CRISIL RATINGS

insight in Risk

CRISIL Default Study - 2009

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Box 1: Meaning and Significance of Default Rates, Default Definition and Method of Computation

Default rates

What are default rates?

The default rate for a specified period is the number of defaults among rated entities during the period, expressed 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 change in credit rating 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 formulating the following decisions:

a) Pricing of debt

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

b) Structuring and pricing of credit-enhanced instruments

The 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 threshold level of credit quality in their portfolios, and for investors who are, because of regulations 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.

Key Variables for Default Rate Computation

(i) Definition of default*

Rating agencies can adopt different approaches to defining and recognising default in their ratings. It is important to distinguish between default rates arising out of varying definitions of default and default recognition policies. A loose and interpretation-dependent definition of default and/or a policy of not immediately reflecting default in the outstanding rating will result in a reduction in the default rate. 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. Further, since CRISIL's credit ratings are an opinion on the timely repayment of debt, any post-default recovery is not factored into CRISIL's credit ratings. CRISIL believes that such an objective definition of default, coupled with its consistent application over time, provides a firm foundation for the meaningful third-party use of its default rates. Thus, **CRISIL's default rates are free from default recognition bias.**

(ii) Period of computation

Default rates can be computed over varying timeframes potentially exposing such computation to period selection bias. For example, if default rates were published over a period of economic strength, they would appear to be artificially low and hence would be of limited use to market participants. CRISIL publishes its default rates from inception to–date, ensuring that they are **free from period selection bias.**

(iii) Computation methodology

Default rates can be computed using different computation methodologies. Each methodology has implication for the numeric outcome as explained in Table A13. CRISIL's default rates are computed using the Annual Average Cumulative Default Rate approach using the weighted annual marginal default rate methodology, with full year-withdrawal adjustments as explained in Annexure 6.

A 'normalisation' of the above variables must, therefore, precede any comparison of default statistics across rating agencies.

*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 - 2009

CRISIL's ratings continue to exhibit robust default prediction ability. The key outcomes of CRISIL's Default and Transition Study – 2009 indicate that CRISIL's ratings have maintained a high accuracy ratio, in addition to strong ordinal default and stability rates. Importantly, the validity of these outcomes is supported by the fact that CRISIL has incorporated all the known global best practices in default rate computation in the study. These best practices include defining default in a digital manner that is free of rating agency interpretation, eliminating period selection bias, using the globally accepted marginal default rate method, and employing the monthly frequency static pools as base data. It is for the first time that CRISIL, in its default and transition study, has used static pools of a monthly frequency in computing default and transition rates; its previous studies factored in only the year-end status of ratings. The new method has significantly enhanced the study's ability to capture defaults and rating changes that have occurred during the year. CRISIL is India's only rating agency to adopt this rigorous method to compute its default rates.

CRISIL's default study for 2009 presents its one-, two-, and three-year cumulative default rates (CDRs) for all ratings assigned by CRISIL till the end of 2009. CRISIL does not permit itself the flexibility to present its default rates based on data for an 'appropriately chosen period', or to reflect a default event that is 'appropriately defined'. Its default rates are, therefore, shorn of subjectivity in the interpretation of default definition, and of bias in selection of period. By using monthly data, CRISIL has ensured that its default rates are as authentic to its actual rating performance as possible. This is in keeping with CRISIL's goal of providing credible ratings and related information to India's financial markets.

The full credit fallout of the global financial turmoil of 2008 was witnessed in 2009. The number of defaults by CRISIL-rated entities increased to 44 in 2009 from 6 in the previous year. All 44 defaults, however, have been by entities rated 'BBB' or lower; more than two-thirds of these were by entities rated 'BB' or lower. The increase in the number of defaults, notwithstanding, CRISIL's CDRs across rating categories have remained stable in 2009 at the 2008 levels. This is indicative of how well CRISIL's ratings enable strong default prediction even in a period of significant economic turmoil.

Interestingly, the one-year stability rates of ratings improved in 2009 over the previous year, for all categories except the higher ones. The stability rates of CRISIL's ratings in the 'AAA' and 'AA' categories declined slightly – an impact of substantial weakening in the credit quality of the global banks and financial institutions on the ratings of their Indian operations.

This edition of CRISIL's default study also analyses the average time to default for all defaulted ratings and concludes that ratings in the higher rating categories are farther away from default than those in the lower rating categories. This analysis is based on all entities that have ever defaulted on CRISIL-rated long-term debt instruments since 1988 and does not cover entities that did not default.

CRISIL's ratings for asset-backed securities have maintained their default-free track record in 2009, the 17th year since such securities were first rated by CRISIL.

