CRISIL RATINGS

insight in Risk

CRISIL Default Study 2007

N Muthuraman
Director, Rating Criteria and Product Development
Tel +91 (44) 4214 5029
nmuthuraman@crisil.com

Subodh K Rai
Senior Manager, Rating Criteria and Product Development
Tel +91 (11) 4250 5125
srai@crisil.com

Box 1: Default rates demystified

What are default rates?
The default rate for a particular rating for any given period is the number of defaults among credits carrying that rating, as a percentage of the total number of outstanding credits carrying that rating.

What are transition rates?
Transition rates indicate the probability of a given credit rating moving to other rating categories over a specified period of time.

Utility of default and transition rates
For all debt market participants, accurate and reliable default and transition rates are critical inputs in the following decisions:

Pricing of debt
Default and transition rates are fundamental inputs in the pricing of a debt or loan. Default probabilities associated with ratings help investors/lenders in quantifying credit risk in their debt exposures, providing key inputs on whether to lend, how much to lend, and at what price. Transition rates are particularly helpful for investors who hold the instrument for a time horizon shorter than the maturity of the instrument.

Structuring and pricing of credit enhanced instruments
Structuring, rating, and pricing of credit-enhanced products depend heavily on default and transition rates of underlying entities. The rapid growth of the structured finance market has made accurate computation of historical default and transition statistics imperative.

Credit risk measurement
Default and transition rates are key inputs for many quantitative risk measurement models. Investors in rated paper can manage their risk exposures effectively if they have access to reliable default and transition rates.

Validating rating scales and quantifying rating stability
Ratings are an indicator of probability of default. If ratings are ordinal, the default rates should increase as one moves down the rating scale. Default and transition rates can be used to validate rating scales and quantify rating stability.

Key determinants of the accuracy and robustness of default and transition rates are the strength of the definition of default and the quality of the data set.

CRISIL's Definition of default
CRISIL defines default as any missed payment on a rated instrument. ***This means that even a single day's delay, or a shortfall of even a single rupee, in terms of the promised payment schedule, would amount to a default.*** Any post-default recovery is not factored in by CRISIL's ratings as this is addressed through a separate recovery risk rating scale.

This rigorous and transparent definition of default provides a firm foundation for the study of CRISIL's default rates, and makes its default rates meaningful and reliable. The fact that this definition has been in place for several years, and is strictly applied, ensures that the data used for the present study is consistent. This rigorous approach underpins the validity of CRISIL's conclusions.

Given its observation that other rating services operating in India adopt varying approaches to the definition of default, CRISIL believes that this study provides unique and valuable insights to investors. It is important to contrast default studies using this digital approach to default, with those default studies that might use a more relaxed or inconsistent definition of default, which is likely to yield lower default rates. Some methodologies recognise default differently in their default studies and their external communication of ratings. Such studies would be less rigorous, and would, therefore, be less useful in pricing and provisioning decisions.

Most reliable data set in India
CRISIL's study of defaults draws on its close to two decades of ratings experience, across manufacturing, finance, and infrastructure sectors. CRISIL has the largest database for long-term ratings in India, encompassing 4642 issuer years. Significantly, it covers 16 years between 1992 and 2007, and therefore includes data from periods of deteriorating as well as improving credit quality, across economic cycles. In the current edition of the Default Study (2007), CRISIL has considered the data relating to 1669 issuer-years for structured finance securities spread over a period of 11 years from 1997 to 2007. For short-term ratings, it has considered 3242 issuer-years for a period of 16 years, between 1992 and 2007. It is thus the most diverse database of its kind that is available in India today. This is critical, as meaningful and robust default rates can only be based on an extensive and varied population.

Based on this strong data set, a rigorous default definition, and time-tested measures of validation, CRISIL's default rates are the most reliable estimate of default probability in the Indian markets today.

An analysis of the ordinal nature, predictive ability, and stability of CRISIL's ratings is presented in the following pages. CRISIL's default and transition rate calculation methodology is explained in Annexure 1.

CRISIL Annual Default and Ratings Transition Study - 2007

First ever study in India that includes ratings of structured finance securities and short-term instruments

CRISIL's annual default study for 2007 introduces default and transition studies for structured finance securities and short-term ratings, along with re-validating CRISIL's ratings as reliable measures of default probability.

For the first time in India, CRISIL presents the cumulative default rates for all long-term instruments inclusive of structured finance and guaranteed securities. The resultant data set, comprising 4642 long-term and 1669 structured transaction data points, is presently the most robust and comprehensive data set ever put together in the Indian debt market. CRISIL believes that the inclusion of ratings of structured finance securities and guaranteed transactions will present a broader view of the Indian debt market. Another first for the debt market is the publication of transition rates for short-term ratings. Such transition rates will be a useful input for short-term debt market participants of varying risk appetites. This kind of innovation and the accompanying analysis is a clear reflection of CRISIL's commitment towards providing beneficial information to the market participants.

