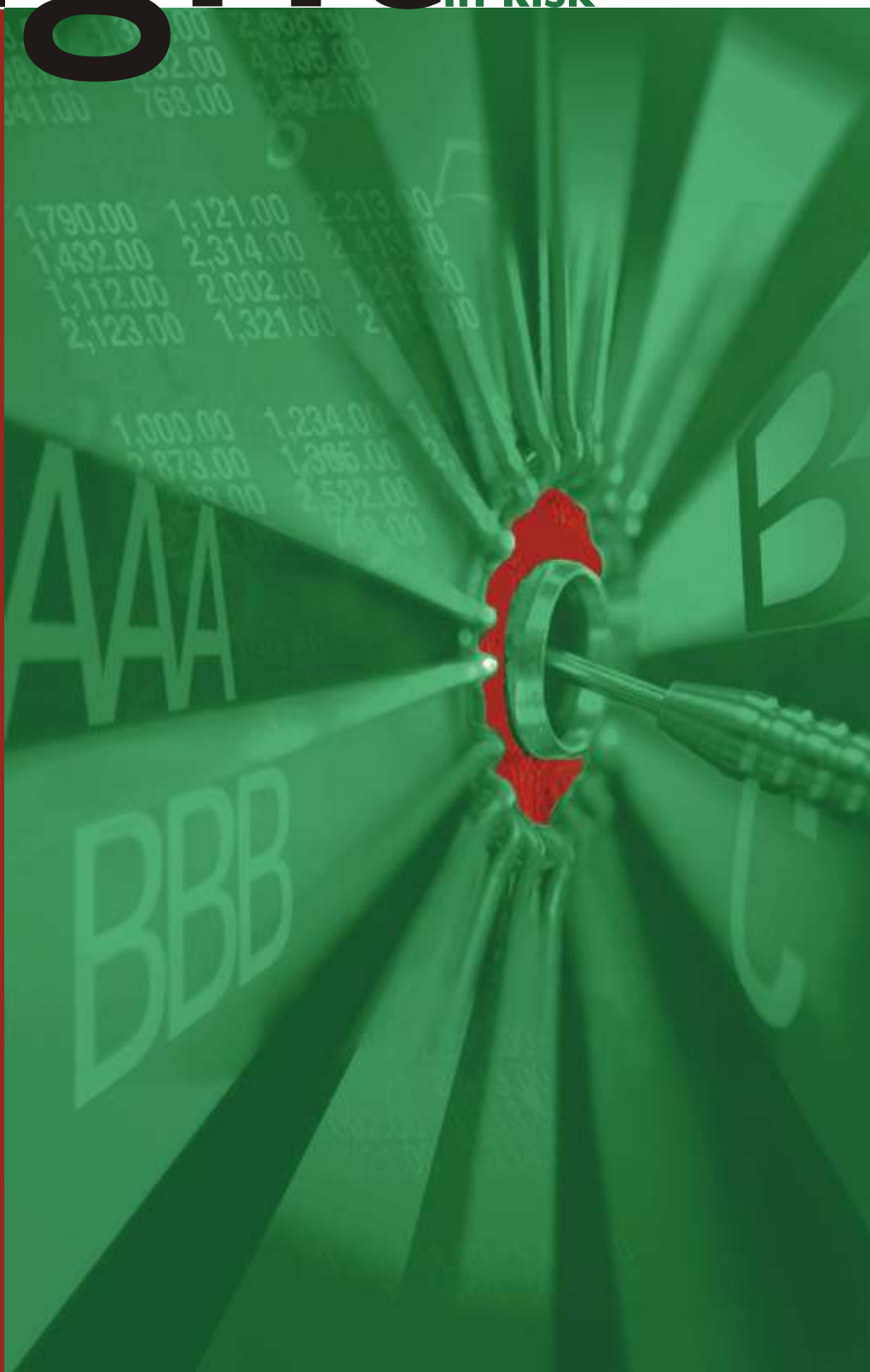
CRISIL RATINGS

insight in Risk

CRISIL Default Study 2008



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Box 1: Default rates and the importance of defining default

Default rates

What are default rates?

The default rate for a specified period is the number of defaults among rated entities during the period, as a percentage of the total number of rated entities whose ratings were outstanding throughout the period. Default rates can be calculated at each rating level, and can be calculated over multiple periods.

