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CRISIL Default Study 2006

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Box 1 : Default rates demystified

What are default rates?

For any given period, the default rate for a particular rating 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 robust default and transition rates are critical inputs in the following decisions:

Pricing of debt

Default and transition rates are fundamental inputs to 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.

As critical inputs to credit risk measurement models

Default and transition rates are key inputs to 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.

Insights into the stability and meanings of ratings

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 ratings experience of 18 years, across manufacturing, finance, and infrastructure sectors. CRISIL has the largest ratings database[1] in India, encompassing over 4463 issuer-years. Significantly, it covers 15 years between 1992 and 2006, and therefore includes data from periods of deteriorating as well as improving credit quality, across economic cycles. CRISIL Ratings is also 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 data set, and a rigorous default definition, and having stood the test of various measures of validation, CRISIL's default rates are the most reliable estimate of default probability in the Indian market.

An analysis of the ordinal nature, predictive ability, and stability of CRISIL's ratings is presented in the following pages.

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[1] The data used for this analysis includes long-term ratings, and long-term ratings implicit in fixed deposit ratings, but excludes structured finance ratings and short-term ratings.

CRISIL Default Study 2006

CRISIL's ratings continue to demonstrate high accuracy levels

CRISIL's annual default study for 2006 once again validates CRISIL's ratings as reliable measures of default probability. CRISIL's ratings continue to be ordinal, with higher ratings translating into a lower likelihood of default. The stability rates of CRISIL's ratings have consistently improved over the years; at 84.5 per cent, currently, they compare well with the stability rates of international rating agencies. In addition, a high and steadily increasing accuracy ratio of 0.81 continues to underpin CRISIL's ratings' strong default prediction ability.

For the first time in the Indian debt market, CRISIL is presenting a trend of its accuracy ratio. This ratio has been consistently high, a clear reflection of CRISIL's commitment to the highest standards of analytical rigour. For debt market participants, this reaffirms the reliability of CRISIL's ratings. The study is based on CRISIL's ratings spanning 15 years, across economic cycles. Because of the quality, depth, and size of this database, it continues to be the most robust in the Indian context.

CRISIL's study continues to highlight the declining trend in default rates. In 2006, for the second year in succession, there has not been a single default. Moreover, default rates observed for CRISIL-rated entities over the last seven years (2000-2006) have been significantly lower than those over the entire period covered under the study, that is, 1992-2006.

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

CRISIL's 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 1. The statistics indicate that, since 1998, CRISIL's default rates have been steadily declining. Moreover, over the last seven years, CRISIL's default rates have been comparable to those of Standard and Poor's (S&P) globally.

Chart 1: Overall Annual Default Rates
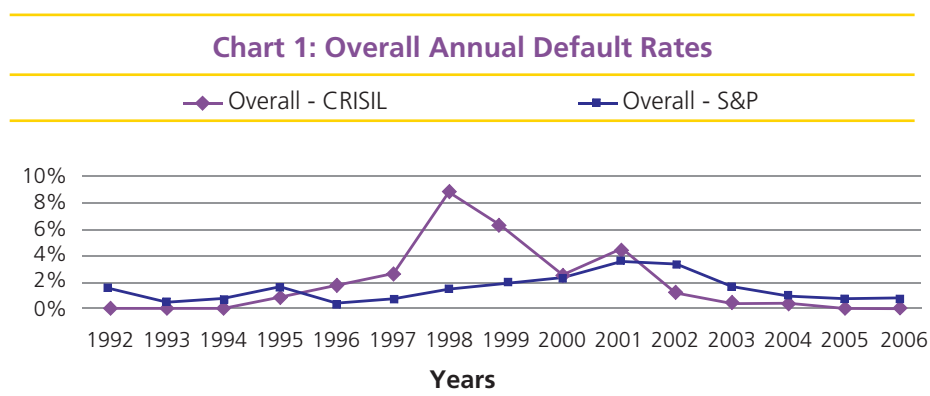
Source: CRISIL Ratings, Standard & Poor's Annual Global Corporate Default Study titled 'Annual 2006 Global Corporate Default Study and Rating Transitions' - (published on February 1, 2007)

CRISIL's default rates for the last seven years (2000-2006) stood at an average of 1.7 per cent, as against an average of 2.7 per cent observed over the entire 15-year period of this study (1992-2006). 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 1 presents an industry-wise analysis of defaults. This analysis highlights the fact that four sectors accounted for about half of the defaults on CRISIL-rated debt over the last 15 years.