CRISIL's long-term ratings continue to be ordinal, with higher ratings translating into a lower likelihood of default. The overall stability rates of CRISIL's ratings have consistently improved over the years; at close to 85 per cent, currently, they compare well with the stability rates of global credit rating agencies. In addition, a high and steadily increasing accuracy ratio, measured by a high Gini coefficient of 0.81, continues to underpin CRISIL ratings' strong default prediction ability.

With a consistent default definition and a transparent default rate calculation methodology, CRISIL believes that it has upheld the highest standards of analytical rigour. The study is based on CRISIL's ratings experience spanning close to two decades, across economic cycles, thereby lending a rare vintage to the underlying data; the study thus offers a unique and comprehensive insight into the Indian debt markets.

CRISIL's study continues to highlight the declining trend in default rates. 2007 turns out to be the third year in succession where no CRISIL-rated instruments have defaulted. Moreover, default rates observed for CRISIL-rated entities over the past eight years (2000-2007) have been significantly lower than those over the entire period covered under the study, that is, 1992-2007.

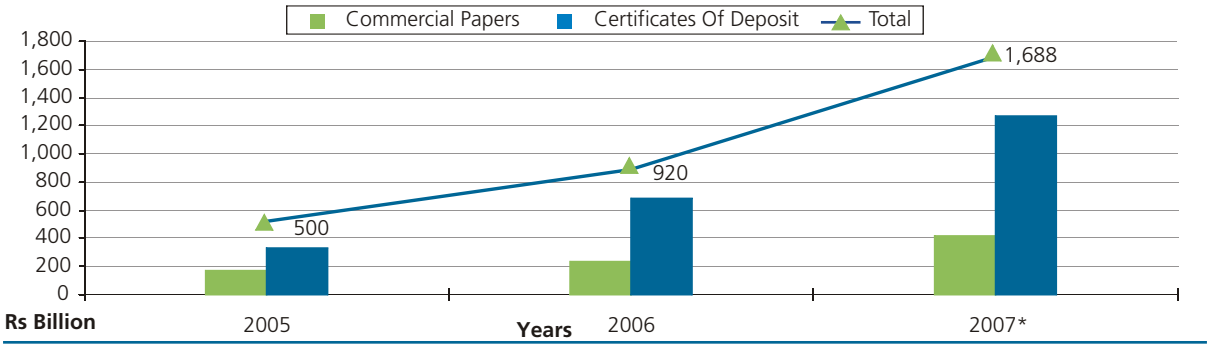
The following paragraphs provide details of CRISIL's default rates since 1992, as well as the results of validity tests for the ordinal nature, CRISIL's predictive ability, and the stability of CRISIL's ratings. The study also contains industry-wise and chronological details of all defaults of CRISIL-rated debt since 1992.

Short-Term Rating Transitions

With growing requirement for short-term funds from corporates, coupled with competitive interest rates, this segment has witnessed a high year-on-year increase in volume of issuances. As a result, the need for additional inputs on stability and transition rates of these instruments will assume importance. To address this requirement, CRISIL presents this first-ever short-term rating transition study.

Chart 1 shows the rapid growth, year on year in the amounts outstanding in the short term markets

Chart 1 : Growth in Short Term Issuances 2005 - 2007



(* Upto November 2007)
(Data source: Reserve Bank of India Archives.).

The matrix in Table 1 provides the observed one-year transition rates for short-term ratings. The diagonal displays the stability rates for each rating. The probability to the left of the diagonal represents the upgrades while that to the right represents the downgrades. Thus, a 'P1+' rating has a stability rate of 97.6 per cent over a one-year period, while a 'P2+' rating has a 17.6 per cent probability of transition to a higher rating over a one-year period.

Table 1: CRISIL Short-Term Average One-Year Transition Rate **1992-2007**

Ratings	Sample Size	P1+	P1	P2+	P2	P3	Speculative Grade
P1+	2783	97.6%	1.9%	0.3%	0.1%	0.1%	0.0%
P1	400	17.0%	80.3%	1.5%	0.8%	0.5%	0.0%
P2+	34	0.0%	17.6%	76.5%	2.9%	2.9%	0.0%
P2	20	20.0%	15.0%	5.0%	55.0%	0.0%	5.0%
P3	3	0.0%	0.0%	0.0%	0.0%	66.7%	33.3%
Speculative Grade	2	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Total	3242						

Source: CRISIL Ratings

Key Observations

- CRISIL Short Term ratings, in its entire 16-year history, has encountered only a solitary default (in the year 1999), and that too due to a sudden and abrupt downturn in the industry, coupled with certain onerous capital-intensive projects undertaken by the issuer.
- The unique feature of short-term ratings is the greater percentage probability of upgrades as compared to downgrades, as is clearly evident from Table 1.
- The major reason for the higher stability of short-term instruments is CRISIL's insistence on liquidity back-up for the instruments. This ensures an orderly exit mechanism for the instrument in the event of a weakening in the issuer's credit profile.
- The stability rates for short-term rating during the shorter period of 2000-2007 are significantly higher than the corresponding stability rate in the entire 16-year rating history of CRISIL (see Table 2).