What are transition rates?

A transition rate measures the probability of a credit rating changing over a specified period. Transition rates can be calculated for the entire rated population, or can refer to a specified rating level.

How default and transition rates are used

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

a) Pricing of debt

Default and transition rates are critical inputs for the pricing of a debt instrument or loan. Default probabilities associated with ratings help investors and lenders in quantifying credit risk in their debt exposures, providing inputs on whether and how much to lend, and at what price.

b) Structuring and pricing of credit-enhanced instruments

Structuring, rating, and pricing of credit-enhanced instruments depend heavily on the default and transition rates of underlying borrowers and securities.

c) Credit risk measurement

Default and transition rates are key inputs for many quantitative risk assessment models. Investors in rated instruments can manage their risk exposures effectively if they have access to reliable default and transition rates. Transition rates are also important for debt funds that need to maintain a certain credit quality in their portfolios, and for investors who are, regulatorily or otherwise, mandated to invest only in securities that are rated at a certain level or above.

d) Indicating the efficacy of the rating scale

CRISIL's credit ratings are an indicator of probability of default. If ratings are reliable, the default rates should decrease as one moves up the rating scale. Default and transition rates can therefore be used to validate rating scales and quantify rating stability.

Default definition

CRISIL's definition of default

CRISIL defines default as any missed payment on a rated instrument. **This means that if a rated obligation is not serviced in full by the due date, the rating moves to 'D' or an equivalent**. Since CRISIL's credit ratings are an opinion on timely repayment of debt, any post-default recovery is not factored into CRISIL's credit ratings.

CRISIL's rigorous and objective definition of default provides a firm foundation for meaningful third-party use of its default rates. The fact that this definition has been in place for several years, and is consistently applied, ensures that the data used for this study is robust.

Rating agencies can adopt different approaches to recognising default. It is important to distinguish between default rates computed in different ways and based on different default definitions and recognition practices. The application of a definition of default that is less rigorous will automatically result in a reduction in the default rate, since many defaults under the rigorous definition would go unrecognised under the relaxed one. Any comparison of default statistics of two rating agencies must necessarily be preceded by a 'normalisation' for potentially different default recognition policies[1]. CRISIL's default and transition rate calculation methodology is explained in Annexure 4.

[1] Please refer to opinion piece 'Clear default definition critical for reliable credit rating', published in CRISIL Rating Scan March 2009

CRISIL Annual Default and Ratings Transition Study - 2008

Removing period selection bias and taking a closer look at retail asset-based ratings

CRISIL's ratings continue to exhibit strong default prediction ability, according to CRISIL's Default and Transition Study - 2008. Strong default prediction ability is evidenced by a high accuracy ratio, ordinal default and stability rates, and the fact that these metrics are computed on a data set that reflects all ratings assigned by CRISIL since ratings were introduced in India. Notably, CRISIL's default statistics are based on a rigorous and objective definition of default that causes CRISIL ratings to move immediately to 'D' (or equivalent), on any delay or shortfall in meeting debt service obligations on rated debt. Spanning 20 years, CRISIL's dataset is the most comprehensive in the Indian debt market.

The comprehensiveness of the data, over multiple economic cycles, prevents any data selection bias (as would occur, for instance, if the data set was chosen over a relatively default-free period). With this, CRISIL becomes the first rating agency in India to implement this best practice for credit rating, as suggested by the Asian Development Bank in its December 2008 *Handbook on Best Practices in Credit Rating.*

