Moody's | Fitch |     | 12       | 78              |
| Food                | S&P      | Moody's |         |     | 77              | 2               | S&P        | Moody's |       |     | 27       | 5               |
| Government          | Moody's  | S&P     |         |     | 2               | 4               | Fitch      | S&P     |       |     | 52       | 14              |
| Healthcare          |          |         |         |     |                 |                 | S&P        | Moody's |       |     | 25       | 10              |
| Insurance           | Fitch    | Moody's |         |     | 28              | 1               | S&P        | Fitch   |       |     | 42       | 1               |
| Manufacturing       |          |         |         |     |                 |                 | S&P        | Moody's |       |     | 12       | 9               |
| Media               | Moody's  | Fitch   |         |     | 31              | 1               | S&P        | Moody's |       |     | 24       | 5               |
| Real Estate         |          |         |         |     |                 |                 | Moody's    | S&P     |       |     | 21       | 3               |
| Retail              | S&P      | Fitch   |         |     | 45              | 2               | S&P        | Moody's |       |     | 51       | 2               |
| Services            |          |         |         |     |                 |                 |            |         |       |     |          |                 |
| Technology          |          |         |         |     |                 |                 |            |         |       |     |          |                 |
| Telecom             |          |         |         |     |                 |                 | S&P        | Moody's | Fitch |     | 2        | 10              |
| Transport           |          |         |         |     |                 |                 | Moody's    | S&P     |       |     | 2        | 7               |
| Utility             | Fitch    | S&P     | Moody's |     | 32              | 18              | S&P        | Fitch   |       |     | 53       | 3               |

The breakout by Industry confirms the results of the summary in table 15. Within the Australian market, S&P and Moody's appear faster in downgrades in most industries, and Fitch is faster to upgrade ratings in many industries. This table also allows an analysis of where most of the ratings changes have occurred. For Australia, most of the action has been in the Finance industry, with lower but substantial changes in the Utility, Commodity and Government areas.

## XII. Conclusions

The following table is a summary of results across the different datasets:

Table 17: Summary of Agency Timeliness

|   | <b>Australia</b>        | <b>Canada</b>                           | <b>USA S&amp;P500</b>   | <b>USA Broad</b>                |
|---|-------------------------|---|-------------------------|---------------------------------|
| Order of timeliness<br>for upgrades<br><faster><br>to<br><slower>   | Fitch<br>Moody's<br>S&P | S&P<br>Fitch<br>DBRS<br>Moody's<br>CBRS | Fitch<br>S&P<br>Moody's | Fitch<br>S&P<br>Moody's<br>DBRS |
| Order of timeliness<br>for downgrades<br><faster><br>to<br><slower> | S&P<br>Moody's<br>Fitch | DBRS<br>Fitch<br>CBRS<br>Moody's<br>S&P | S&P<br>Fitch<br>Moody's | S&P<br>Fitch<br>DBRS<br>Moody's |

Timeliness of ratings can be interpreted in both a positive and a negative way. A rating agency that is faster to change ratings may be doing so from an operational or a philosophical point of view. They may have extra resources and the ability to complete risk assessment before their competitors. They may also have a different assessment of risk, and decide that the correct rating level has changed prior to competitors.

Corporate credit ratings attempt to be an accurate forecast of future risk for a bond. If a rating agency repeatedly upgrades and downgrades a particular bond, then market participants will have less confidence in the performance of that bond and the ability of the Rating Agency to accurately forecast risk. Many corporations operate within a multi-year industry cycle, and rating

agencies also must take these larger cycles into account when providing a rating, and try to avoid rating changes simply to match the cycle of an industry.

This paper has found that Standard and Poor's tends to be the most cautious of the Rating Agencies, with the fastest downgrades of corporate bonds, and average timing for upgrades. The one notable exception to this rule is in the Canadian Market when Standard and Poor's appears to be more accepting of risk and slower to downgrade. Across the 4 datasets Moody's is the slowest to downgrade bonds, but is also slow to upgrade as well. Fitch is generally quite aggressive with both upgrades and downgrades.

This paper has found that rating agencies are not consistent in their relative timeliness in different markets. While each rating agency has guidelines and Ratings Criteria to help standardize rating quality and consistency, it is apparent that this infrastructure does not ensure the same relative performance in different markets. The differences can most likely be attributed to differing staff knowledge and expertise in the various locations, poor internal dialog between the regional offices of a Rating Agency, and also variation due to different legal environments.

While this paper's results can be explained by Rating Agency philosophy and operational ability, these results can also be used in a predictive way. Due to the expected relative timing of rating changes, an S&P downgrade is more likely than other rating changes to result in a subsequent downgrade by a second rating agency. Also, a rating upgrade by Fitch is most likely to be followed by an upgrade by another Rating Agency. Moody's rating changes have less of a predictive effect, as they more commonly occur after other agencies have already moved their rating. It is outside the scope of this paper to examine the correlation between rating migrations by different agencies, but quantifying the increase in the likelihood of a rating change by one agency when another agency has announced a rating change is a worthy extension to this paper.

## Appendix 1: Analysis of Canadian Data:

### All Corporates from 1 January 1980 to 26 November 2005

There are 5 Rating Agencies operating in Canada that have published a sufficient quantity of rating changes for analysis in this paper.

Table 18: Initial Data for Canada

|                              | <b>CBRS</b> | <b>DBRS</b> | <b>Fitch</b> | <b>Moody's</b> | <b>S&amp;P</b> | <b>Other Agencies</b> | <b>Total</b> |
|------------------------------|-------------|-------------|--------------|----------------|----------------|-----------------------|--------------|
| <b># Companies Covered</b>   | 475         | 600         | 74           | 453            | 466            | -                     | -            |
| <b>Total Ratings Records</b> | 3248        | 2844        | 324          | 3968           | 3184           | 437                   | 14005        |
| <b>Other/Not useful</b>      | 1382        | 1439        | 0            | 1085           | 0              | -                     | 4343         |
| <b>Useful</b>                | 1866        | 1405        | 324          | 2883           | 3184           | -                     | 9662         |
| <b>Initiations</b>           | 438         | 572         | 112          | 836            | 898            | -                     | 2856         |
| <b>Upgrades</b>              | 410         | 109         | 37           | 429            | 359            | -                     | 1344         |
| <b>Downgrades</b>            | 433         | 261         | 76           | 684            | 825            | -                     | 2279         |
| <b>Withdrawals</b>           | 474         | 143         | 13           | 337            | 245            | -                     | 1212         |
| <b>No Change</b>             | 111         | 320         | 86           | 597            | 857            | -                     | 1971         |
| <b>Creditwatch upgrade</b>   | 21          | 75          | 38           | 243            | 328            | -                     | 705          |
| <b>Creditwatch unchanged</b> | 73          | 119         | 8            | 31             | 74             | -                     | 961          |
| <b>Creditwatch downgrade</b> | 17          | 126         | 40           | 323            | 455            | -                     | 305          |

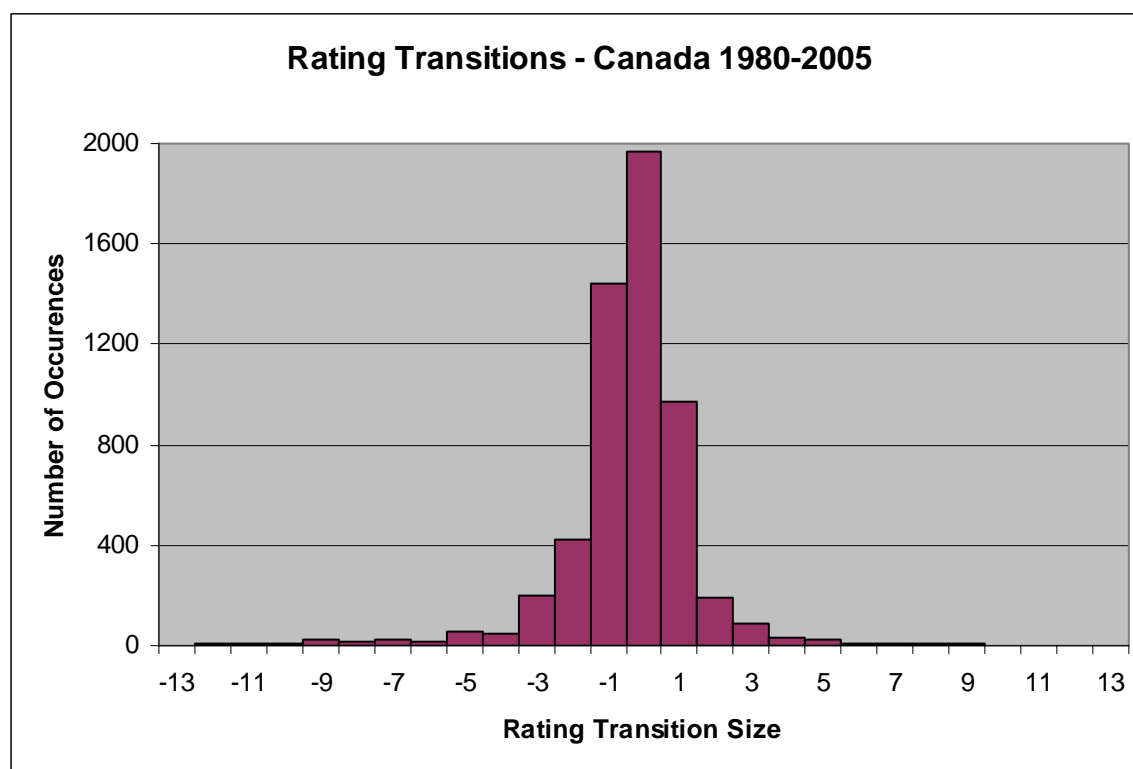
This rough data set provides the following set of rating changes that can be compared with those from other rating agencies:

Table 19: Comparable data for Canada

|                              | <b>CBRS</b> | <b>DBRS</b> | <b>Fitch</b> | <b>Moody's</b> | <b>S&amp;P</b> | <b>Total</b> |
|------------------------------|-------------|-------------|--------------|----------------|----------------|--------------|
| <b>Upgrades</b>              | 410         | 109         | 37           | 429            | 359            | 1344         |
| <b>Downgrades</b>            | 433         | 261         | 76           | 684            | 825            | 2279         |
| <b>Creditwatch upgrade</b>   | 21          | 75          | 38           | 243            | 328            | 705          |
| <b>Creditwatch downgrade</b> | 17          | 126         | 40           | 323            | 455            | 305          |

A summary of all rating transitions looks as follows:

Figure 2: The size of rating transitions in Canada:



The largest grouping is a zero rating notch migration. One notch downgrades and upgrades are the next most common events.