What is new in this edition: Adopting a global best practice

Computing default rates on monthly data to accurately reflect the effects of the crisis on ratings

This edition of CRISIL's default study is based on ratings outstanding at the beginning of each month (monthly data) as compared to the earlier practice of basing the default study on ratings outstanding at the beginning of each year (annual data). This change is particularly significant at this time on two counts: the global economic turmoil created tremendous turbulence in the credit market, particularly in the lower rating categories; and CRISIL's median rating has trended downward over the past few years (in the BB category presently, as compared to being in the AA category in 2007) in the wake of the ratings assigned to a large number of issuers for their bank loans. Consequently, CRISIL's credit ratings changed much more in 2009 than before – both in number and frequency. In this scenario, continuing with the earlier approach of basing the default study on annual data may not capture many significant intra-year rating events. To eliminate this infirmity, CRISIL has based this edition of its default study on monthly data. Further, as default rate computation based on monthly data is considered a global best practice, as also mentioned in the Asian Development Bank's publication 'Handbook on International Best Practices in Credit Rating' published in December 2008, CRISIL will use this approach for all future editions of its default study. Also, as this edition marks a transition in CRISIL's earlier approach of calculating default and transition rates, it presents all key results based on annual data as well in Annexure 4 (in Tables A5, A6, A7 and A8 respectively).

The year 2009 witnessed a sharp economic downturn as a consequence of the global financial crisis. Governments and monetary authorities around the globe responded to this with unprecedented levels of fiscal and monetary support to mitigate the adverse fallout of the financial crisis on the real sector. As a result of these measures, the financial markets and the general economic environment returned to stability by the end of the year. These sharp changes in the business and financial environment resulted in many CRISIL-rated companies retracing some of the sharp decline in credit quality that they had seen at the beginning of the year. This default study captures these events with the highest possible fidelity.

This 2009 edition of CRISIL's Default Study contains:

I. **Movement in overall annual Default Rates since inception**

II. **Movement in Rating Accuracy Ratio since inception**

III. **For Corporate Issuers**
- One-year, two-year and three-year cumulative default rates
- One-year transition rates for ratings on both the long-term scale and the short-term scale
- Movement in stability rates over the last four years

IV. **For Structured Finance Instruments**
- One-year, two-year and three-year cumulative default rates
- One year transition rates
- Movement in stability rates over the last four years

V. **Retail ABS and MBS Issuance- One Year Transition Rates**

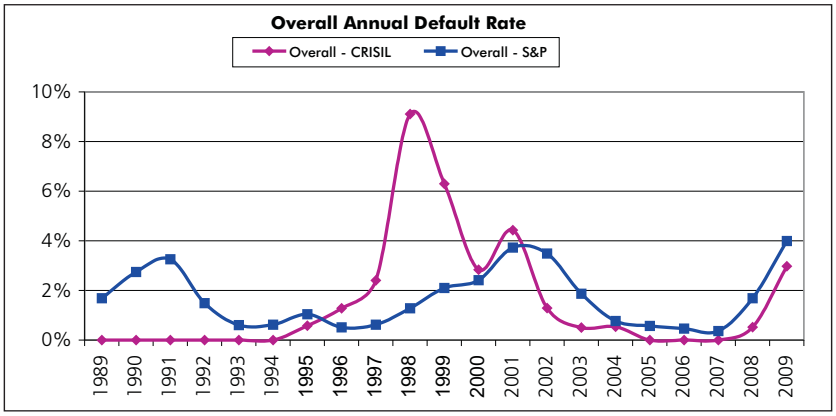
VI. **Annexures**
- Annexure 1: Industry-wise classification of defaults
- Annexure 2: Analysis of defaults : time to default
- Annexure 3: List of defaults in 2009
- Annexure 4: Comparative default and transition rates based on annual data
- Annexure 5: Lorenz curve and Gini coefficient for CRISIL Ratings – inception to 2009
- Annexure 6: Methodology used by CRISIL in this study

I. Movement in Overall Annual Default Rates Since Inception

Annual default rates for corporate issuers[1] rise in the wake of global crisis

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 an increase since 2008.