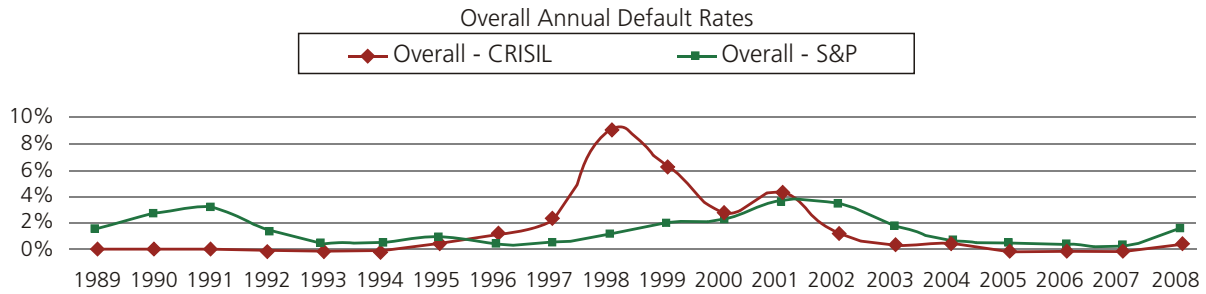
This edition of CRISIL's Default and Transition Study also carries, for the first time in India, separate performance data for its retail-asset-backed securitisation ratings. This data comprises almost 1200 data points starting from the first such rating that was assigned in 1992; critically, none of these rated instruments has ever defaulted. Stability rates for these ratings are comparable to those of other ratings assigned by CRISIL. The frequency of downgrades on these ratings has increased somewhat in the recent past, from a historical level that was close to zero, but even so has been lower than the corresponding figure for CRISIL's other debt ratings. This could be because of the increasing levels of credit protection available to investors in CRISIL-rated pools, which have offset the credit impact of the present economic slowdown.

This study provides details of CRISIL's default and transition rates, and the results of validity tests for the ordinal nature, predictive ability, and stability of CRISIL's ratings.

Long-Term Default Rates

Default rates have to be both low and stable, over a given time horizon, to be usefully factored in for the pricing of debt. The trend for CRISIL's annual default rate *(the proportion of total defaults in a particular year to total ratings outstanding throughout that year)* is shown in Chart 1. The statistics indicate a steady decline in default rates from 1998 to 2007, followed by a marginal increase in 2008.

Chart 1: Comparison of Overall Annual Default Rates



Source: CRISIL Ratings

CRISIL's average default rate for the past nine years (2000-08) stands at 1.5 per cent, as against an average of 2.5 per cent observed over the entire 20-year period of this study (1989-2008). About 70 per cent of the defaults so far in CRISIL's portfolio occurred between 1997 and 1999.

Cumulative default rates (CDRs)

CRISIL believes that publication of default rates from inception is the most objective way of capturing the consistency in any rating agency's performance. If default rates were published after excluding a particularly weak economic period[2], they would appear lower, but would not be entirely accurate and would therefore be of limited use to market participants.

[2] For example, between 1997 and 1999, there were several defaults because of the simultaneous presence of many factors including an economic slowdown and structural/ regulatory changes, especially in the financial sector; please refer to Annexure 1 for details of year-wise defaults. If default rate calculations were to exclude this crucial period, the default rates would be lower but would not present an accurate picture.

As CRISIL's ratings are opinions on default risk, the higher the rating, the lower should be the default rate. Such an inverse correlation between credit ratings and default probabilities is desirable for any rating agency and is called the test of ordinality. Table 1 below shows CRISIL's one-, two-, and three-year withdrawal-adjusted cumulative default rates across different rating categories from 1989 until December 2008 *(Please refer to Annexure 4 for the methodology used in calculation of default rates)*. CRISIL's default rates continue to be ordinal. Notably, not a single long-term instrument rated 'AAA' by CRISIL has ever defaulted.

Table 1: CRISIL's average cumulative default rates for long-term ratings (withdrawal-adjusted)

1-, 2-, and 3-Year CDRs, 1989 - 2008				
Rating	Issuer-years	1-Year	2-Year	3-Year
AAA	752	0.00%	0.00%	0.00%
AA	1572	0.00%	0.36%	1.18%
A	1495	0.94%	4.02%	8.40%
BBB	648	3.40%	9.15%	16.46%
AAA to BBB	4467	0.81%	2.74%	5.43%
BB and Below	458	18.56%	31.42%	41.22%
Total	4925			

Source: CRISIL Ratings

CRISIL also publishes default rates for more recent periods (2000-2008 and 2002-2008), to provide a picture of rating behaviour over the past few years. These are presented in Table 12 and Table 13 in Annexure 2. These default rates are also ordinal.

Ordinality in One-Year Stability Rates

Stability rates indicate the probability of ratings remaining unchanged over a given time horizon. The stability of CRISIL's ratings increases with movement up the rating scale; in other words, CRISIL's stability rates are also ordinal. Table 2 shows CRISIL's one-year stability rates over the past twenty years.