Table 2: CRISIL Short-Term Average One-Year Transition Rate **2000-2007**

Ratings	Sample Size	P1+	P1	P2+	P2	P3	Speculative Grade
P1+	1499	98.8%	0.9%	0.1%	0.1%	0.0%	0.0%
P1	146	13.0%	84.9%	2.1%	0.0%	0.0%	0.0%
P2+	13	0.0%	23.1%	69.2%	7.7%	0.0%	0.0%
P2	5	40.0%	40.0%	0.0%	20.0%	0.0%	0.0%
P3	1	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
Speculative Grade	-	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	1664						

Source: CRISIL Ratings

Structured Finance Securities - Default Rates

CRISIL was the first to rate several complex structured transactions in the Indian market. As of date, CRISIL has ratings data on 1669 data points spanning a decade of rating structured finance securities. These structured securities include securitisation transactions, namely, asset-backed securities, mortgage-backed securities, and collateralised debt obligations, as well as other structured finance transactions like guarantee and partial guarantee transactions. Using this data set and the methodology as described in Annexure 1, Table 3 provides the observed three-year cumulative default rates at category level for the period between 1997 and 2007 for the ratings of structured finance securities.

Table 3: CRISIL Average Cumulative Default Rates For Ratings of Structured Finance Securities (withdrawal adjusted) **1997 to 2007**

Ratings	Sample Size	1-Year	2-Year	3-Year
AAA(so)	1198	0.1%	0.4%	0.8%
AA(so)	149	0.0%	0.0%	0.0%
A(so)	258	0.0%	3.2%	7.0%
BBB(so)	32	0.0%	0.0%	0.0%
Investment Grade AAA(so) to BBB(so)	1637	0.1%	0.8%	1.7%
Speculative Grade	32	25.0%	21.9%	21.9%

Source: CRISIL Ratings

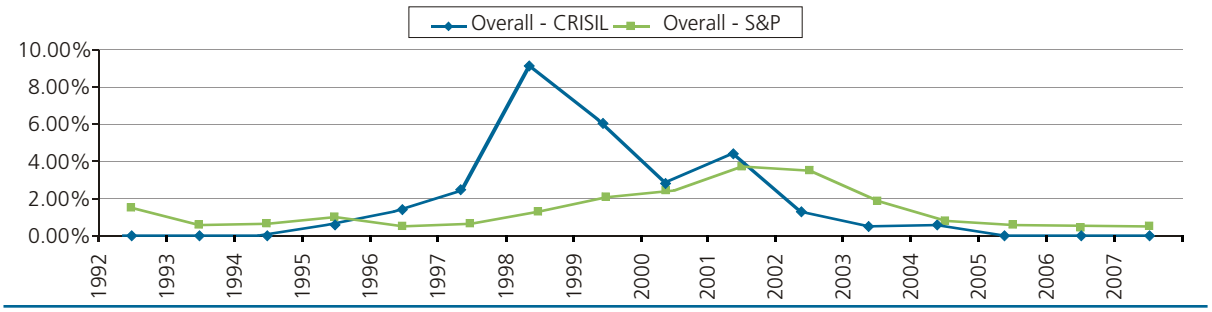
In Table 3, the three-year cumulative default rates for securities rated 'AAA (so)' is at 0.8 per cent due to recognition of default on certain guaranteed papers on account of observed delay in payment of interest on the securities. Here, because of strict adherence to the stated policy of recognising defaults on the basis of 'single-rupee single-day delay', the said time lag was taken to be sufficient reason for recognising default.

Incidentally, all the 'AAA (so)' instruments that were downgraded due to default were subsequently paid off to the investors in full and the rated instruments have been redeemed thereafter. The structured transactions to default were guaranteed by the state government in one case and by the central government in others; the issuers eventually emerged from default within a span of one to three years.

Long-Term Default Rates

The movement of overall annual default rates (the proportion of total defaults to total outstanding ratings in a particular year) for CRISIL's ratings is shown in Chart 2. The statistics indicate that, since 1998, CRISIL's default rates have been steadily declining. Moreover, over the past eight years, CRISIL's default rates have been comparable to those of Standard & Poor's (S&P) globally.

Chart 2. Overall Annual Default Rate



Source: CRISIL Ratings

CRISIL's default rates for the past eight years (2000-07) stood at an average of 1.5 per cent, as against an average of 2.6 per cent observed over the entire 16-year period of this study (1992-2007). Moreover, about 70 per cent of defaults in CRISIL's portfolio, till date, occurred between 1997 and 1999, resulting in an upward bias for CRISIL's overall historical default rates.

Table 4 presents an industry-wise analysis of long term defaults. This analysis highlights the fact that four sectors accounted for about half of the defaults on CRISIL-rated debt instruments over the past 16 years.