Table 20: Number of Ratings Transitions by Type in Canada:

|                         | <b>CBRS</b> | <b>DBRS</b> | <b>Fitch</b> | <b>Moody's</b> | <b>S&amp;P</b> | <b>Total</b> |
|-------------------------|-------------|-------------|--------------|----------------|----------------|--------------|
| <i>I / Upgrade</i>      | 313         | 90          | 34           | 222            | 182            | 841          |
| <i>I / Downgrade</i>    | 330         | 159         | 64           | 295            | 393            | 1241         |
| <i>I / CW upgrade</i>   | 13          | 61          | 34           | 132            | 182            | 421          |
| <i>I / CW downgrade</i> | 11          | 98          | 37           | 186            | 317            | 652          |
|                         |             |             |              |                |                |              |
| <i>S / Upgrade</i>      | 55          | 17          | 1            | 166            | 139            | 378          |
| <i>S / Downgrade</i>    | 55          | 73          | 7            | 326            | 352            | 813          |
| <i>S / CW upgrade</i>   | 9           | 14          | 4            | 111            | 146            | 284          |
| <i>S / CW downgrade</i> | 3           | 28          | 3            | 137            | 138            | 309          |
|                         |             |             |              |                |                |              |
| <i>I → S Downgrade</i>  | 48          | 29          | 5            | 63             | 80             | 225          |
| <i>S → I Upgrade</i>    | 42          | 2           | 2            | 41             | 38             | 125          |



A summary of the number of ratings that lead or lag those from other companies is listed in table 21. Note that this was done for both a 92 day and a 31 day “window”.

Table 21: Lead or Lag versus other rating Agencies in Canada:

|                 |                | DBRS    |     |      |     | Fitch   |     |      |     | Moody's |     |      |     | S & P   |     |      |     |
|-----------------|----------------|---------|-----|------|-----|---------|-----|------|-----|---------|-----|------|-----|---------|-----|------|-----|
|                 |                | Upgrade |     | Down |     | Upgrade |     | Down |     | Upgrade |     | Down |     | Upgrade |     | Down |     |
|                 | CBRS           | 92d     | 31d | 92d  | 31d | 92d     | 31d | 92d  | 31d | 92d     | 31d | 92d  | 31d | 92d     | 31d | 92d  | 31d |
| <b>#Leading</b> |                | 1       | 0   | 9    | 6   | 0       | 0   | 0    | 0   | 14      | 1   | 31   | 16  | 6       | 2   | 30   | 15  |
| <b>#Same</b>    |                | 0       | 0   | 0    | 0   | 0       | 0   | 0    | 0   | 2       | 2   | 5    | 5   | 1       | 1   | 2    | 2   |
| <b>#Lagging</b> |                | 2       | 1   | 9    | 7   | 3       | 0   | 3    | 0   | 13      | 9   | 23   | 8   | 6       | 3   | 15   | 10  |
| <b>Mean</b>     |                | 16      | 16  | 0    | 2   | 43      | 0   | 67   | 0   | -11     | 10  | 2    | -3  | -11     | 0   | -17  | -5  |
| <b>Median</b>   |                | 16      | 16  | 1    | 4   | 43      | 0   | 74   | 0   | 0       | 15  | -7   | -7  | 0       | 0   | -19  | -13 |
|                 | <b>DBRS</b>    |         |     |      |     |         |     |      |     |         |     |      |     |         |     |      |     |
| <b>#Leading</b> |                |         |     |      |     | 4       | 4   | 11   | 6   | 26      | 13  | 81   | 53  | 6       | 4   | 90   | 54  |
| <b>#Same</b>    |                |         |     |      |     | 3       | 3   | 6    | 6   | 0       | 0   | 15   | 15  | 2       | 2   | 34   | 34  |
| <b>#Lagging</b> |                |         |     |      |     | 5       | 3   | 15   | 9   | 13      | 6   | 54   | 25  | 13      | 7   | 58   | 23  |
| <b>Mean</b>     |                |         |     |      |     | 2       | -5  | 4    | 3   | -20     | -6  | -1   | -4  | 16      | 1   | -2   | -2  |
| <b>Median</b>   |                |         |     |      |     | 0       | 0   | 0    | 0   | -26     | -1  | -1   | -2  | 10      | 0   | 0    | 0   |
|                 | <b>Fitch</b>   |         |     |      |     |         |     |      |     |         |     |      |     |         |     |      |     |
| <b>#Leading</b> |                |         |     |      |     |         |     |      |     | 5       | 2   | 15   | 13  | 2       | 0   | 18   | 10  |
| <b>#Same</b>    |                |         |     |      |     |         |     |      |     | 1       | 1   | 1    | 1   | 3       | 3   | 1    | 1   |
| <b>#Lagging</b> |                |         |     |      |     |         |     |      |     | 2       | 0   | 23   | 12  | 5       | 3   | 16   | 12  |
| <b>Mean</b>     |                |         |     |      |     |         |     |      |     | -4      | -10 | 11   | -1  | 8       | 9   | -3   | 0   |
| <b>Median</b>   |                |         |     |      |     |         |     |      |     | -14     | -3  | 3    | 0   | 0       | 0   | -1   | 0   |
|                 | <b>Moody's</b> |         |     |      |     |         |     |      |     |         |     |      |     |         |     |      |     |
| <b>#Leading</b> |                |         |     |      |     |         |     |      |     |         |     |      |     | 37      | 15  | 132  | 74  |
| <b>#Same</b>    |                |         |     |      |     |         |     |      |     |         |     |      |     | 3       | 6   | 58   | 56  |
| <b>#Lagging</b> |                |         |     |      |     |         |     |      |     |         |     |      |     | 53      | 31  | 151  | 86  |
| <b>Mean</b>     |                |         |     |      |     |         |     |      |     |         |     |      |     | 0       | 4   | 0    | 1   |
| <b>Median</b>   |                |         |     |      |     |         |     |      |     |         |     |      |     | 2       | 1   | 0    | 0   |

Looking at aggregating timing for each agency's for upgrades (lead/lag versus other agencies for average of median and mean):

Table 22: Summary of leading versus lagging in Canada

| Agency                   | Upgrade Lead/Lag                       | Downgrade Lead/Lag                     |
|--------------------------|--|--|
| CBRS                     | 1/3                                    | 2/2                                    |
| DBRS                     | 2.5/1.5                                | 3/1                                    |
| Fitch                    | 2.5/1.5                                | 2.5/1.1                                |
| Moody's                  | 1/3                                    | 1.5/2.5                                |
| S&P                      | 3.5/0.5                                | 0.5/3.5                                |
| <b>Timeliness Order:</b> | <b>S&amp;P Fitch DBRS Moody's CBRS</b> | <b>DBRS Fitch CBRS Moody's S&amp;P</b> |

Table 23: Summary of Leading and Lagging Rating Agencies for Upgrades and Downgrades by industry in Canada:

| Category            | Upgrades |         |         |         | Gap Size (days) | Total # Ratings | Downgrades |         |         |         | Gap Size | Total # Ratings |
|---------------------|----------|---------|---------|---------|-----------------|-----------------|------------|---------|---------|---------|----------|-----------------|
|                     | First    | Second  | Third   | 4th     |                 |                 | First      | Second  | Third   | 4th     |          |                 |
| #N/A                |          |         |         |         |                 |                 |            |         |         |         |          |                 |
| Advertising         |          |         |         |         |                 |                 |            |         |         |         |          |                 |
| Aerospace           |          |         |         |         |                 |                 |            |         |         |         |          |                 |
| Agriculture         |          |         |         |         |                 |                 | CBRS       | DBRS    | S&P     |         | 25       | 4               |
| Beverages           |          |         |         |         |                 |                 | S&P        | Moody's | CBRS    |         | 27       | 4               |
| Chemical            | S&P      | Fitch   | Moody's |         | 19              | 2               | Fitch      | Moody's | S&P     | DBRS    | 22       | 11              |
| Clothing            |          |         |         |         |                 |                 |            |         |         |         |          |                 |
| Commercial          |          |         |         |         |                 |                 | CBRS       | Moody's | S&P     | DBRS    | 12       | 50              |
| Commodity           | S&P      | DBRS    | Moody's | CBRS    | 17              | 41              | S&P        | Moody's | DBRS    | CBRS    | 19       | 80              |
| Construction        | Moody's  | CBRS    | S&P     |         | 15              | 12              | S&P        | DBRS    | Moody's | CBRS    | 19       | 18              |
| Education           |          |         |         |         |                 |                 |            |         |         |         |          |                 |
| Entertainment & Rec | S&P      | Moody's |         |         | 60              | 1               | S&P        | Moody's |         |         | 1        | 4               |
| Finance             | Fitch    | Moody's | S&P     | Fitch   | 12              | 20              | Moody's    | S&P     | Fitch   | DBRS    | 11       | 44              |
| Food                |          |         |         |         |                 |                 | S&P        | Moody's |         |         | 11       | 3               |
| Government          | CBRS     | DBRS    | Moody's | S&P     | 35              | 19              | Moody's    | CBRS    | S&P     |         | 18       | 14              |
| Healthcare          | S&P      | Moody's |         |         | 2               | 2               |            |         |         |         |          |                 |
| Insurance           | Fitch    | S&P     |         |         | 0               | 3               | DBRS       | Fitch   | Moody's | S&P     | 8        | 39              |
| Manufacturing       | S&P      | CBRS    | DBRS    | Moody's | 10              | 17              | DBRS       | S&P     | Moody's | CBRS    | 8        | 125             |
| Media               | S&P      | DBRS    | CBRS    | Moody's | 17              | 39              | Moody's    | S&P     |         |         | 17       | 35              |
| Real Estate         | S&P      | DBRS    |         |         | 22              | 6               | Moody's    | CBRS    | DBRS    |         | 47       | 4               |
| Retail              | Moody's  | S&P     |         |         | 28              | 2               | S&P        | DBRS    | Moody's |         | 9        | 17              |
| Services            |          |         |         |         |                 |                 |            |         |         |         |          |                 |
| Technology          | S&P      | Moody's |         |         | 28              | 4               | S&P        | CBRS    | DBRS    | Moody's | 13       | 7               |
| Telecom             | S&P      | DBRS    | Fitch   | Moody's | 12              | 43              | Fitch      | CBRS    | DBRS    | Moody's | 4        | 195             |
| Transport           | CBRS     | DBRS    | S&P     | Moody's | 55              | 5               | CBRS       | Fitch   | DBRS    | S&P     | 7        | 140             |
| Utility             | CBRS     | Moody's | DBRS    |         | 31              | 4               | CBRS       | S&P     | Moody's |         | 35       | 15              |