Table 2: Stability rates of CRISIL's long-term ratings

One year average stability rates				
Period	AAA	AA	A	BBB
1989-2008	96.28%	90.78%	83.08%	73.92%
1989-2007	96.74%	90.42%	82.89%	73.95%
1989-2006	96.85%	89.98%	82.82%	73.85%
1989-2005	96.43%	89.77%	82.55%	73.52%

Source: CRISIL Ratings

Considering a shorter period, Table 3 shows the one-year stability rates at individual rating levels since 2000. 'AAA' and 'AA' stability rates can be seen consistently above 97 and 92 percent respectively. Likewise, 'A' and 'BBB' ratings have also displayed high stability rates.

Table 3: Stability rates of CRISIL's long-term ratings

One year average stability rates				
Years	AAA	AA	A	BBB
2000-2008	97.05%	93.50%	85.21%	76.06%
2000-2007	97.85%	93.04%	84.55%	76.30%
2000-2006	98.22%	92.35%	84.33%	76.00%
2000-2005	97.83%	92.16%	83.17%	74.36%

Source: CRISIL Ratings

Transition rates - the other side of the coin - indicate the probability of a given rating moving to other rating categories. Since credit ratings are drivers of bonds' yields and therefore of their prices, transition rates are relevant for investors who do not intend to hold debt instruments to maturity, or need to regularly mark their investments to market. Additionally, they are of crucial importance for investors who are mandated to only hold investments that are of a certain minimum credit quality. Table 4 presents CRISIL's transition rates for various rating categories.

Table 4: CRISIL's average one-year transition rates for long-term ratings

One year average transition rates : 1989 - 2008									
Rating	Issuer-years	AAA	AA	A	BBB	BB	B	C	D
AAA	752	96.28%	3.72%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
AA	1572	2.23%	90.78%	6.04%	0.51%	0.32%	0.13%	0.00%	0.00%
A	1495	0.00%	3.81%	83.08%	7.09%	4.21%	0.20%	0.67%	0.94%
BBB	648	0.00%	0.31%	5.56%	73.92%	13.58%	1.24%	2.01%	3.40%
BB	342	0.00%	0.59%	0.00%	2.34%	74.85%	1.75%	5.26%	15.21%
B	34	0.00%	0.00%	0.00%	5.88%	0.00%	55.88%	8.82%	29.41%
C	82	0.00%	0.00%	0.00%	1.22%	0.00%	0.00%	70.73%	28.05%
Total	4925								

Source: CRISIL Ratings

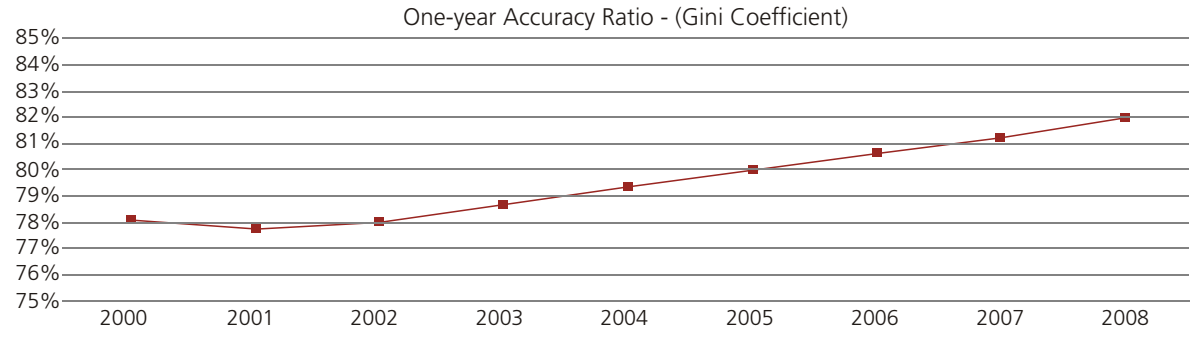
As can be seen, over the period 1989-2008, 90.78 per cent of instruments rated in the 'AA' category have remained in that category at the end of one year; 2.23 per cent have been upgraded to a higher rating ('AAA'), and close to 7 per cent have been downgraded to a lower rating. The highlighted diagonal of Table 4 has the stability rates of different rating categories (consequently, the figures match those in the first row of Table 2).

As with CRISIL's default rates, CRISIL's one-year transition rates are also reliable because they have been compiled using data that covers a long period (1989 - 2008), including multiple business cycles.