Table 4: Industry-wise Classification of Defaults

Industry	1992 to 1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
Non Banking Finance Company				4	13	3									20
Steel, Non Ferrous Metals and Mining			2	1	6	2	2	2							15
Textile				3	1	3	1	2		1					11
Consumer Durables		2	1	1	5				1						10
Chemicals				1	1	1	3	2	1						9
Construction and construction material			1		3	2	1	1							8
Automotive			1	1	2	1		1			1				7
Engineering					2	3	1	1							7
Pharmaceuticals			1		1	3		1							6
Paper & Paper Products				1	1	1			1						4
Diversified					3										3
Packaging					2	1									3
Power and power equipment							1	2							3
Sugar						3									3
Computers - Hardware					2										2
Miscellaneous					1		1								2
Telecommunication and related equipments					1	1									2
Courier & Express Services				1											1
Hotels						1									1
Oil & Refining						1									1
Printing						1									1
Shipping							1								1
Total Defaults	**0**	**2**	**6**	**13**	**44**	**27**	**11**	**12**	**3**	**1**	**1**	**0**	**0**	**0**	**120**

Source: CRISIL Ratings

As mentioned earlier, the majority of defaults occurred between 1997 and 1999 due to the simultaneous occurrence of a number of events, including economic recession, and structural/regulatory changes, especially in the financial sector. Although economic cycles will continue, CRISIL believes that structural and regulatory changes of this magnitude are unlikely in the future, thus rendering the possibility of a repeat of the 1997-1999 default rates remote. Hence, in order to provide the users with more meaningful and forward-looking estimates of default probability for each rating category, CRISIL continues to publish default rates for the period beginning 2000 onwards, besides the full data set as an additional input.

Cumulative Default Rates

CRISIL's average cumulative default rates (CDRs) for the entire period of this study (1992-2007) are presented in Table 5; Table 6 presents the same for the last eight years (2000 to 2007).

Table 5: CRISIL Average Cumulative Default Rates (withdrawal-adjusted) 1992-2007

Rating	Sample Size	1-Year	2-Year	3-Year
AAA	647	0.00%	0.00%	0.00%
AA	1457	0.00%	0.39%	1.28%
A	1447	0.97%	4.17%	8.73%
BBB	635	3.31%	9.23%	16.77%
Investment Grade (AAA to BBB)	4186	0.84%	2.98%	6.01%
Speculative Grade	456	18.64%	31.25%	40.52%

Source: CRISIL Ratings
(CRISIL's methodology for calculation of default and transition rates is explained in Annexure 1)

Table 6: CRISIL Average Cumulative Default Rates (withdrawal-adjusted) 2000-2007

Rating	Sample Size	1-Year	2-Year	3-Year
AAA	419	0.00%	0.00%	0.00%
AA	593	0.00%	0.22%	0.22%
A	239	0.42%	1.03%	1.97%
BBB	86	3.49%	5.42%	8.47%
Investment Grade (AAA to BBB)	1337	0.30%	0.63%	0.99%
Speculative Grade	84	15.48%	20.58%	20.58%

Source: CRISIL Ratings
(CRISIL's methodology for calculation of default and transition rates is explained in Annexure 1)

Key Observations

- CRISIL's long-term ratings continue to be ordinal. Since CRISIL's ratings are opinions on default risk, the higher the rating, the lower should be the default rate. The inverse correlation between CRISIL's credit ratings and default probabilities is evident from Tables 5 and 6.
- In contrast to the ratings on structured finance securities, no long-term instrument rated 'AAA' has ever defaulted in the past. The three-year CDR for 1337 data points in the long-term investment grade is very low at just 0.99 per cent for the period 2000 - 2007.

Cumulative Default Rates Including Ratings on Structured Finance Securities

The unique feature of the 2007 default study is the inclusion of ratings on structured finance securities, along with the long-term ratings, for computation of cumulative default rates. Table 7 provides default rates for such a combined data set.

Table 7: CRISIL Average Cumulative Default Rates For All Ratings -Long-Term and Structured Finance securities; (withdrawal-adjusted) 1992-2007

Ratings	Sample Size	1-Year	2-Year	3-Year
AAA	1845	0.1%	0.2%	0.4%
AA	1606	0.0%	0.4%	1.2%
A	1705	0.8%	4.0%	8.5%
BBB	667	3.1%	8.9%	16.4%
Investment Grade (AAA to BBB)	5823	0.6%	2.4%	4.8%
Speculative Grade	488	19.1%	30.8%	39.4%

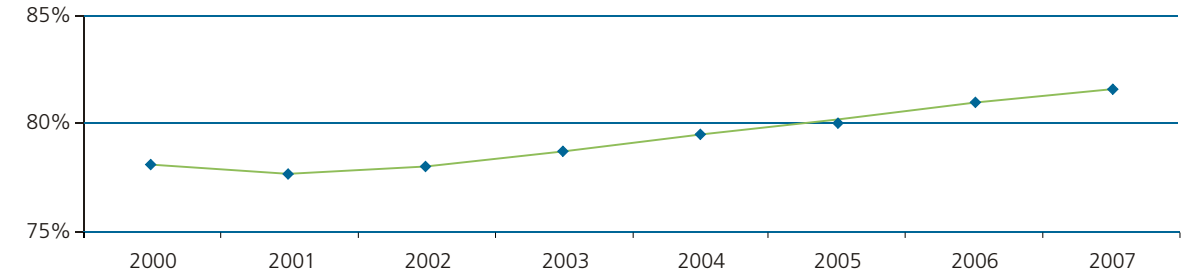
Source: CRISIL Ratings

Strong Predictive Ability

CRISIL's ratings continue to demonstrate their strong ability to predict default. Using data from 1992 to end-2007, the accuracy ratio for CRISIL's ratings-measured using the Gini coefficient-is high at 0.81 (see Chart 5 in Annexure 2), and has moved steadily up from 0.77 in 2001; this is only marginally lower than S&P's global average of 0.83 as per S&P's 2007 Default and Transition study. Please refer to Annexure 2 for the methodology for calculation of the accuracy ratio.