Table 1: Industry-wise classification of Defaults

Industry	1992-94	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
Non Banking Finance Companies				4	13	3								20
Metals, mining,and steel			2	1	6	2	2	2						15
Textile				3	1	3	1	2		1				11
Consumer products		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	120
Number of ratings outstanding through the years	569[*]	345	467	540	483	429	388	271	233	198	186	173	181	4463

[*] The sum of the ratings for the given years.

Source: CRISIL Ratings

It is interesting to note that the majority of defaults occurred between 1997 and 1999. This was 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 experience remote. The table also highlights the robustness of CRISIL's dataset, which covers a down-cycle in credit quality (in the second half of the 1990s) and the current up-cycle in credit quality with very few defaults.

Cumulative default rates

CRISIL's average cumulative default rates for the entire period of this study (1992-2006) are presented in Table 2 and Chart 2 below; Table 3 and Chart 3 present the same for the last seven years (2000 to 2006).

Table 2: CRISIL Average Cumulative Default Rates (withdrawal-adjusted) (%), 1992-2006

Rating	Sample size	1-year	2-year	3-year
AAA	578	0.00	0.00	0.00
AA	1383	0.00	0.41	1.36
A	1423	0.98	4.23	8.85
BBB	625	3.36	9.38	17.03
Investment grade (AAA to BBB)	4009	0.87	3.10	6.27
Speculative grade	454	18.72	31.45	40.86

Source: CRISIL Ratings

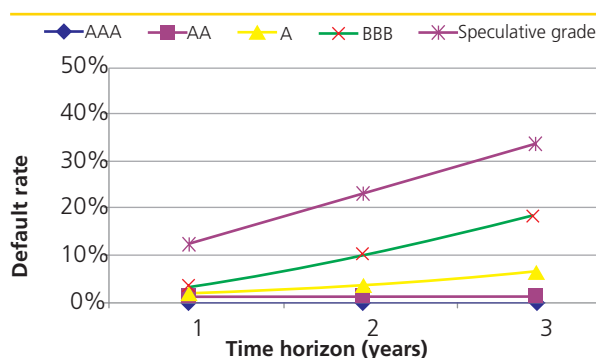**Chart 2: CRISIL Average Cumulative Default rates (Withdrawal-Adjusted), 1992-2006**

Table 3: CRISIL Average Cumulative Default Rates (withdrawal-adjusted) (%), 2000-2006				
Rating	Sample size	1-year	2-year	3-year
AAA	393	0.00	0.00	0.00
AA	613	0.00	0.21	0.49
A	320	0.63	1.53	2.85
BBB	125	4.00	7.05	9.56
Investment grade (AAA to BBB)	1451	0.48	1.03	1.66
Speculative Grade	179	11.73	25.88	28.18

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

Chart 3: CRISIL Average Cumulative Default rates (withdrawal-adjusted), 2000-2006
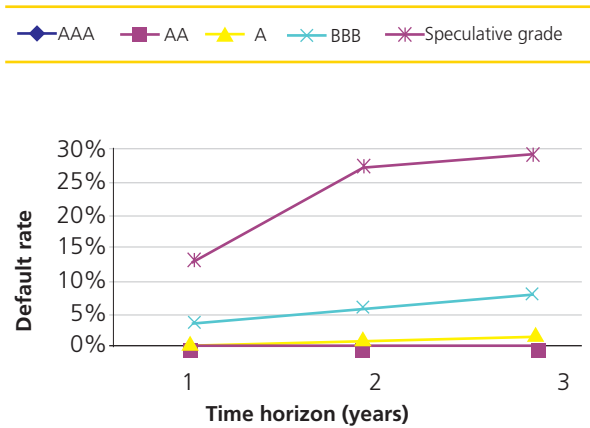
Ordinality