Strong predictive ability

The raison d'ˆtre for ratings is their ability to classify entities based on their likelihood of default. CRISIL's ratings continue to demonstrate their strong ability to predict default. Using data from the beginning of 1989 to end-2008, the accuracy ratio of CRISIL's ratings - measured using the Gini coefficient, applied over one-year periods - stands at a high of 0.82 *(please refer to Annexure 3 for more details on relationship between Gini coefficient and rating accuracy)*, and has moved steadily up from 0.77 in 2001. This is comparable to S&P's global average Gini of 0.82 as per S&P's 2008 Default and Transition study[3]. Chart 2 shows the movement in the Gini coefficient of CRISIL's ratings.

Chart 2: Accuracy ratio



Source: CRISIL Ratings

Short-Term Rating Transitions

The matrix in Table 5 provides the one-year transition rates for CRISIL's short-term ratings. The diagonal displays the stability rates for each rating. The number to the left of the diagonal represents the probability of an upgrade, while that to the right represents the probability of a downgrade. A 'P1+' rating has a stability rate of 97.7 per cent over a one-year period, and a 'P2+' rating has a 14.3 per cent probability of transition to a higher rating over a one-year period.

[3] Default, Transition, and Recovery: 2008 Annual Global Corporate Default Study and Rating Transitions: published by Standard and Poor's at www.ratingsdirect.com on Feb 25, 2009.

Table 5: CRISIL average one-year transition rates for short-term ratings

One year average transition rates : 1989- 2008							
Rating	Issuer Years	P1+	P1	P2+	P2	P3	Below P3
P1+	3037	97.73%	1.84%	0.23%	0.13%	0.07%	0.00%
P1	425	16.00%	81.18%	1.65%	0.71%	0.47%	0.00%
P2+	35	0.00%	14.29%	80.00%	2.86%	2.86%	0.00%
P2	22	18.18%	13.64%	4.55%	59.09%	0.00%	4.55%
P3	3	0.00%	0.00%	0.00%	0.00%	66.67%	33.33%
Below P3	1	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Total	3523						

Source: CRISIL Ratings

The stability rate for 'P1+' ratings is close to 98 percent while 'P1' and 'P2+' ratings show a stability of 80 percent or more. The stability rates for the higher short-term ratings during the more recent 2000-2008 period are significantly higher than the corresponding stability rate in the entire 20-year rating history of CRISIL *(please refer to table 14 in annexure 2)*.

Structured Finance Securities

CRISIL publishes updates on the performance of its rated retail ABS and retail MBS transactions; for the first time in India the default and transition statistics for ABS and MBS instruments are being published separately, in this edition of CRISIL's Default and Transition Study.

Retail Asset Backed Securities (ABS) and retail Mortgage backed securities (MBS)

CRISIL's database of retail ABS and MBS transactions consists of 1192 issue-years across sixteen years (1993-2008). **There have been no defaults in CRISIL-rated ABS and MBS instruments; the cumulative default rates for these instruments therefore stay at zero per cent for all rating categories across all years**. 'AAA(so)' rated ABS/MBS instruments, which account for 95 per cent of the ratings in the database, have stability rates of almost 97 per cent. Table 6 shows the transition rates for ABS and MBS ratings for the period 1993 2008.

Table 6 : CRISIL's average one-year transition rates for ABS and MBS ratings

One year average transition rates : 1993 - 2008						
Rating	Issue-years	AAA(so)	AA(so)	A(so)	BBB(so)	BB(so) and below
AAA(so)	1129	96.90%	2.66%	0.44%	0.00%	0.00%
AA(so)	12	41.67%	58.33%	0.00%	0.00%	0.00%
A(so)	3	0.00%	0.00%	100.00%	0.00%	0.00%
BBB(so)	48	0.00%	0.00%	2.08%	97.92%	0.00%
BB(so) and below	0	0.00%	0.00%	0.00%	0.00%	0.00%
Total	1192					

Source: CRISIL Ratings

The Indian securitisation market is very 'AAA(so)' centric, reflected in the large number of issuer-years for this rating. Data density drops dramatically below the 'AAA(so)' level, largely explaining the non-ordinal stability rates below 'AAA(so)'. Furthermore, a significant number of 'AA(so)' rated instruments have performed well, resulting in upgrades.