The accuracy ratio of CRISIL's ratings has remained consistently high, as Chart 3 reveals. Since the accuracy ratio is a measure of the effectiveness of a rating system, the high accuracy ratio of CRISIL's ratings underlines the reliability of its ratings. CRISIL has achieved these accuracy levels through its robust rating process and high analytical rigour employed in each of its ratings.

Chart 3. Accuracy Ratio - 1 Year Defaults **2000-2007**



Source: CRISIL Ratings

Ordinality in Stability Rates

Stability rates indicate the probability of ratings remaining unchanged, that is, not showing any transition over a given time horizon. The overall stability for investment grade ('AAA' to 'BBB') ratings is 86.3 per cent. There is an increase in stability rates as we move up the investment grade rating ladder; in other words, ordinality of stability rates is observed in investment grade ratings.

Table 8: CRISIL's Average One-Year Transition Rates **1992 - 2007**

Rating	Sample Size	AAA	AA	A	BBB	BB	B	C	D
AAA	647	97.4%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
AA	1457	2.3%	90.3%	6.3%	0.6%	0.4%	0.1%	0.0%	0.0%
A	1447	0.0%	3.9%	82.7%	7.2%	4.4%	0.2%	0.7%	0.9%
BBB	635	0.0%	0.3%	5.5%	73.7%	13.9%	1.3%	2.0%	3.3%
BB	341	0.0%	0.6%	0.0%	2.3%	74.8%	1.8%	5.3%	15.2%
B	34	0.0%	0.0%	0.0%	5.9%	0.0%	55.9%	8.8%	29.4%
C	81	0.0%	0.0%	0.0%	1.2%	0.0%	0.0%	70.4%	28.4%
Total	4642								

Source: CRISIL Ratings

The shaded diagonal of Table 8 gives the stability rates of different rating categories for long-term instruments. For example, Table 8 tells us that on average 90.3 per cent of instruments rated 'AA' have remained at 'AA', 2.3 per cent have been upgraded to 'AAA', and 7.4 per cent have been downgraded, in any one-year period.

Transition rates-the other side of the coin-indicate the probability of a given rating moving to other rating categories. Transition rates are thus particularly relevant for investors with time horizons shorter than the maturity of the debt instruments they hold, and for investors who need to regularly mark their investments to market.

Table 9 shows the One-Year average stability rates at individual rating level as well as on an overall basis. On an overall basis, the stability rates have been steadily rising and now are at a five year high of 84.9 per cent. On a year on year comparison in 2007 the AAA stability rate has slid down by 0.2% points. Such a slide is mainly due to pressure on credit quality consequent to Indian corporates' global ambitions and intent to expand. This is reflected in an increasing risk appetite leading to the current phase of acquisitions and capacity expansions as witnessed in 2007.

Table 9: CRISIL's One-Year Average Stability Rates

Years	AAA	AA	A	BBB	Overall*
1992 - 2007	97.4%	90.3%	82.7%	73.7%	84.9%
1992 - 2006	97.6%	89.9%	82.6%	73.6%	84.5%
1992 - 2005	97.2%	89.7%	84.4%	73.3%	84.0%
1992 - 2004	96.9%	89.3%	82.4%	73.2%	83.6%
1992 - 2003	96.4%	89.2%	82.3%	73.3%	83.2%

* All Non-Default Category Ratings
Source: CRISIL Ratings

Using the combined data set of long-term and structured instruments, the one-year average transition rates is given in Table 10.

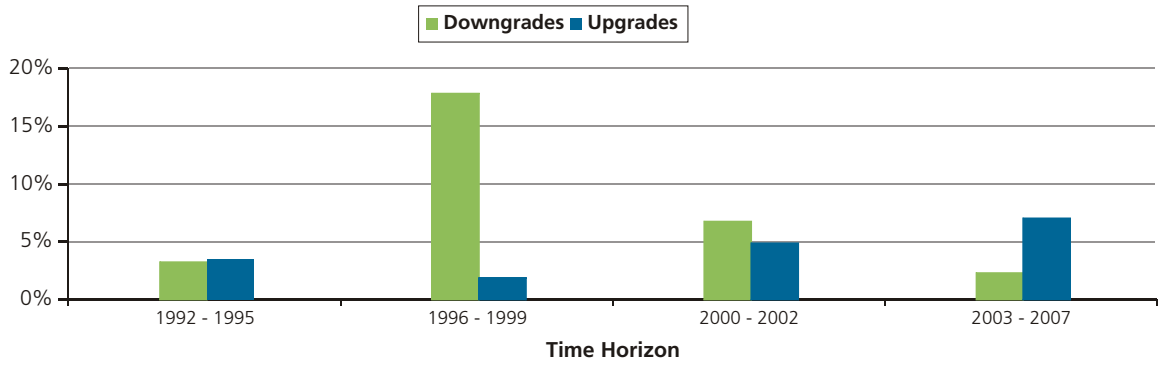
Table 10: CRISIL's Average One-Year Transition Rates **1992-2007**