CRISIL's ratings continue to be ordinal. Since CRISIL's ratings are opinions on default risk, the higher the rating, the lower the default rate should be. The inverse correlation between CRISIL's credit ratings and default probabilities is evident from the tables 2 and 3 and charts 2 and 3 above.

Strong predictive ability

CRISIL's ratings continue to demonstrate their strong ability to predict default. Using data from 1992 to end-2006, the accuracy ratio for CRISIL's ratings measured using the Gini coefficient is high at 0.81 (see Chart 6), up from 0.80 last year; this is only marginally lower than S&P's global average of 0.83. 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 4 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, and underpins its transition and default statistics.

Chart 4: Accuracy Ratio-One Year Defaults 2000-2006
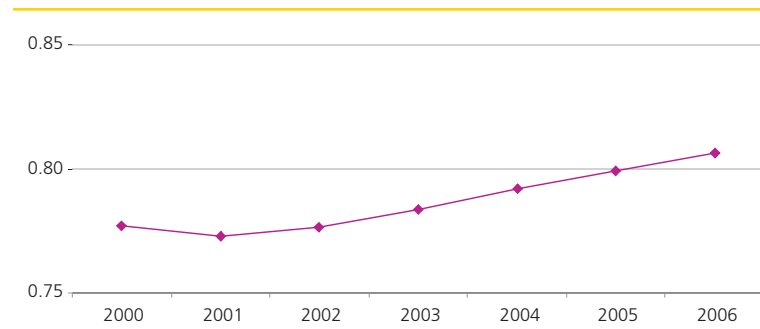
Source: CRISIL Ratings

Improvement in stability rates

Stability rates indicate the probability of ratings remaining unchanged, that is, not showing any transition over a given time horizon. The shaded diagonal of Table 4 gives the stability rates of different rating categories. For example, Table 4 tells us that on average 89.88 per cent of 'AAs' have remained at 'AA', 2.39 per cent have been upgraded to 'AAA', and only 7.73 per cent have been downgraded, in any one-year period. CRISIL's stability rates have been higher for higher rating categories, as illustrated in Table 5. The overall stability rates of CRISIL's ratings have also improved steadily over the last three years, recording a high 96.7 per cent in 2006, up from 94.2 per cent in 2005, and 92.4 per cent in 2004. This is highlighted in Table 5.

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 4 indicates CRISIL's one-year average transition rates for the period 1992-2006.

Table 4:
CRISIL's Average One-Year Transition Rates (%) 1992 - 2006

(in percentage)

| Rating	Sample size	AAA	AA	A	BBB	BB	B	C	D
AAA	578	97.58	2.42	0.00	0.00	0.00	0.00	0.00	0.00
AA	1383	2.39	89.88	6.65	0.58	0.36	0.14	0.00	0.00
A	1423	0.00	3.73	82.64	7.31	4.43	0.21	0.70	0.98
BBB	625	0.00	0.32	5.60	73.60	13.92	1.28	1.92	3.36
BB	339	0.00	0.59	0.00	2.06	74.93	1.77	5.31	15.34
B	34	0.00	0.00	0.00	5.88	0.00	55.88	8.83	29.41
C	81	0.00	0.00	0.00	1.23	0.00	0.00	70.37	28.40

Source: CRISIL Ratings

Table 5:
CRISIL's One-Year Average Stability Rates

(in percentage)

Data Set	AAA	AA	A	BBB	Overall*
2006	100.0	93.6	100.0	100.0	96.7
2005	100.0	94.9	81.8	75.0	94.2
2004	100.0	91.1	88.5	66.7	92.4
1992-2006 Average	97.6	89.9	82.6	73.6	84.5

* All non-default category Ratings

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 (1992-2006), and cover a complete credit quality cycle. Chart 5 illustrates different periods of decreasing and improving credit quality, marked by increase and decrease in the percentage of downgrades.