## Appendix 2: Analysis of USA Data

### S&P 500 Constituents from 1 January 1980 to 26 November 2005

Table 24: Initial Data for US S&P

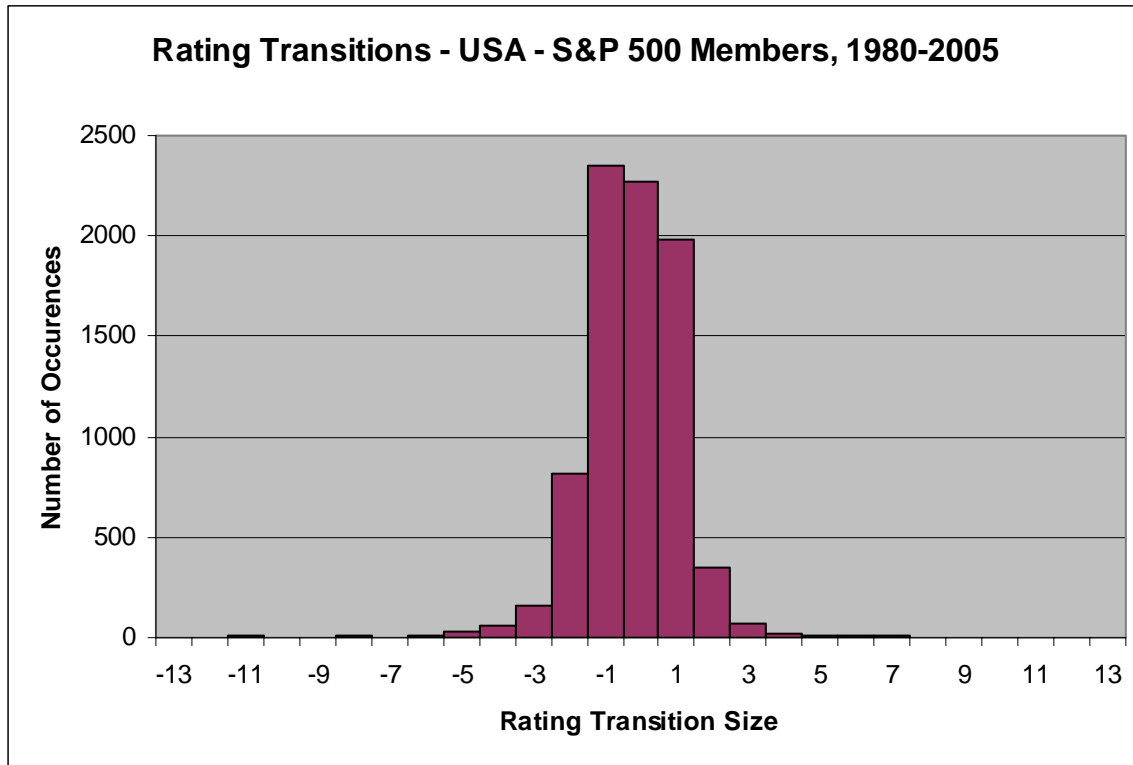
|                              | <b>Fitch</b> | <b>Moody's</b> | <b>S&amp;P</b> | <b>Other Agencies</b> | <b>Total</b> |
|------------------------------|--------------|----------------|----------------|-----------------------|--------------|
| <b># Companies Covered</b>   | 320          | 434            | 444            | -                     | -            |
| <b>Total Ratings Records</b> | 2686         | 7292           | 7365           | 566                   | 17909        |
| <b>Other/Not useful</b>      |              |                |                | -                     |              |
| <b>Useful</b>                | 1887         | 5973           | 4926           | -                     | 13038        |
| <b>Initiations</b>           | 647          | 1369           | 789            | 139                   | 2944         |
| <b>Upgrades</b>              | 281          | 1082           | 1080           | 10                    | 2453         |
| <b>Downgrades</b>            | 528          | 1457           | 1428           | 35                    | 3448         |
| <b>Withdrawals</b>           | 78           | 429            | 94             | 15                    | 616          |
| <b>No Change</b>             | 353          | 1636           | 1535           | 53                    | 3577         |
| <b>Creditwatch upgrade</b>   | 136          | 658            | 526            | 6                     | 1326         |
| <b>Creditwatch unchanged</b> | 20           | 23             | 34             | 15                    | 92           |
| <b>Creditwatch downgrade</b> | 197          | 955            | 975            | 32                    | 2159         |

Table 25: Comparable Data for US S&P:

|                              | <b>Fitch</b> | <b>Moody's</b> | <b>S&amp;P</b> | <b>Total</b> |
|------------------------------|--------------|----------------|----------------|--------------|
| <b>Upgrades</b>              | 281          | 1082           | 1080           | 2443         |
| <b>Downgrades</b>            | 528          | 1457           | 1428           | 3413         |
| <b>Creditwatch upgrade</b>   | 136          | 658            | 526            | 1320         |
| <b>Creditwatch downgrade</b> | 197          | 955            | 975            | 2127         |

A summary of all rating transitions looks as follows:

Figure 3: The size of rating transitions for USA S&P:



The largest grouping is for a one rating notch downgrade. A zero notch migration and a one notch upgrade are the next most common events.

Table 26: Number of Ratings Transitions by Type for US S&P:

|                         | Fitch | Moody's | S&P  | Total |
|-------------------------|-------|---------|------|-------|
| <i>I / Upgrade</i>      | 175   | 598     | 721  | 1502  |
| <i>I / Downgrade</i>    | 350   | 981     | 1110 | 2469  |
| <i>I / CW upgrade</i>   | 79    | 380     | 377  | 839   |
| <i>I / CW downgrade</i> | 165   | 713     | 847  | 1752  |
|                         |       |         |      |       |
| <i>S / Upgrade</i>      | 66    | 338     | 207  | 613   |
| <i>S / Downgrade</i>    | 116   | 275     | 174  | 568   |
| <i>S / CW upgrade</i>   | 57    | 278     | 149  | 487   |
| <i>S / CW downgrade</i> | 32    | 242     | 128  | 407   |
|                         |       |         |      |       |
| <i>I → S Downgrade</i>  | 62    | 201     | 144  | 411   |
| <i>S → I Upgrade</i>    | 40    | 146     | 152  | 338   |

A summary of the number of ratings that lead or lag those from other companies is listed in table 27. Note that this was done for both a 92 day and a 31 day “window”.

Table 27: Lead or Lag versus other rating Agencies for US S&P:

|                 |                | <b>Moody's</b> |               |                  |               | <b>S &amp; P</b> |               |                  |               |
|-----------------|----------------|----------------|---------------|------------------|---------------|------------------|---------------|------------------|---------------|
|                 |                | <i>Upgrade</i> |               | <i>Downgrade</i> |               | <i>Upgrade</i>   |               | <i>Downgrade</i> |               |
|                 | <b>Fitch</b>   | <i>92 day</i>  | <i>31 day</i> | <i>92 day</i>    | <i>31 day</i> | <i>92 day</i>    | <i>31 day</i> | <i>92 day</i>    | <i>31 day</i> |
| <b>#Leading</b> |                | 63             | 36            | 256              | 145           | 42               | 20            | 198              | 113           |
| <b>#Same</b>    |                | 4              | 2             | 56               | 53            | 14               | 14            | 85               | 81            |
| <b>#Lagging</b> |                | 54             | 26            | 216              | 119           | 32               | 20            | 216              | 135           |
| <b>Mean</b>     |                | -5             | -4            | -1               | -1            | -3               | 0             | 0                | 0             |
| <b>Median</b>   |                | -1             | -1            | 0                | 0             | 0                | 0             | 0                | 0             |
|                 | <b>Moody's</b> |                |               |                  |               |                  |               |                  |               |
| <b>#Leading</b> |                |                |               |                  |               | 146              | 91            | 443              | 247           |
| <b>#Same</b>    |                |                |               |                  |               | 14               | 14            | 130              | 136           |
| <b>#Lagging</b> |                |                |               |                  |               | 168              | 93            | 538              | 352           |
| <b>Mean</b>     |                |                |               |                  |               | 5                | 0             | 0                | 1             |
| <b>Median</b>   |                |                |               |                  |               | 2                | 0             | 0                | 0             |

Looking at aggregating timing for each agency’s for upgrades (lead/lag versus other agencies for average of median and mean):