Ratings	Sample Size	AAA	AA	A	BBB	BB	B	C	D
AAA	1845	98.2%	1.5%	0.1%	0.0%	0.0%	0.0%	0.1%	0.1%
AA	1606	2.7%	90.2%	6.2%	0.5%	0.3%	0.1%	0.0%	0.0%
A	1705	0.0%	4.3%	83.3%	6.2%	4.6%	0.2%	0.6%	0.8%
BBB	667	0.0%	0.3%	5.2%	74.8%	13.3%	1.3%	2.0%	3.1%
BB	372	0.0%	0.5%	0.0%	4.0%	73.1%	1.6%	4.9%	15.9%
B	34	0.0%	0.0%	0.0%	5.9%	0.0%	55.9%	8.8%	29.4%
C	82	0.0%	0.0%	0.0%	1.2%	0.0%	0.0%	69.5%	29.3%
Total	**6311**								

Source: CRISIL Ratings

As with CRISIL's default rates, its one-year transition rates are reliable because they have been compiled over a long time frame (1992-2007), and cover more than one business cycle and credit quality cycle. Chart 4 illustrates different periods of decreasing and improving credit quality, marked by increase and decrease in the percentage of downgrades.

Chart 4. Percentage of Upgrades and Downgrades



Source: CRISIL Ratings

Conclusion: CRISIL's Default and Transition Rates-Robust and Reliable

The ordinal nature of default rates, strong predictive ability of CRISIL ratings, and their high stability demonstrate the strength of CRISIL's rating processes. These processes have been set up, stabilised, and refined in the light of close to two decades of CRISIL's rating experience, and their robustness is today recognised by both issuers and investors. This study presents empirical evidence that CRISIL's ratings are ordinal and have shown a track record of good predictive ability. The study is based on CRISIL's ratings assigned over 16 years, covering a complete credit quality cycle. The quality, vintage, and diversity of the instruments, and the size of the database continue to make this the most comprehensive study on default behaviour in corporate India.

Annexure 1: Default and Transition Rate Methodology

Concept of static pools

A static pool of a particular year is made up of a set of companies having a given rating outstanding at the beginning of that year. Once formed, the pool does not admit any new members. For a company to be included in an n-year static pool, its rating has to be outstanding through the entire 'n' years. Companies that withdraw or default in between will remain withdrawn or in default for the remaining years. Therefore, a withdrawn company that is subsequently rated again, or a company from the pool that defaults and recovers, is not considered for re-inclusion in the pool. A company that remains rated for more than one year is counted as many times as the number of years over which it was rated. The methodology assumes that all ratings are kept current through an ongoing surveillance process, which, in CRISIL's case, is one of the cornerstones of the ratings' value proposition.

For instance, a company continually rated from January 1, 1995, to January 1, 2000, would appear in five consecutive static pools, whereas a company first appearing on January 1, 2002, and having an outstanding rating till January 1, 2003, will appear only in the 2002 static pool. As this analysis is for annual default/transition statistics, only the net effect of multiple rating changes, if any, in a year is recorded.

Marginal default rate

Notations:

For CRISIL's data,

Y: Year of formation of the static pool (1992 to 2007)
R: A given rating category on the Rating Scale ('AAA' to 'C')
t: Years from the formation of the static pool (1,2,3, 4….)

$M_t^Y(R)$ = defaults from rating category 'R' in t^{th} year of Y-year static pool
$N_t^Y(R)$ = Non-defaulted ratings outstanding in t^{th} year in rating category 'R' from the Y-year static pool

Illustration[1]: Consider a hypothetical static pool formed in the year 1985, and having 100 companies outstanding at a rating of 'BB' at the beginning of the year. Suppose, out of this pool, there is one default in the first year, three in the second year, and none in the third year. Also assume there are no withdrawals in any year. Then, using the above notation,

$M_1^{1985}(BB) = 1$, $M_2^{1985}(BB) = 3$, and $M_3^{1985}(BB) = 0$
$N_1^{1985}(BB) = 100$, $N_2^{1985}(BB) = 99$, and $N_3^{1985}(BB) = 96$

For rating category 'R', the t^{th} year marginal default rate for Y-year static pool is the probability of a firm, in the static pool formed at the starting of the year Y, surviving till the end of period (t-1) and defaulting only in year t.