Chart 5: Percentage of Upgrades and Downgrades
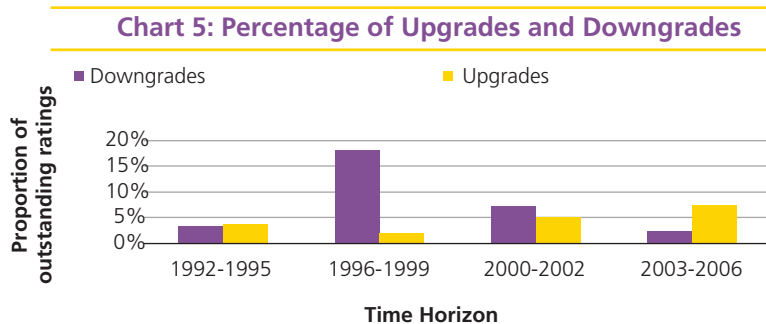
Source: CRISIL Ratings

Conclusion: CRISIL's default and transition rates-Robust and Reliable

The ordinal nature, predictive ability, and stability of CRISIL's ratings demonstrate the strength of CRISIL's rating processes. These processes have been set up, stabilised, and refined in the light of CRISIL's 18 years of 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 15 years and covering a complete credit quality cycle. The quality, depth and size of this database continue to make it the most robust in the Indian context.

Annexure 1: Default and Transition rate Methodology

Concept of static pools

A static pool of a year is 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 only appear 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 2006)
>
> 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[2]: 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 tth 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, $MDR_1^{1985}(BB) = M_1^{1985}(BB) / N_1^{1985}(BB) = 1/100 = 0.01$

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

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	]

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

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

Now,

Probability of the firm surviving till the end of tth 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 the 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 tth 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 6 - CRISIL Ratings: Performance in predicting defaults
One-year defaults (1992-2006)**
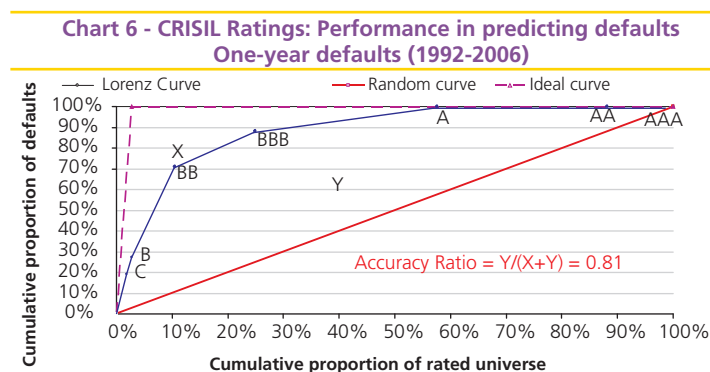
Source: CRISIL Ratings

How to read the Chart on the Accuracy ratio (Chart 6)

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 6, 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 4463 issuer-years, implying an overall default rate of 2.7 per cent, the bottom 2.7 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. CRISIL Ratings has shaped the development of the Indian debt markets, having rated over 5,600 debt instruments worth over Rs. 8.80 trillion issued by about 3200 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.

Association with Standard & Poor's: CRISIL's majority shareholder is Standard & Poor's, a division of The McGraw-Hill Companies and the world's foremost provider of independent credit ratings, indices, risk evaluation, investment research and data.

Leading corporations worldwide are rated by Standard & Poor's.

All CRISIL businesses operate on the core values of Analytical Rigour, Independence, Integrity, Innovation and Commitment.

CRISIL Ratings' consistent adherence to these principles is recognised by users of its ratings, and has been the key factor that makes CRISIL the leading player in this field and the most reliable opinion on risk.

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