Table 28: Summary of Leading versus Lagging Upgrades for US S&P

| <b>Agency</b>            | <b>Upgrade Lead/Lag</b>      | <b>Downgrade Lead / Lag</b>  |
|--------------------------|------------------------------|------------------------------|
| Fitch                    | 2/0                          | 1/1                          |
| Moody's                  | 0/2                          | 0/2                          |
| S&P                      | 1/1                          | 2/0                          |
| <b>Timeliness Order:</b> | <b>Fitch S&amp;P Moody's</b> | <b>S&amp;P Fitch Moody's</b> |

Table 29: Summary of Upgrades and downgrades and the order of Rating Agency timeliness by industry for US S&P

| Category            | Upgrades |         |         |     | Gap Size (days) | Total # Ratings | Downgrades |         |         |     | Gap Size | Total # Ratings |
|---------------------|----------|---------|---------|-----|-----------------|-----------------|------------|---------|---------|-----|----------|-----------------|
|                     | First    | Second  | Third   | 4th |                 |                 | First      | Second  | Third   | 4th |          |                 |
| #N/A                |          |         |         |     |                 |                 |            |         |         |     |          |                 |
| Advertising         | S&P      | Fitch   | Moody's |     | 5               | 14              | Moody's    | Fitch   | S&P     |     | 5        | 61              |
| Aerospace           | Moody's  | S&P     |         |     | 14              | 2               | Moody's    | S&P     |         |     | 4        | 26              |
| Agriculture         | Moody's  | S&P     |         |     | 26              | 2               | Moody's    | S&P     |         |     | 12       | 3               |
| Beverages           | Moody's  | Fitch   | S&P     |     | 11              | 3               | S&P        | Moody's |         |     | 1        | 9               |
| Chemical            | Moody's  | S&P     |         |     | 3               | 3               | Fitch      | S&P     | Moody's |     | 20       | 39              |
| Clothing            |          |         |         |     |                 |                 | Moody's    | S&P     |         |     | 26       | 7               |
| Commercial          | Moody's  | S&P     |         |     | 25              | 5               | Moody's    | S&P     |         |     | 4        | 4               |
| Commodity           | Fitch    | S&P     | Moody's |     | 20              | 70              | S&P        | Fitch   | Moody's |     | 1        | 177             |
| Construction        | Fitch    | Moody's | S&P     |     | 36              | 6               | S&P        | Moody's |         |     | 39       | 6               |
| Education           |          |         |         |     |                 |                 |            |         |         |     |          |                 |
| Entertainment & Rec |          |         |         |     |                 |                 | Moody's    | S&P     | Fitch   |     | 15       | 8               |
| Finance             | Moody's  | S&P     | Fitch   |     | 11              | 68              | Fitch      | Moody's | S&P     |     | 5        | 83              |
| Food                | Moody's  | S&P     |         |     | 4               | 17              | Fitch      | Moody's | S&P     |     | 3        | 58              |
| Government          |          |         |         |     |                 |                 |            |         |         |     |          |                 |
| Healthcare          | S&P      | Moody's | Fitch   |     | 9               | 69              | Fitch      | S&P     | Moody's |     | 5        | 168             |
| Insurance           |          |         |         |     |                 |                 | Fitch      | Moody's | S&P     |     | 7        | 125             |
| Manufacturing       | Fitch    | S&P     | Moody's |     | 8               | 37              | Fitch      | S&P     | Moody's |     | 5        | 290             |
| Media               | S&P      | Moody's | Fitch   |     | 12              | 35              | Fitch      | Moody's | S&P     |     | 12       | 59              |
| Real Estate         | Moody's  | S&P     | Fitch   |     | 22              | 9               | S&P        | Moody's | Fitch   |     | 48       | 19              |
| Retail              | Fitch    | S&P     | Moody's |     | 20              | 55              | Fitch      | S&P     | Moody's |     | 12       | 75              |
| Services            | S&P      | Moody's | Fitch   |     | 3               | 11              | Moody's    | S&P     | Fitch   |     | 13       | 66              |
| Technology          | S&P      | Moody's | Fitch   |     | 26              | 45              | S&P        | Fitch   | Moody's |     | 9        | 155             |
| Telecom             | Fitch    | S&P     | Moody's |     | 13              | 28              | Moody's    | Fitch   | S&P     |     | 2        | 203             |
| Transport           | S&P      | Fitch   | Moody's |     | 26              | 19              | Fitch      | S&P     | Moody's |     | 4        | 206             |
| Utility             | S&P      | Fitch   | Moody's |     | 13              | 49              | S&P        | Fitch   | Moody's |     | 3        | 271             |

### Appendix 3: Analysis of USA Data:

#### All Corporates from 1 January 2005 to 26 November 2005

Table 30: Initial Data for US All Corporates

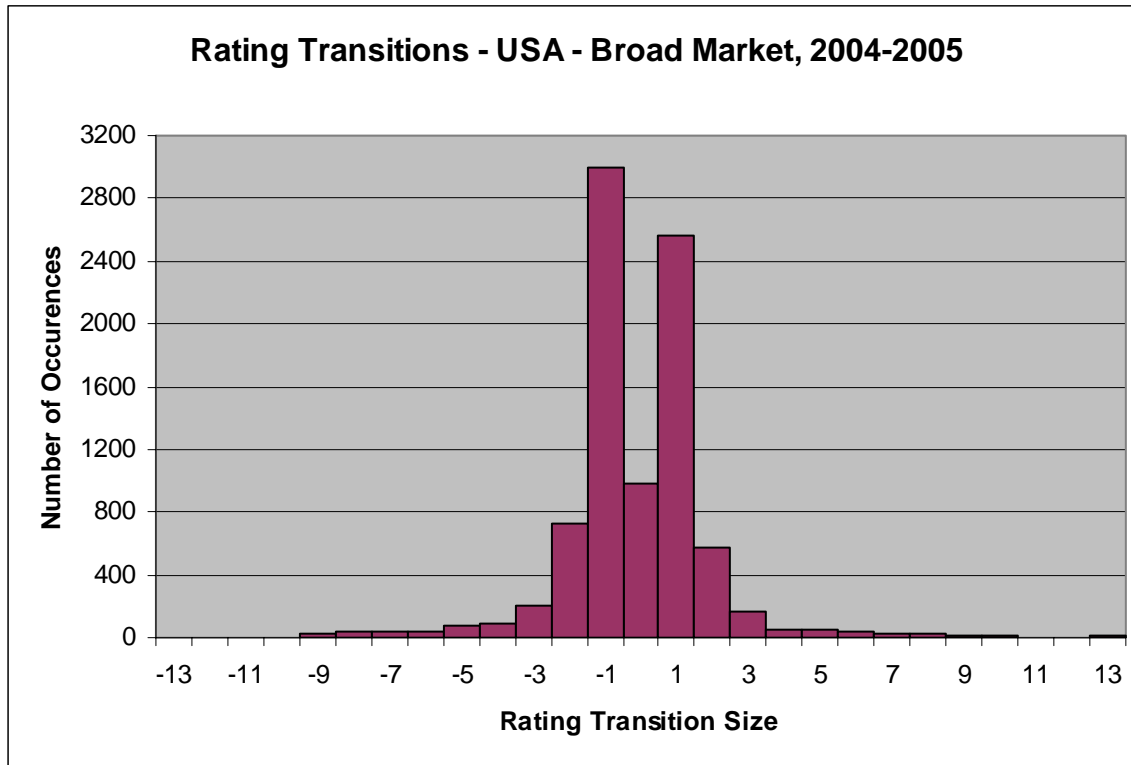
|                              | <b>DBRS</b> | <b>Fitch</b> | <b>Moody's</b> | <b>S&amp;P</b> | <b>Other Agencies</b> | <b>Total</b> |
|------------------------------|-------------|--------------|----------------|----------------|-----------------------|--------------|
| <b># Companies Covered</b>   | 321         | 2100         | 3663           | 3515           | -                     | -            |
| <b>Total Ratings Records</b> | 1016        | 5098         | 13636          | 12246          | 3832                  | 35828        |
| <b>Other/Not useful</b>      | 504         | 2092         | 3311           | 3809           | -                     | 13548        |
| <b>Useful</b>                | 512         | 3006         | 10325          | 8437           | -                     | 22280        |
| <b>Initiations</b>           | 353         | 545          | 1674           | 1043           | -                     | 3615         |
| <b>Upgrades</b>              | 20          | 634          | 1646           | 1219           | -                     | 3519         |
| <b>Downgrades</b>            | 36          | 550          | 1790           | 1854           | -                     | 4230         |
| <b>Withdrawals</b>           | 6           | 289          | 2104           | 820            | -                     | 3219         |
| <b>No Change</b>             | 97          | 988          | 3111           | 3501           | -                     | 7697         |
| <b>Creditwatch upgrade</b>   | 12          | 490          | 1654           | 1526           | -                     | 3682         |
| <b>Creditwatch unchanged</b> | 41          | 38           | 85             | 194            | -                     | 358          |
| <b>Creditwatch downgrade</b> | 44          | 460          | 1372           | 1781           | -                     | 3657         |

Table 31: Comparable data for US All Corporates

|                              | <b>DBRS</b> | <b>Fitch</b> | <b>Moody's</b> | <b>S&amp;P</b> | <b>Total</b> |
|------------------------------|-------------|--------------|----------------|----------------|--------------|
| <b>Upgrades</b>              | 20          | 634          | 1646           | 1043           | 3343         |
| <b>Downgrades</b>            | 36          | 550          | 1790           | 1854           | 4230         |
| <b>Creditwatch upgrade</b>   | 12          | 490          | 1654           | 1526           | 3682         |
| <b>Creditwatch downgrade</b> | 44          | 460          | 1372           | 1781           | 3657         |

A summary of all rating transitions looks as follows:

Figure 4: The size of rating transitions in US for all Corporates:



The largest grouping is a one notch downgrade. A one notch upgrade is the next most common transition.