Mathematically, the marginal default rate for category 'R' in year t from Y static pool, **$MDR_t^Y(R)$**, is defined as

$MDR_t^Y(R) = M_t^Y(R) / N_t^Y(R)$
Therefore, $MDR_1^{1985}(BB) = M_1^{1985}(BB) / N_1^{1985}(BB) = 1/100 = 0.01$

Cumulative average default rate

The concept of survival analysis is used to compute the cumulative default probabilities. We calculate the cumulative probability of a firm defaulting as follows:

The cumulative probability of a firm defaulting by the end of (t+1) years	=	[Cumulative probability of the firm defaulting by the end of t years + Probability of the firm defaulting in $(t+1)^{th}$ year]

Probability of the firm defaulting in $(t+1)^{th}$ year	=	[Probability of the firm surviving till end of t^{th} year * Marginal Probability of the firm defaulting in $(t+1)^{th}$ year]

[1] This illustration is for explanatory purposes only, and does not indicate the actual or observed probabilities of default in any rating category

Further, for a firm to default in the $(t+1)^{th}$ year, it should survive till the end of t years. So,

Now,

Probability of the firm surviving till the end of t^{th} year	=	1- Cumulative probability of the firm defaulting by the end of t years

Hence,

Probability of the firm defaulting in $(t+1)^{th}$ year	=	[(1- Cumulative probability of the firm defaulting by the end of t years) * Marginal Probability of the firm defaulting in $(t+1)^{th}$ year]

Therefore, returning to the first expression,

The cumulative probability that a firm defaults by the end of (t+1) years	=	Cumulative probability of the firm defaulting by the end of t years	+	[(1- Cumulative probability of the firm defaulting by the end of t years) * (Marginal Probability of the firm defaulting in $(t+1)^{th}$ year)]

Restating the above in notation, if **$CPD_{t+1}(R)$** = cumulative default probability of a firm rated R defaulting in t+1 years, then,

$CPD_t(R) = MDR_t(R)$; for t=1

$CPD_{t+1}(R) = CPD_t(R) + (1 - CPD_t(R)) * MDR_{t+1}(R)$; for t=2,3….5 etc.

This iterative computation is repeated for all static pools, and a weighted average (weighted by the category-wise sample sizes) is taken to compute the overall default rate.

Withdrawal adjustment

In the year subsequent to its having obtained the rating, the firm can move to three different states - it can be timely on payments (and have a non-default rating outstanding), can default, or can repay the debt and withdraw the rating. As firms are not monitored post-withdrawal, the 'true state' (whether default or no default) of a firm whose rating has been withdrawn remains unknown in subsequent years. Therefore, a modified $MDR_t^Y(R)$ that ignores withdrawn firms is an appropriate measure of marginal default probability. As mentioned earlier, $N_t^Y(R)$ is also adjusted for the firms that belong to the static pool and have defaulted by the start of year t. The modified $N_t^Y(R)$ is:

$N_t^Y(R)$ = Number of firms in the static pool formed at the starting of year Y with rating category R
- Number of defaults till the end of period (t-1)
- Number of withdrawn firms till end of period t.

As reliable information meeting CRISIL's stringent requirements is not available post-withdrawal, withdrawal-adjusted default rates have been used for this study.

Post-default return of a firm

Post-default, firms sometimes recover and, consequently, receive a non-default rating in subsequent years. As CRISIL's credit rating is an indicator of the probability of default, default is considered an 'absorbing state',that is, a firm cannot come back to its original static pool post-default. In static pool methodology, the recovered firm is considered a new firm, which, if it continues to be rated, appears in the static pool of the year in which it recovered.

Methodology for transition rates

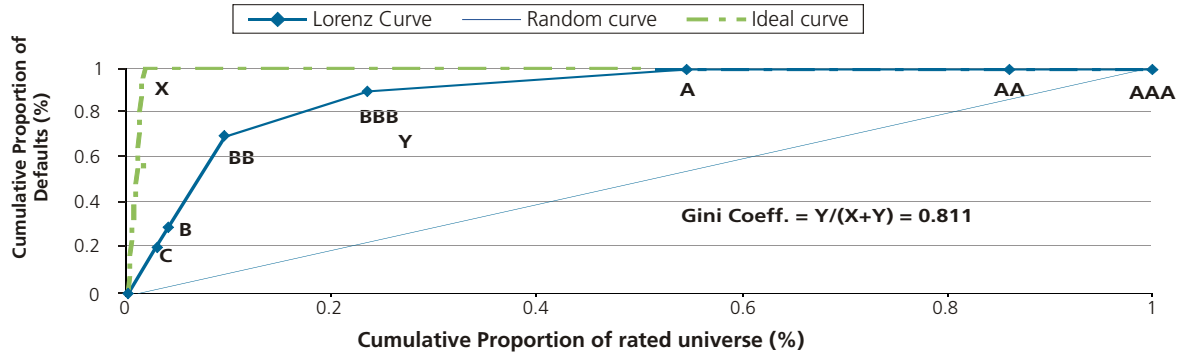
The t-year transition rate (from rating R1 to rating R2) for the static pool formed at the start of year Y, is the proportion of firms rated R1 at the beginning of static pool, that are found to be in R2 at the end of t years. This proportion is called the t-year transition probability from R1 to R2. The t-year transition matrix is formed by computing transition probabilities from various rating categories (except D) to other rating categories.

Withdrawal-adjusted transition rates are computed as mentioned above, but excluding companies that are withdrawn at the end of the t years.

In computation of t-year transition rates, ratings at a point of time, and at the end of the t^{th} year thereafter, are considered. Therefore, the firm does not drop out of the sample when withdrawn in between.