All Structured Finance Securities Default and Transition Rates

CRISIL was the pioneer in rating several complex structured finance securities in the Indian market and its database comprises 2248 issue-years *(including 1192 issue-years for ABS and MBS instruments presented in table 6 above)*, spanning sixteen years. CRISIL has ratings outstanding on a variety of structured finance securities; besides ABS and MBS instruments, these include single-loan sell-downs and instruments backed by full or partial guarantees. Table 7 below provides the one-, two-, and three-year cumulative default rates at each rating category level for the period 1993 - 2008 *(Please refer Table 15 in Annexure 2 for default rates of the 2002- 2008 period)*.

Table 7: CRISIL average cumulative default rates (CDR) for ratings on structured finance securities (1993-2008)

For ratings on structured finance securities (1993-2008)				
1-,2- and 3 -Year CDRs, 1993 - 2008				
Ratings	Issue-years	1-Year	2-Year	3-Year
AAA(so)	1656	0.06%	0.29%	0.52%
AA(so)	194	0.00%	0.00%	0.00%
A(so)	295	0.00%	2.87%	6.29%
BBB(so)	71	0.00%	0.00%	0.00%
AAA(so) to BBB(so)	2216	0.05%	0.75%	**1.86%**
BB(so) and below	32	25.00%	25.00%	**25.00%**
Total	2248			

Source: CRISIL Ratings

Table 7 shows that the one-year cumulative default rate for securities rated 'AAA(so)' is at 0.06 per cent. This is on account of a central-government-guaranteed 'AAA(so)' rated instrument that defaulted in 2005, because the trustee delayed in invoking the guarantee, resulting in a delay in payouts to investors; under its rigorous default recognition norms, CRISIL treated this as a default. There were eight defaults from instruments rated 'BB(so)' and below, seven of which were guaranteed by some state governments. All nine defaults were subsequently cured; the investors have been paid in full and the rated instruments redeemed.

Tables 8 and 9 present the one-year stability rates of structured finance instrument ratings for different periods.

Table 8: CRISIL's stability rates for structured finance securities ratings

One-year stability rates since 1993				
Period	AAA(so)	AA(so)	A(so)	BBB(so)
1993-2008	97.04%	87.63%	88.14%	97.18%
1993-2007	98.57%	86.71%	87.09%	93.94%
1993-2006	98.62%	83.47%	86.11%	92.31%
1993-2005	98.48%	81.37%	85.17%	80.00%

Source: CRISIL Ratings

These stability rates are high, and are ordinal except for the 'BBB(so)' category.

Table 9: CRISIL's Stability rates for structured finance securities ratings

One-year stability rates since 2000				
Period	AAA(so)	AA(so)	A(so)	BBB(so)
2000-2008	96.94%	91.77%	86.82%	98.57%
2000-2007	98.60%	91.79%	85.47%	96.88%
2000-2006	98.67%	89.32%	84.19%	100.00%
2000-2005	98.51%	88.46%	82.92%	100.00%

Source: CRISIL Ratings

Table 10 shows the one-year average transition rates for structured finance securities for the period 1993 - 2008.

One year Average Transition Rates - 1993 - 2008									
Rating	Issue-years	AAA(so)	AA(so)	A(so)	BBB(so)	BB(so)	B(so)	C(so)	D
AAA(so)	1656	97.04%	2.54%	0.30%	0.00%	0.00%	0.00%	0.06%	0.06%
AA(so)	194	7.73%	87.63%	4.64%	0.00%	0.00%	0.00%	0.00%	0.00%
A(so)	295	0.00%	6.10%	88.14%	0.34%	5.42%	0.00%	0.00%	0.00%
BBB(so)	71	0.00%	0.00%	1.41%	97.18%	1.41%	0.00%	0.00%	0.00%
BB(so)	31	0.00%	0.00%	0.00%	22.58%	54.84%	0.00%	0.00%	22.58%
B(so)	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C(so)	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Total	2248								

Source: CRISIL Ratings

Nearly three-fourths of all structured finance ratings - 1656 issue-years out of a total of 2248 issue-years - are rated AAA (so) and show a high stability rate of 97.04 per cent. The shaded diagonal in the above table shows the stability rates for various rating categories.