Table 32: Number of Ratings Transitions by Type for All US Corporates:

|                         | DBRS | Fitch | Moody's | S&P  | Total |
|-------------------------|------|-------|---------|------|-------|
| <i>I / Upgrade</i>      | 12   | 328   | 455     | 446  | 1241  |
| <i>I / Downgrade</i>    | 26   | 328   | 387     | 582  | 1323  |
| <i>I / CW upgrade</i>   | 6    | 295   | 604     | 673  | 1578  |
| <i>I / CW downgrade</i> | 37   | 349   | 623     | 1022 | 2031  |
|                         |      |       |         |      |       |
| <i>S / Upgrade</i>      | 6    | 224   | 1036    | 645  | 1911  |
| <i>S / Downgrade</i>    | 6    | 172   | 1277    | 1145 | 2600  |
| <i>S / CW upgrade</i>   | 6    | 195   | 1050    | 853  | 2104  |
| <i>S / CW downgrade</i> | 7    | 111   | 749     | 759  | 1626  |
|                         |      |       |         |      |       |
| <i>I → S Downgrade</i>  | 4    | 50    | 126     | 128  | 307   |
| <i>S → I Upgrade</i>    | 2    | 82    | 155     | 128  | 367   |



A summary of the number of ratings that lead or lag those from other companies is listed in table 33. Note that this was done for both a 92 day and a 31 day “window”.

Table 33: Lead or Lag versus other rating Agencies for All US Corporates:

|                 |                | Fitch   |     |           |     | Moody's |     |           |     | S & P   |     |           |     |
|-----------------|----------------|---------|-----|-----------|-----|---------|-----|-----------|-----|---------|-----|-----------|-----|
|                 |                | Upgrade |     | Downgrade |     | Upgrade |     | Downgrade |     | Upgrade |     | Downgrade |     |
|                 |                | 92d     | 31d | 92d       | 31d | 92d     | 31d | 92d       | 31d | 92d     | 31d | 92d       | 31d |
|                 | <b>DBRS</b>    |         |     |           |     |         |     |           |     |         |     |           |     |
| <b>#Leading</b> |                | 6       | 6   | 13        | 8   | 0       | 0   | 39        | 35  | 12      | 8   | 12        | 8   |
| <b>#Same</b>    |                | 0       | 0   | 5         | 5   | 0       | 0   | 6         | 6   | 2       | 2   | 2         | 2   |
| <b>#Lagging</b> |                | 9       | 9   | 18        | 12  | 8       | 8   | 21        | 13  | 21      | 2   | 21        | 12  |
| <b>Mean</b>     |                | -2      | -2  | 8         | -1  | 8       | 8   | -5        | -8  | 10      | -4  | 11        | 0   |
| <b>Median</b>   |                | 1       | 1   | 9         | 0   | 9       | 9   | -7        | -15 | -5      | -5  | 11        | 4   |
|                 | <b>Fitch</b>   |         |     |           |     |         |     |           |     |         |     |           |     |
| <b>#Leading</b> |                |         |     |           |     | 144     | 100 | 169       | 100 | 82      | 60  | 143       | 77  |
| <b>#Same</b>    |                |         |     |           |     | 21      | 21  | 61        | 61  | 38      | 38  | 73        | 70  |
| <b>#Lagging</b> |                |         |     |           |     | 140     | 82  | 173       | 84  | 57      | 42  | 167       | 107 |
| <b>Mean</b>     |                |         |     |           |     | -1      | -1  | 0         | -1  | -3      | -2  | -1        | 0   |
| <b>Median</b>   |                |         |     |           |     | 0       | 0   | 0         | 0   | 0       | 0   | 0         | 0   |
|                 | <b>Moody's</b> |         |     |           |     |         |     |           |     |         |     |           |     |
| <b>#Leading</b> |                |         |     |           |     |         |     |           |     | 211     | 127 | 445       | 229 |
| <b>#Same</b>    |                |         |     |           |     |         |     |           |     | 51      | 51  | 160       | 148 |
| <b>#Lagging</b> |                |         |     |           |     |         |     |           |     | 274     | 182 | 603       | 391 |
| <b>Mean</b>     |                |         |     |           |     |         |     |           |     | 1       | 1   | 0         | 1   |
| <b>Median</b>   |                |         |     |           |     |         |     |           |     | 1       | 1   | 0         | 1   |

Looking at aggregating timing for each agency's for upgrades (lead/lag versus other agencies for average of median and mean):

Table 34: Summary of Leading versus Lagging Upgrades for All US Corporates

| Agency                   | Upgrade Lead/Lag                  | Downgrade Lead / Lag              |
|--------------------------|-----------------------------------|-----------------------------------|
| DBRS                     | 0.5 / 2.5                         | 1 / 2                             |
| Fitch                    | 3 / 0                             | 1.5 / 1.5                         |
| Moody's                  | 1 / 2                             | 0.5 / 2.5                         |
| S&P                      | 1.5 / 1.5                         | 3 / 0                             |
| <b>Timeliness Order:</b> | <b>Fitch S&amp;P Moody's DBRS</b> | <b>S&amp;P Fitch DBRS Moody's</b> |

Table 35: Summary of Upgrades and downgrades and the order of Rating Agency timeliness by industry for all US Corporates

| Category            | Upgrades |         |         |      | Gap Size (days) | Total # Ratings | Downgrades |         |         |         | Gap Size | Total # Ratings |
|---------------------|----------|---------|---------|------|-----------------|-----------------|------------|---------|---------|---------|----------|-----------------|
|                     | First    | Second  | Third   | 4th  |                 |                 | First      | Second  | Third   | 4th     |          |                 |
| #N/A                |          |         |         |      |                 |                 |            |         |         |         |          |                 |
| Advertising         |          |         |         |      |                 |                 | S&P        | Moody's |         |         | 5        | 10              |
| Aerospace           | Fitch    | S&P     | Moody's |      | 12              | 8               | Fitch      | S&P     | Moody's |         | 35       | 8               |
| Agriculture         |          |         |         |      |                 |                 |            |         |         |         |          |                 |
| Beverages           | Moody's  | Fitch   |         |      | 13              | 1               |            |         |         |         |          |                 |
| Chemical            | Moody's  | S&P     | Fitch   |      | 3               | 34              | S&P        | Fitch   | Moody's |         | 3        | 58              |
| Clothing            | S&P      | Moody's | Fitch   |      | 22              | 8               | Moody's    | S&P     |         |         | 6        | 22              |
| Commercial          | S&P      | Moody's | Fitch   |      | 15              | 18              | S&P        | Moody's | Fitch   |         | 7        | 40              |
| Commodity           | Moody's  | Fitch   | S&P     |      | 3               | 106             | Fitch      | Moody's | S&P     |         | 7        | 83              |
| Construction        | Fitch    | Moody's | S&P     |      | 17              | 14              | S&P        | Moody's |         |         | 1        | 16              |
| Education           |          |         |         |      |                 |                 |            |         |         |         |          |                 |
| Entertainment & Rec | Moody's  | Fitch   | S&P     |      | 9               | 13              | S&P        | Moody's | Fitch   |         | 16       | 37              |
| Finance             | Moody's  | Fitch   | S&P     | DBRS | 5               | 227             | Moody's    | S&P     | Fitch   | DBRS    | 9        | 147             |
| Food                | S&P      | Moody's | Fitch   |      | 24              | 23              | DBRS       | S&P     | Fitch   | Moody's | 7        | 60              |
| Government          |          |         |         |      |                 |                 |            |         |         |         |          |                 |
| Healthcare          | S&P      | Fitch   | Moody's |      | 21              | 39              | Fitch      | S&P     | Moody's |         | 4        | 116             |
| Insurance           | Fitch    | Moody's | S&P     |      | 13              | 34              | Fitch      | S&P     | Moody's | DBRS    | 4        | 77              |
| Manufacturing       | Fitch    | S&P     | Moody's |      | 11              | 36              | Fitch      | DBRS    | S&P     | Moody's | 7        | 265             |
| Media               | Fitch    | Moody's | S&P     |      | 13              | 15              | DBRS       | S&P     | Fitch   | Moody's | 24       | 81              |
| Real Estate         | Fitch    | Moody's | S&P     |      | 8               | 23              | Moody's    | S&P     | Fitch   |         | 14       | 29              |
| Retail              | Fitch    | Moody's | S&P     |      | 23              | 41              | S&P        | Fitch   | Moody's |         | 2        | 155             |
| Services            | S&P      | Moody's | Fitch   |      | 4               | 20              | S&P        | Moody's | Fitch   |         | 5        | 78              |
| Technology          | S&P      | Moody's | Fitch   |      | 17              | 23              | Fitch      | Moody's | S&P     |         | 7        | 16              |
| Telecom             | Fitch    | Moody's | DBRS    | S&P  | 7               | 128             | S&P        | Fitch   | Moody's | DBRS    | 9        | 111             |
| Transport           | S&P      | Fitch   | Moody's |      | 9               | 34              | S&P        | Moody's | DBRS    | Fitch   | 4        | 436             |
| Utility             | S&P      | Fitch   | Moody's |      | 6               | 164             | Moody's    | S&P     | Fitch   |         | 6        | 112             |

## Appendix 4: Rating Equivalences

The different rating agencies each have their own series of credit rating levels. However, for long term corporate bond ratings, each uses a similar scale with 26 steps. In this study, we will use the following translation between ratings by different agencies:

Table 36: Rating Equivalences

| Code | CBRS | DBRS | Fitch | Moody's | S&P  |
|------|------|------|-------|---------|------|
| 26   | AAA  | AAA  | AAA   | Aaa     | AAA  |
| 25   | AA+  | AAH  | AA+   | Aa1     | AA+  |
| 24   | AA   | AA   | AA    | Aa2     | AA   |
| 23   | AA-  | AAL  | AA-   | Aa3     | AA-  |
| 22   | A+   | AH   | A+    | A1      | A+   |
| 21   | A    | A    | A     | A2      | A    |
| 20   | A-   | AL   | A-    | A3      | A-   |
| 19   | BBB+ | BBBH | BBB+  | Baa1    | BBB+ |
| 18   | BBB  | BBB  | BBB   | Baa2    | BBB  |
| 17   | BBB- | BBBL | BBB-  | Baa3    | BBB- |
| 16   | BB+  | BBH  | BB+   | Ba1     | BB+  |
| 15   | BB   | BB   | BB    | Ba2     | BB   |
| 14   | BB-  | BBL  | BB-   | Ba3     | BB-  |
| 13   | B+   | BH   | B+    | B1      | B+   |
| 12   | B    | B    | B     | B2      | B    |
| 11   | B-   | BL   | B-    | B3      | B-   |
| 10   | CCC+ | CCCH | CCC+  | Caa1    | CCC+ |
| 9    | CCC  | CCC  | CCC   | Caa2    | CCC  |
| 8    | CCC- | CCCL | CCC-  | Caa3    | CCC- |
| 7    | CC+  | CCH  | CC+   | Ca      | CC+  |
| 6    | CC   | CC   | CC    | Ca      | CC   |
| 5    | CC-  | CCL  | CC-   | Ca      | CC-  |
| 4    | C+   | CH   | C+    | C       | C+   |
| 3    | C    | C    | C     | C       | C    |
| 2    | C-   | CL   | C-    | C       | C-   |
| 1    | D    | D    | D     | D       | D    |
| 0    | NR   | NR   | NR    | NR      | NR   |
| 0    | WR   | WR   | WR    | WR      | WR   |

## Appendix 5: Rating Types

The data from Bloomberg included a number of different types of rating. For this particular study, we chose to only look at long term credit ratings. We also required meaningful amounts of data – at least two agencies and a statistically significant number of data points.

Table 37: Rating Types

| Code | Name                     | Sufficient Data | CBRS | DBRS | Fitch | Moody's | S&P | We Will Use |
|------|--------------------------|-----------------|------|------|-------|---------|-----|-------------|
| 1    | Asset Backed Short Term  | .               | ✓    | ✓    | ✓     | ✓       | ✓   |             |
| 2    | Bank Financial Strength  | ✓               | .    | .    | .     | ✓       | .   | ✓           |
| 3    | Bank Loan Debt           | .               | .    | .    | ✓     | ✓       | .   |             |
| 4    | CC LT Foreign Bank Depst | .               | .    | .    | .     | ✓       | .   |             |
| 5    | CC LT Foreign Curr Debt  | .               | .    | .    | .     | ✓       | .   |             |
| 6    | CC ST Foreign Curr Debt  | .               | .    | .    | .     | .       | .   |             |
| 7    | Claims Paying ability    | .               | .    | ✓    | .     | .       | .   |             |
| 8    | Commercial Paper         | .               | .    | .    | .     | .       | .   |             |
| 9    | Corporate Credit         | ✓               | ✓    | ✓    | .     | .       | .   | ✓           |
| 10   | Cummulative Preferred    | ✓               | ✓    | ✓    | .     | ✓       | .   | ✓           |
| 11   | Equity Linked            | .               | ✓    | ✓    | ✓     | ✓       | .   |             |
| 12   | FC Curr Issuer Rating    | ✓               | .    | .    | .     | ✓       | .   |             |
| 13   | Financial Strength       | .               | .    | .    | ✓     | .       | ✓   |             |
| 14   | Finl Strength Outlook    | .               | .    | .    | .     | .       | .   |             |
| 15   | Foreign Currency LT Debt | .               | .    | ✓    | ✓     | ✓       | ✓   |             |
| 16   | Foreign Currency ST Debt | .               | .    | .    | ✓     | ✓       | ✓   |             |
| 17   | Foreign LT Bank Deposits | .               | .    | .    | .     | .       | .   |             |
| 18   | Government Issues        | ✓               | ✓    | .    | .     | .       | .   |             |
| 19   | Insurance Finl Strength  | .               | .    | .    | .     | ✓       | .   |             |
| 20   | Insurance Paying Ability | .               | .    | .    | .     | .       | .   |             |
| 21   | Investment Strength      | ✓               | ✓    | .    | .     | .       | .   | ✓           |
| 22   | Issuer Rating            | ✓               | .    | .    | .     | ✓       | .   | ✓           |
| 23   | JR Subordinated Debt     | .               | ✓    | ✓    | ✓     | ✓       | .   |             |
| 24   | LC Curr Issuer Rating    | .               | .    | .    | .     | ✓       | .   |             |
| 25   | Local Currency LT Debt   | .               | .    | ✓    | ✓     | ✓       | ✓   |             |
| 26   | Local Currency ST Debt   | .               | .    | .    | .     | ✓       | ✓   |             |
| 27   | Local LT Bank Deposits   | .               | .    | .    | .     | ✓       | .   |             |
| 28   | Long Term                | ✓               | .    | .    | ✓     | .       | .   | ✓           |
| 29   | Long Term Bank Deposits  | .               | ✓    | ✓    | ✓     | ✓       | .   |             |
| 30   | Long Term Counterparty   | ✓               | ✓    | .    | .     | ✓       | .   | ✓           |
| 31   | Long Term Issuer Credit  | .               | .    | .    | .     | .       | .   |             |
| 32   | Long Term Outlook        | ✓               | .    | .    | .     | .       | ✓   |             |
| 33   | LT Credit Outlook        | .               | .    | .    | .     | .       | ✓   |             |
| 34   | LT Foreign Crncy Outlook | ✓               | .    | .    | .     | .       | ✓   |             |
| 35   | LT Foreign Issuer Credit | .               | .    | .    | .     | .       | ✓   |             |
| 36   | LT Local Crncy Outlook   | ✓               | .    | .    | .     | .       | ✓   |             |
| 37   | LT Local Issuer Credit   | .               | .    | .    | .     | .       | ✓   |             |

|    |                          |   |   |   |   |   |   |   |
|----|--------------------------|---|---|---|---|---|---|---|
| 38 | Mortgage Debt            | . | . | . | . | . | . | . |
| 39 | Non-Cumm. Preferred      | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 40 | Outlook                  | . | . | ✓ | ✓ | ✓ | ✓ | . |
| 41 | Preference Stock         | . | . | ✓ | . | ✓ | . | . |
| 42 | Preferred                | ✓ | ✓ | ✓ | . | . | . | ✓ |
| 43 | Preferred Stock          | . | ✓ | ✓ | ✓ | ✓ | . | . |
| 44 | Senior Debt              | ✓ | . | . | . | . | . | ✓ |
| 45 | Senior Implied Issuer    | ✓ | . | . | . | ✓ | . | ✓ |
| 46 | Senior Secured Debt      | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 47 | Senior Subordinate       | ✓ | ✓ | ✓ | ✓ | ✓ | . | ✓ |
| 48 | Senior Unsecured Debt    | ✓ | ✓ | ✓ | ✓ | ✓ | . | ✓ |
| 49 | Short Term               | . | ✓ | ✓ | ✓ | ✓ | . | . |
| 50 | Short Term Issuer Credit | . | . | . | . | . | ✓ | . |
| 51 | Short Term Outlook       | . | . | . | . | . | . | . |
| 52 | ST Foreign Issuer Credit | ✓ | . | . | . | . | ✓ | . |
| 53 | ST Local Issuer Credit   | ✓ | . | . | . | . | ✓ | . |
| 54 | Subordinated Debt        | . | ✓ | ✓ | ✓ | ✓ | . | . |

## Appendix 6: Industry Assignments

To aggregate by industry, the following industry classifications were used. This industry allocation scheme was performed to achieve the aim of aggregating into a small number of distinct industry types. It does not exactly follow the North American Industry Classification System (NAICS) that is the standard one used for classifying industries within Canada, Mexico and the United States. There are two reasons for this: First, the data also includes Australia, and second, the aim was to achieve a small number of industry groups, and a custom grouping that follows the same philosophy as NAICS can arrive at the desired number of industry groupings.