Annexure 2: Calculation of Accuracy Ratio

Chart 5: CRISIL Ratings, Performance in Predicting Defaults
One Year Defaults (1992 - 2007)



Source: CRISIL Ratings

How to read the chart on the accuracy ratio (Chart 5)

If ratings had no ability to predict default, then default rates and ratings would show no relationship. For example, assume 30 defaults occur in one year out of 1000 ratings (that is, default rate of 3 per cent). In any randomly selected 100 companies (10 per cent of the rated population) one would expect to see 3 defaulted companies (10 per cent of defaulted population), since the number of defaults one would expect to observe in a sample is proportional to the selected number of companies. This is represented by the random curve, which will be a diagonal straight line. On the other hand, if ratings are perfect predictors of default, then in the given example the worst 30 ratings should capture all the defaults. This is represented by the ideal curve.

Since no rating system is perfect, the actual predictive power lies between these two extremes. The cumulative curve represents the actual experience. The closer the cumulative curve is to the ideal curve, the better the predictive power of the ratings. This is quantified by measuring the area between the cumulative curve and random curve (area 'Y' in the chart) in relation to the area between the ideal curve and random curve (area 'X'+'Y' in the chart). This ratio of Y/(X+Y), called the Gini coefficient or the accuracy ratio, will be close to 1 if ratings have excellent predictive ability, as the cumulative curve will almost coincide with the ideal curve. On the other hand, it will be close to zero if ratings have poor predictive power, as in this case the cumulative curve will almost coincide with the random curve.

Definitions

Cumulative default curve (Lorenz curve)

A plot of cumulative proportion of defaults, category-wise, against the total proportion of issuers up to that category. For instance, in Chart 5, 88 per cent of the defaults observed were in the BBB and lower categories; these categories had only 25 per cent of outstanding issuers. In other words, the bottom 25 per cent of issuers accounted for 88 per cent of all defaults that have taken place.

Random curve

A plot of cumulative proportion of issuers against the cumulative proportion of defaulters, assuming that defaults are equally distributed across rating categories. In such a plot, the bottom 25 per cent of issuers would account for exactly 25 per cent of defaults; the plot would therefore be a diagonal straight line, and ratings would have zero predictive value.

Ideal curve

A plot of the cumulative proportion of issuers against the cumulative proportion of defaulters, if ratings were perfectly rank-ordered, so that all defaults occurred only among the lowest-rated entities. Since 120 defaults have occurred across 4642 issuer-years, implying an overall default rate of 2.6 per cent, the bottom 2.6 per cent of issuers would have accounted for all the defaults if ratings were perfect default predictors and any rating categories above this level would have no defaults at all.

Accuracy ratio / Gini coefficient

Accuracy ratio = (Area between Lorenz curve and random curve) / (Area between ideal curve and random curve)

CRISIL RATINGS

CRISIL Ratings is India's most influential and the world's fourth largest ratings agency - the most reliable opinion on risk. It is the market leader in India - shaping the development of the debt markets having rated over 6,700 debt instruments worth over Rs.13.50 trillion (over USD 343 billion) issued by over 4,600 companies. CRISIL Ratings has created rating methodologies for debt instruments and innovative structures across sectors. It is the only rating agency in India operating on the basis of sector specialisation.

CRISIL Offices

Head Office
CRISIL House
121 / 122 Andheri-Kurla Road
Andheri (East)
Mumbai 400 093, India.
TEL +91 (22) 6691 3001 - 09
FAX +91 (22) 6691 3000

Regional Offices in India

Ahmedabad
303, Paritosh, Usmanpura
Ahmedabad 380 013, India.
TEL +91 (79) 2755 0317 / 1533
FAX +91 (79) 2755 9863

Bangalore
W-101, Sunrise Chambers
22, Ulsoor Road
Bangalore 560 042, India.
TEL +91 (80) 2558 0899, 2559 4802
FAX +91 (80) 2559 4801

Chennai
Thapar House
43 / 44, Montieth Road
Egmore
Chennai 600 008, India.
TEL +91 (44) 2854 6205 / 06, 2854 6093
FAX +91 (44) 2854 7531

Hyderabad
3rd Floor, Uma Chambers
Plot no. 9 & 10, Nagarjuna Hills
(Near Punjagutta X Road)
Hyderabad 500 082, India.
TEL +91 (40) 2335 8103 / 8105
FAX +91 (40) 2335 7507

Kolkata
Horizon, 4th floor
57, Chowringhee Road
Kolkata 700 071, India.
TEL +91 (33) 2289 1949 / 1950
FAX +91 (33) 2283 0597

New Delhi
The Mira
G-1, 1st Floor
Plot No. 1 & 2
Ishwar Nagar
Near Okhla Crossing
New Delhi 110065
TEL +91 (11) 42505100, 26930117 / 21
FAX +91 (11) 26842212

Pune
1187 / 17 Ghole Road
Shivajinagar
Pune 411 005, India.
TEL +91 (20) 2553 9064 / 67
FAX +91 (20) 2553 9068

www.crisil.com