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

The ordinal nature of default rates, high stability and strong predictive ability of CRISIL ratings, demonstrate the strength of CRISIL's rating processes. These processes have been set up, stabilised, and refined in the light of two decades of CRISIL's rating experience, and their robustness is today recognised by issuers and investors. The study is based on CRISIL's ratings assigned over the last twenty years, covering more than one full credit cycle. The quality, vintage, and diversity of the instruments, the size of the database coupled with strict default definition and transparent default recognition practices, continue to make this the most comprehensive study on corporate defaults and rating transitions in India.

Annexure 1: Industry-wise Classification of Defaults

CRISIL is the first rating agency in India to have published an industry-wise classification and a chronological account of all the defaults in its portfolio that form part of the static pools used for computing default rates. Over the past twenty years, four industries *(Non-Banking Financial Companies, Metals and Mining, Textiles, and Consumer Durables)* accounted for a little less than half of the defaults on CRISIL-rated debt instruments, as shown in Table 11 below.

Table 11: Industry-wise and chronological break-up of defaults over the last twenty years.

Industry	1989-1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Non Banking Finance Company				4	13	3										**20**
Metals and Mining			2	1	6	2	2	2								**15**
Textile				3	1	3	1	2		1					1	**12**
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	**1**	**121**

Source: CRISIL Rating releases

As can be seen, the majority of defaults occurred between 1997 and 1999; there were a number of factors operating simultaneously in that period, including an economic slowdown, 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 to recur, rendering the possibility of a repeat of the 1997-1999 level of defaults remote.

Annexure 2: Default and Transition rates - 2000 to date

Three-year CDR for long-term ratings

Table 12: CRISIL average cumulative default rates
For long-term ratings (withdrawal-adjusted)

1-, 2- and 3 - year CDRs 2000 - 2008				
Rating	Issuer-years	1-Year	2-Year	3-Year
AAA	543	0.00%	0.00%	0.00%
AA	769	0.00%	0.16%	0.37%
A	365	0.55%	1.32%	2.43%
BBB	142	4.23%	6.65%	8.56%
AAA to BBB	1819	0.44%	0.80%	1.17%
BB and Below	183	11.48%	26.82%	30.78%
Total	2002			

Source: CRISIL Ratings

Table 13: CRISIL average cumulative default rates
For long-term ratings (withdrawal-adjusted)

1-, 2- and 3 - Year CDRs 2002 - 2008				
Rating	Issuer-years	1-Year	2-Year	3-Year
AAA	444	0.00%	0.00%	0.00%
AA	585	0.00%	0.00%	0.00%
A	196	0.51%	1.25%	2.36%
BBB	68	2.94%	5.15%	5.15%
AAA to BBB	1293	0.23%	0.46%	0.63%
BB and Below	50	6.00%	9.40%	8.37%
Total	1343			

Source: CRISIL Ratings

One-year transition rates for short-term instruments

Table 14: CRISIL Average one-year transition rates for short-term ratings, 2000-2008

One year Average transition rates : 2000- 2008							
Ratings	Issuer Years	P1+	P1	P2+	P2	P3	Below P3
P1+	1922	98.80%	0.94%	0.10%	0.05%	0.10%	0.00%
P1	201	12.94%	85.08%	1.99%	0.00%	0.00%	0.00%
P2+	17	0.00%	17.65%	76.47%	5.88%	0.00%	0.00%
P2	9	22.22%	22.22%	0.00%	55.56%	0.00%	0.00%
P3	2	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Below P3	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total	2151						