Table 38: Industry groups

| Code | Name                     | Category            |
|------|--------------------------|---------------------|
| 1    | Advertising Agencies     | Advertising         |
| 1    | Advertising Services     | Advertising         |
| 2    | Aerospace/Defense        | Aerospace           |
| 2    | Aerospace/Defense-Equip  | Aerospace           |
| 3    | Agricultural Operations  | Agriculture         |
| 3    | Pastoral&Agricultural    | Agriculture         |
| 4    | Beverages-Non-alcoholic  | Beverages           |
| 4    | Beverages-Wine/Spirits   | Beverages           |
| 4    | Brewery                  | Beverages           |
| 5    | Agricultural Chemicals   | Chemical            |
| 5    | Chemicals-Diversified    | Chemical            |
| 5    | Chemicals-Fibers         | Chemical            |
| 5    | Chemicals-Other          | Chemical            |
| 5    | Chemicals-Plastics       | Chemical            |
| 5    | Chemicals-Specialty      | Chemical            |
| 5    | Coatings/Paint           | Chemical            |
| 6    | Apparel Manufacturers    | Clothing            |
| 6    | Athletic Footwear        | Clothing            |
| 6    | Athletic Equipment       | Clothing            |
| 6    | Intimate Apparel         | Clothing            |
| 6    | Footwear&Related Apparel | Clothing            |
| 7    | B2B/E-Commerce           | Commercial          |
| 7    | Commercial Services      | Commercial          |
| 7    | Distribution/Wholesale   | Commercial          |
| 7    | Divers Oper/Commer Serv  | Commercial          |
| 7    | Diversified Operations   | Commercial          |
| 7    | Funeral Serv&Rel Items   | Commercial          |
| 7    | Import/Export            | Commercial          |
| 7    | Office Supplies&Forms    | Commercial          |
| 7    | Printing-Commercial      | Commercial          |
| 7    | Rental Auto/Equipment    | Commercial          |
| 7    | Storage/Warehousing      | Commercial          |
| 8    | Coal                     | Commodity           |
| 8    | Diversified Minerals     | Commodity           |
| 8    | Fisheries                | Commodity           |
| 8    | Forestry                 | Commodity           |
| 8    | Gold Mining              | Commodity           |
| 8    | Invest Comp - Resources  | Commodity           |
| 8    | Metal-Aluminum           | Commodity           |
| 8    | Metal-Copper             | Commodity           |
| 8    | Metal-Diversified        | Commodity           |
| 8    | Metal-Iron               | Commodity           |
| 8    | Mining Services          | Commodity           |
| 8    | Non-Ferrous Metals       | Commodity           |
| 8    | Oil Comp-Explor&Prodtn   | Commodity           |
| 8    | Oil Comp-Integrated      | Commodity           |
| 8    | Oil Field Mach&Equip     | Commodity           |
| 8    | Oil Refining&Marketing   | Commodity           |
| 8    | Oil&Gas Drilling         | Commodity           |
| 8    | Oil-Field Services       | Commodity           |
| 8    | Pipelines                | Commodity           |
| 8    | Platinum                 | Commodity           |
| 8    | Precious Metals          | Commodity           |
| 8    | Quarrying                | Commodity           |
| 8    | Steel-Producers          | Commodity           |
| 8    | Sugar                    | Commodity           |
| 8    | Wool                     | Commodity           |
| 9    | Airport Develop/Maint    | Construction        |
| 9    | Bldg Prod-Air&Heating    | Construction        |
| 9    | Bldg Prod-Cement/Aggreg  | Construction        |
| 9    | Bldg Prod-Doors&Windows  | Construction        |
| 9    | Bldg Prod-Light Fixtures | Construction        |
| 9    | Bldg Prod-Wood           | Construction        |
| 9    | Bldg&Construct Prod-Misc | Construction        |
| 9    | Bldg-Mobil Home/Mfd Hous | Construction        |
| 9    | Bldg-Residential/Commer  | Construction        |
| 9    | Building&Construct-Misc  | Construction        |
| 9    | Building-Heavy Construct | Construction        |
| 9    | Building-Maint&Service   | Construction        |
| 10   | Schools-Day Care         | Education           |
| 11   | Casino Hotels            | Entertainment & Rec |
| 11   | Casino Services          | Entertainment & Rec |
| 11   | Cruise Lines             | Entertainment & Rec |
| 11   | Gambling (Non-Hotel)     | Entertainment & Rec |
| 11   | Golf                     | Entertainment & Rec |
| 11   | Leisure&Rec Products     | Entertainment & Rec |
| 11   | Music                    | Entertainment & Rec |
| 11   | Night Clubs              | Entertainment & Rec |
| 11   | Professional Sports      | Entertainment & Rec |
| 11   | Racetracks               | Entertainment & Rec |
| 11   | Recreational Centers     | Entertainment & Rec |
| 11   | Resorts/Theme Parks      | Entertainment & Rec |
| 11   | Theaters                 | Entertainment & Rec |
| 12   | Building Societies       | Finance             |
| 12   | Closed-end Funds         | Finance             |
| 12   | Commer Banks Non-US      | Finance             |
| 12   | Commer Banks-Central US  | Finance             |
| 12   | Commer Banks-Eastern US  | Finance             |
| 12   | Commer Banks-Southern US | Finance             |
| 12   | Commer Banks-Western US  | Finance             |
| 12   | Commercial Serv-Finance  | Finance             |
| 12   | Cooperative Banks        | Finance             |
| 12   | Diversified Finan Serv   | Finance             |
| 12   | Export/Import Bank       | Finance             |
| 12   | Fiduciary Banks          | Finance             |

|    |                          |            |    |                          |               |
|----|--------------------------|------------|----|--------------------------|---------------|
| 12 | Finance-Auto Loans       | Finance    | 15 | Disposable Medical Prod  | Healthcare    |
| 12 | Finance-Commercial       | Finance    | 15 | Drug Delivery Systems    | Healthcare    |
| 12 | Finance-Consumer Loans   | Finance    | 15 | Health Care Cost Contain | Healthcare    |
| 12 | Finance-Credit Card      | Finance    | 15 | Hospital Beds/Equipment  | Healthcare    |
| 12 | Finance-Invest Bnkr/Brkr | Finance    | 15 | Feminine Health Care Prd | Healthcare    |
| 12 | Finance-Investment Fund  | Finance    | 15 | Medical Instruments      | Healthcare    |
| 12 | Finance-Leasing Compan   | Finance    | 15 | Medical Labs&Testing Srv | Healthcare    |
| 12 | Finance-Mtge Loan/Banker | Finance    | 15 | Medical Products         | Healthcare    |
| 12 | Finance-Other Services   | Finance    | 15 | Medical-Biomedical/Gene  | Healthcare    |
| 12 | Internet Financial Svcs  | Finance    | 15 | Medical-Drugs            | Healthcare    |
| 12 | Invest Mgmt/Advis Serv   | Finance    | 15 | Medical-Generic Drugs    | Healthcare    |
| 12 | Investment Companies     | Finance    | 15 | Medical-HMO              | Healthcare    |
| 12 | Money Center Banks       | Finance    | 15 | Medical-Hospitals        | Healthcare    |
| 12 | Mortgage Banks           | Finance    | 15 | Medical-Nursing Homes    | Healthcare    |
| 12 | Regional Bank            | Finance    | 15 | Medical-Outptnt/Home Med | Healthcare    |
| 12 | Regional Banks-Non US    | Finance    | 15 | Medical-Whsle Drug Dist  | Healthcare    |
| 12 | S&L/Thrfts-Central US    | Finance    | 15 | MRI/Medical Diag Imaging | Healthcare    |
| 12 | S&L/Thrfts-Eastern US    | Finance    | 15 | Optical Supplies         | Healthcare    |
| 12 | S&L/Thrfts-Southern US   | Finance    | 15 | Pharmacy Services        | Healthcare    |
| 12 | S&L/Thrfts-Western US    | Finance    | 15 | Phys Practice Mgmt       | Healthcare    |
| 12 | Special Purpose Banks    | Finance    | 15 | Phys Therapy/Rehab Cntrs | Healthcare    |
| 12 | Special Purpose Entity   | Finance    | 15 | Respiratory Products     | Healthcare    |
| 12 | Specified Purpose Acquis | Finance    | 15 | Retirement/Aged Care     | Healthcare    |
| 12 | Super-Regional Banks-US  | Finance    | 15 | Therapeutics             | Healthcare    |
| 12 | Supranational Bank       | Finance    | 15 | Veterinary Diagnostics   | Healthcare    |
| 12 | Venture Capital          | Finance    | 15 | Vitamins&Nutrition Prod  | Healthcare    |
| 13 | Food-Baking              | Food       | 16 | Financial Guarantee Ins  | Insurance     |
| 13 | Food-Canned              | Food       | 16 | Insurance Brokers        | Insurance     |
| 13 | Food-Catering            | Food       | 16 | Life/Health Insurance    | Insurance     |
| 13 | Food-Confectionery       | Food       | 16 | Multi-line Insurance     | Insurance     |
| 13 | Food-Dairy Products      | Food       | 16 | Mutual Insurance         | Insurance     |
| 13 | Food-Meat Products       | Food       | 16 | Property/Casualty Ins    | Insurance     |
| 13 | Food-Misc/Diversified    | Food       | 16 | Reinsurance              | Insurance     |
| 13 | Food-Retail              | Food       | 17 | Advanced Materials/Prd   | Manufacturing |
| 13 | Food-Wholesale/Distrib   | Food       | 17 | Appliances               | Manufacturing |
| 13 | Poultry                  | Food       | 17 | Audio/Video Products     | Manufacturing |
| 14 | Municipal-City           | Government | 17 | Batteries/Battery Sys    | Manufacturing |
| 14 | Municipal-County         | Government | 17 | Ceramic Products         | Manufacturing |
| 14 | Municipal-Education      | Government | 17 | Consumer Products-Misc   | Manufacturing |
| 14 | Municipal-Local Auth     | Government | 17 | Containers-Metal/Glass   | Manufacturing |
| 14 | Public Thoroughfares     | Government | 17 | Containers-Paper/Plastic | Manufacturing |
| 14 | Regional Agencies        | Government | 17 | Diagnostic Equipment     | Manufacturing |
| 14 | Regional Authority       | Government | 17 | Diversified Manufact Op  | Manufacturing |
| 14 | Schools                  | Government | 17 | Electronic Connectors    | Manufacturing |
| 14 | Sovereign                | Government | 17 | Engines-Internal Combust | Manufacturing |
| 14 | Sovereign Agency         | Government | 17 | Filtration/Separat Prod  | Manufacturing |
| 15 | Cosmetics&Toiletries     | Healthcare | 17 | Garden Products          | Manufacturing |
| 15 | Dental Supplies&Equip    | Healthcare | 17 | Home Furnishings         | Manufacturing |
| 15 | Diagnostic Kits          | Healthcare | 17 | Home Decoration Products | Manufacturing |
| 15 | Dialysis Centers         | Healthcare | 17 | Housewares               | Manufacturing |

|    |                           |               |
|----|---------------------------|---------------|
| 17 | Industrial Gases          | Manufacturing |
| 17 | Mach Tools&Rel Products   | Manufacturing |
| 17 | Machinery-Constr&Mining   | Manufacturing |
| 17 | Machinery-Electrical      | Manufacturing |
| 17 | Machinery-Farm            | Manufacturing |
| 17 | Machinery-General Indust  | Manufacturing |
| 17 | Machinery-Machinery Handl | Manufacturing |
| 17 | Machinery-Material Handl  | Manufacturing |
| 17 | Machinery-Pumps           | Manufacturing |
| 17 | Metal Processors&Fabrica  | Manufacturing |
| 17 | Metal Products-Fasteners  | Manufacturing |
| 17 | Miscellaneous Manufactur  | Manufacturing |
| 17 | Office Furnishings-Orig   | Manufacturing |
| 17 | Optical Recognition Equi  | Manufacturing |
| 17 | Paper&Related Products    | Manufacturing |
| 17 | Photo Equipment&Supplies  | Manufacturing |
| 17 | Rubber/Plastic Products   | Manufacturing |
| 17 | Rubber-Tires              | Manufacturing |
| 17 | Soap&Cleaning Prepar      | Manufacturing |
| 17 | Shipbuilding              | Manufacturing |
| 17 | Steel Pipe&Tube           | Manufacturing |
| 17 | Steel-Specialty           | Manufacturing |
| 17 | Textile-Apparel           | Manufacturing |
| 17 | Textile-Home Furnishings  | Manufacturing |
| 17 | Textile-Products          | Manufacturing |
| 17 | Tobacco                   | Manufacturing |
| 17 | Tools-Hand Held           | Manufacturing |
| 17 | Toys                      | Manufacturing |
| 17 | Wire&Cable Products       | Manufacturing |
| 18 | Broadcast Serv/Program    | Media         |
| 18 | Cable TV                  | Media         |
| 18 | Industr Audio&Video Prod  | Media         |
| 18 | Internet Content-Info/Ne  | Media         |
| 18 | Motion Pictures&Services  | Media         |
| 18 | Multimedia                | Media         |
| 18 | Publishing-Books          | Media         |
| 18 | Publishing-Newspapers     | Media         |
| 18 | Publishing-Periodicals    | Media         |
| 18 | Radio                     | Media         |
| 18 | Television                | Media         |
| 19 | Hotels&Motels             | Real Estate   |
| 19 | Property Trust            | Real Estate   |
| 19 | Real Estate Mgmt/Servic   | Real Estate   |
| 19 | Real Estate Oper/Develop  | Real Estate   |
| 19 | REITS-Apartments          | Real Estate   |
| 19 | REITS-Diversified         | Real Estate   |
| 19 | REITS-Health Care         | Real Estate   |
| 19 | REITS-Hotels              | Real Estate   |
| 19 | REITS-Manufactured Homes  | Real Estate   |
| 19 | REITS-Mortgage            | Real Estate   |
| 19 | REITS-Office Property     | Real Estate   |
| 19 | REITS-Regional Malls      | Real Estate   |
| 19 | REITS-Shopping Centers    | Real Estate   |
| 19 | REITS-Single Tenant       | Real Estate   |
| 19 | REITS-Storage             | Real Estate   |
| 19 | REITS-Warehouse/Industr   | Real Estate   |
| 20 | Retail-Apparel/Shoe       | Retail        |
| 20 | Retail-Arts&Crafts        | Retail        |
| 20 | Retail-Auto Parts         | Retail        |
| 20 | Retail-Automobile         | Retail        |
| 20 | Retail-Bedding            | Retail        |
| 20 | Retail-Bookstore          | Retail        |
| 20 | Retail-Building Products  | Retail        |
| 20 | Retail-Catalog Shopping   | Retail        |
| 20 | Retail-Computer Equip     | Retail        |
| 20 | Retail-Consumer Electron  | Retail        |
| 20 | Retail-Convenience Store  | Retail        |
| 20 | Retail-Discout            | Retail        |
| 20 | Retail-Drug Store         | Retail        |
| 20 | Retail-Fabric Store       | Retail        |
| 20 | Retail-Home Furnishings   | Retail        |
| 20 | Retail-Jewelry            | Retail        |
| 20 | Retail-Leisure Products   | Retail        |
| 20 | Retail-Mail Order         | Retail        |
| 20 | Retail-Major Dept Store   | Retail        |
| 20 | Retail-Misc/Diversified   | Retail        |
| 20 | Retail-Music Store        | Retail        |
| 20 | Retail-Office Supplies    | Retail        |
| 20 | Retail-Pet Food&Supplies  | Retail        |
| 20 | Retail-Petroleum Prod     | Retail        |
| 20 | Retail-Propane Distrib    | Retail        |
| 20 | Retail-Regnl Dept Store   | Retail        |
| 20 | Retail-Restaurants        | Retail        |
| 20 | Retail-Sporting Goods     | Retail        |
| 20 | Retail-Toy Store          | Retail        |
| 20 | Retail-Video Rental       | Retail        |
| 20 | Retail-Vision Serv Cntr   | Retail        |
| 20 | Retail-Vitamins/Nutr Sup  | Retail        |
| 21 | Advertising Sales         | Services      |
| 21 | Auction House/Art Dealer  | Services      |
| 21 | Collectibles              | Services      |
| 21 | Computer Services         | Services      |
| 21 | Consulting Services       | Services      |
| 21 | Direct Marketing          | Services      |
| 21 | E-Marketing/Info          | Services      |
| 21 | Engineering/R&D Services  | Services      |
| 21 | E-Services/Consulting     | Services      |
| 21 | Human Resources           | Services      |
| 21 | Internet Security         | Services      |
| 21 | Lottery Services          | Services      |



|    |                          |            |    |                          |            |
|----|--------------------------|------------|----|--------------------------|------------|
| 21 | Marine Services          | Services   | 22 | X-Ray Equipment          | Technology |
| 21 | Multilevel Dir Selling   | Services   | 23 | Cellular Telecom         | Telecom    |
| 21 | Non-Profit Charity       | Services   | 23 | Satellite Telecom        | Telecom    |
| 21 | Private Corrections      | Services   | 23 | Telecom Eq Fiber Optics  | Telecom    |
| 21 | Protection-Safety        | Services   | 23 | Telecom Services         | Telecom    |
| 21 | Security Services        | Services   | 23 | Telecommunication Equip  | Telecom    |
| 21 | Seismic Data Collection  | Services   | 23 | Telephone-Integrated     | Telecom    |
| 21 | Traffic Management Sys   | Services   | 23 | Wireless Equipment       | Telecom    |
| 21 | Travel Services          | Services   | 24 | Airlines                 | Transport  |
| 22 | Agricultural Biotech     | Technology | 24 | Auto Repair Centers      | Transport  |
| 22 | Applications Software    | Technology | 24 | Auto/Trk Prts&Equip-Orig | Transport  |
| 22 | Circuit Boards           | Technology | 24 | Auto/Trk Prts&Equip-Repl | Transport  |
| 22 | Communications Software  | Technology | 24 | Auto-Cars/Light Trucks   | Transport  |
| 22 | Computer Aided Design    | Technology | 24 | Auto-Med&Heavy Duty Trks | Transport  |
| 22 | Computer Software        | Technology | 24 | Electronic Parts Distrib | Transport  |
| 22 | Computers                | Technology | 24 | Motorcycle/Motor Scooter | Transport  |
| 22 | Computers-Integrated Sys | Technology | 24 | Transport-Air Freight    | Transport  |
| 22 | Computers-Memory Devices | Technology | 24 | Transport-Equip&Leasng   | Transport  |
| 22 | Computers-Peripher Equip | Technology | 24 | Transport-Marine         | Transport  |
| 22 | Data Processing/Mgmt     | Technology | 24 | Transport-Rail           | Transport  |
| 22 | Decision Support Softwar | Technology | 24 | Transport-Services       | Transport  |
| 22 | Drug Detection Systems   | Technology | 24 | Transport-Truck          | Transport  |
| 22 | E-Commerce/Products      | Technology | 24 | Whsing&Harbor Trans Serv | Transport  |
| 22 | E-Commerce/Services      | Technology | 0  | Inactive/Unknown         | Unknown    |
| 22 | Educational Software     | Technology | 0  | N.A.                     | Unknown    |
| 22 | Electric Products-Misc   | Technology | 0  | N/A                      | Unknown    |
| 22 | Electronic Compo-Misc    | Technology | 25 | Air Pollution Control Eq | Utility    |
| 22 | Electronic Compo-Semicon | Technology | 25 | Alternative Waste Tech   | Utility    |
| 22 | Electronic Measur Instr  | Technology | 25 | Electric-Distribution    | Utility    |
| 22 | Electronics-Military     | Technology | 25 | Electric-Generation      | Utility    |
| 22 | Enterprise Software/Serv | Technology | 25 | Electric-Integrated      | Utility    |
| 22 | Entertainment Software   | Technology | 25 | Electric-Transmission    | Utility    |
| 22 | Industrial Automat/Robot | Technology | 25 | Energy-Alternate Sources | Utility    |
| 22 | Instruments-Controls     | Technology | 25 | Gas-Distribution         | Utility    |
| 22 | Instruments-Scientific   | Technology | 25 | Gas-Transportation       | Utility    |
| 22 | Internet Applic Sftwr    | Technology | 25 | Hazardous Waste Disposal | Utility    |
| 22 | Internet Infrastr Sftwr  | Technology | 25 | Independ Power Producer  | Utility    |
| 22 | Medical Information Sys  | Technology | 25 | Non-hazardous Waste Disp | Utility    |
| 22 | Networking Products      | Technology | 25 | Pollution Control        | Utility    |
| 22 | Office Automation&Equip  | Technology | 25 | Power Conv/Supply Equip  | Utility    |
| 22 | Research&Development     | Technology | 25 | Recycling                | Utility    |
| 22 | Semicon Compo-Intg Circu | Technology | 25 | Remediation Services     | Utility    |
| 22 | Semiconductor Equipment  | Technology | 25 | Utilities                | Utility    |
| 22 | Transactional Software   | Technology | 25 | Water                    | Utility    |
| 22 | Web Portals/ISP          | Technology | 25 | Water Treatment Systems  | Utility    |

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[www.dbrs.com](http://www.dbrs.com)

[www.ambest.com](http://www.ambest.com)

## Software Credits:

All code was custom written for this project, with the help of the following standard

libraries:

|                  |  |
|------------------|--|
| Java 1.5.0_06    | Standard Java language from Sun Microsystems   |
| Netbeans IDE 5.0 | Sun's Java Integrated Development Environment  |
| JExcelApi (JXL)  | Java interface library to Excel, allowing reading and writing from Excel spreadsheets. Used under LGPL (Lesser General Public License) |