Source: CRISIL Ratings

Three-year CDRs for ratings of structured finance securities

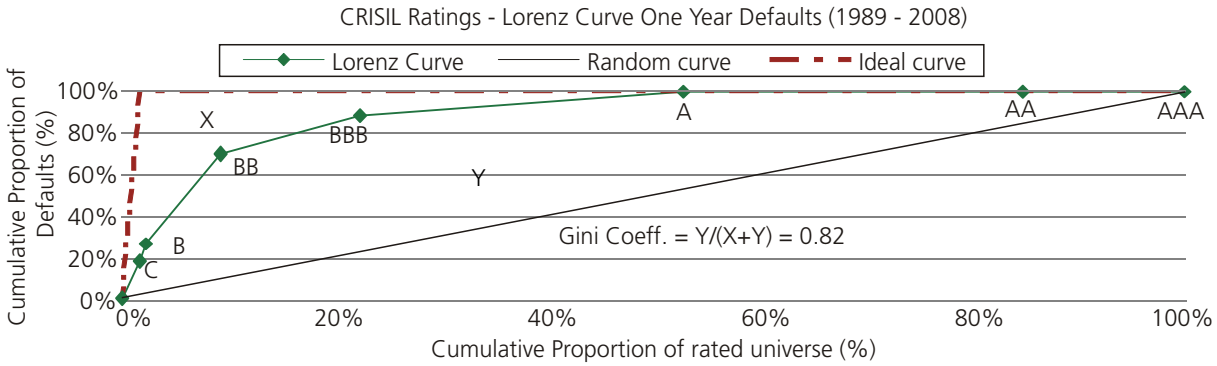
Table 15: CRISIL average cumulative default rates (CDRs), for structured finance ratings (withdrawal-adjusted)

1, 2 & 3 Year CDR - 2002-2008				
Ratings	Issue-years	1-Year	2-Year	3-Year
AAA(so)	1486	0.07%	0.33%	0.62%
AA(so)	159	0.00%	0.00%	0.00%
A(so)	189	0.00%	0.00%	0.00%
BBB(so)	70	0.00%	0.00%	0.00%
AAA(so) to BBB(so)	1904	0.05%	0.26%	**0.48%**
BB(so) and below	30	26.67%	26.67%	**26.67%**
Total	1934			

Source: CRISIL Ratings

Annexure 3: Gini Coefficient and Rating Accuracy

Chart 3: Graphical representation of Rating Accuracy



Source: CRISIL Ratings

How to read the Chart on the Accuracy Ratio (Chart 3)

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 (Lorenz 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 1 if ratings have perfect predictive ability, as the cumulative curve will 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. Thus a higher Gini coefficient indicates a better predictive ability of any rating system.

Definition

Cumulative default curve (also called Lorenz curve)

The Lorenz curve is a plot of cumulative proportion of defaults category-wise, *(of issuers having ratings outstanding at the beginning of the year and being in default at the end of the year)*, against the total proportion of issuers up to that category. For instance, in Chart 3, 88 per cent of the defaults recorded were in the BBB and lower categories; these categories had only 25 per cent of total ratings outstanding. In other words, the bottom 25 per cent of ratings accounted for 88 per cent of all defaults that have taken place.

Random curve

The random curve is 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

The ideal curve is 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 121 defaults have occurred across 4925 issuer-years, implying an overall default rate of 2.5 per cent, the bottom 2.5 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)

Annexure 4: Default and Transition Rate Methodology

Concept of static pools

A static pool of a particular year is made up of a set of entities having a given rating outstanding at the beginning of that year. Once formed, the pool does not admit any new members. For an entity to be included in an n-year static pool, its rating has to be outstanding through the entire period of n years. Entities whose ratings are withdrawn or are placed in default in the interim will continue to be withdrawn or in default for the remaining years. Therefore, an entity that ceases to be rated and is subsequently rated again, or an entity in the pool that defaults and recovers later, is not considered for re-inclusion in the pool. An entity 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 a cornerstone of the ratings' value proposition.

For instance, an entity that had ratings alive (not withdrawn) 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 (during the period 1989-2008)
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[4]: Consider a hypothetical static pool formed in 1989, 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,

$M_1^{1989}(BB) = 1$, $M_2^{1989}(BB) = 3$, and $M_3^{1989}(BB) = 0$
$N_1^{1989}(BB) = 100$, $N_2^{1989}(BB) = 99$, and $N_3^{1989}(BB) = 96$

For rating category 'R', the t^{th} year marginal default rate for Y-year static pool is the probability of an entity, 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, $\mathbf{MDR_t^Y(R)}$, is defined as

$MDR_t^Y(R) = M_t^Y(R) / N_t^Y(R)$

Therefore, $MDR_1^{1989}(BB) = M_1^{1989}(BB) / N_1^{1989}(BB) = 1/100 = 0.01$

[4]This illustration is for explanation 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 t^{th} year * Marginal probability of the firm defaulting in $(t+1)^{th}$ year]

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 number of data points) 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 on its debt repayments, or can repay the debt fully 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 t^{th} year thereafter, are considered.

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