Chart 1: Overall Annual Default Rates



Source: CRISIL Ratings

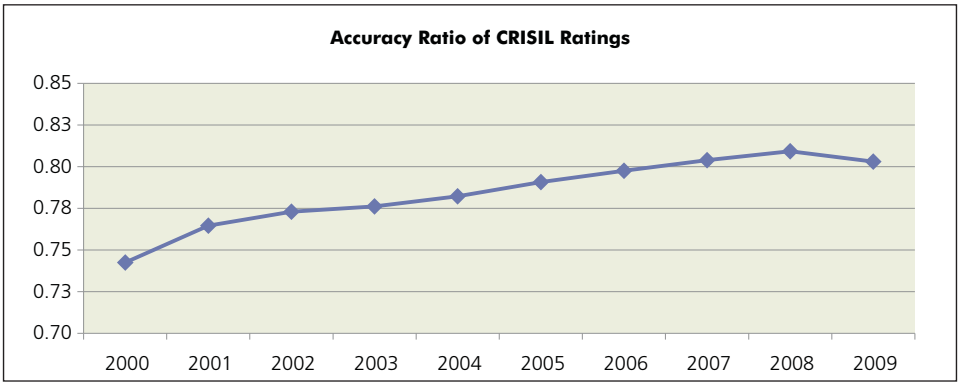
The increase in the overall annual default rate in 2009 reflects the impact of the credit turmoil witnessed in 2008 and early 2009. CRISIL's average overall default rate for the past ten years (from 2000 to 2009) stands at 1.9 per cent, as against an average of 2.5 per cent observed over the entire 22-year period of this study (1988 to 2009). About 50 per cent of the 171 defaults so far in CRISIL's portfolio occurred between 1997 and 1999 and about 25 per cent occurred between 2008 and 2009; however, the latter was on a much larger base of ratings amid rapidly increasing rating penetration in India. Further, the defaults were primarily from the lower rating categories; there were no defaults from the 'A' category and above in the 2008-09 period.

II. Movement in Rating Accuracy Ratio Since Inception

Rating accuracy ratio declines due to turmoil but remains strong

The raison d'être for ratings is their utility in classifying entities based on the likelihood of default. CRISIL's ratings continue to demonstrate their strong ability to predict default. Chart 2 shows the movement in the Gini coefficient (a measure of rating accuracy) of CRISIL's ratings.

Chart 2: Accuracy ratio



Source: CRISIL Ratings

Using data from the beginning of 1988 to end-2009, the accuracy ratio of CRISIL's ratings—measured using the Gini coefficient, applied over one-year periods—stands at a high of 0.80 (refer to Annexure 5 for more details on the relationship between the Gini coefficient and rating accuracy), and has moved steadily up from 0.74 in 2000, but for a marginal dip in 2009 due to the economic turmoil.

[1]'Corporate issuers' is a generic term used here to refer to various types of entities which have availed credit ratings from CRISIL and form a part of the Default Study. The term includes companies- both public limited and private limited, societies, partnerships, proprietorship, trusts etc across manufacturing, financial as well infrastructure sectors.

III. For Corporate Issuers

One-year, two-year and three-year Cumulative default rates

As credit ratings are opinions on default risk, the higher the rating, the lower should be the probability of default. 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 shows CRISIL's one-, two-, and three-year withdrawal-adjusted cumulative default rates across different rating categories from 1988 until December 2009 (Please refer to Annexure 6 for the methodology used in the calculation of default rates). CRISIL's default rates continue to be largely 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)

One, Two, and Three-Year CDRs, between 1988 and 2009				
Rating	**Issuer-months**	**One-Year**	**Two-Year**	**Three-Year**
AAA	9975	0.00%	0.00%	0.00%
AA	20171	0.05%	0.47%	1.24%
A	18544	1.00%	4.15%	8.50%
BBB	8670	4.11%	10.54%	18.12%
BB	3945	15.87%	26.05%	35.16%
B	625	16.32%	41.80%	66.26%
C	927	31.18%	51.86%	64.17%
Total	**62857**			

Source: CRISIL Ratings

CRISIL also publishes default rates for more recent periods (between 2000 and 2009 and between 2002 and 2009), to provide a picture of rating behaviour over the more recent periods. These are presented in Table A3 and Table A4 in Annexure 4. These default rates are also ordinal.

As there has been a change in the methodology for calculating default rates—CRISIL now uses monthly static pools compared with annual static pools used in the past—for the purpose of comparison, this edition of the default study also presents the default rates for the periods between 1988 and 2009 and between 2000 and 2009 calculated using annual static pools in Annexure 4 (in Tables A5 and A6, respectively).

One-year transition rates for ratings on both long-term scale and short-term scale

Transition rates indicate the probability of a given rating moving to other rating categories. Since credit ratings drive bonds' yields and, therefore, their prices, transition rates are relevant for investors who do not intend to hold debt instruments to maturity, or need to mark their investments to market regularly. Additionally, they are of crucial importance for investors who are mandated to only hold investments that are of a certain minimum credit quality. Table 2 presents CRISIL's transition rates for various rating categories.

Table 2: CRISIL's average one-year transition rates for long-term ratings

One-year average transition rates: between 1988 and 2009									
Rating	**Issuer-months**	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**C**	**D**
AAA	9975	96.1%	3.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
AA	20171	2.0%	91.0%	5.8%	0.7%	0.3%	0.1%	0.0%	0.0%
A	18544	0.0%	3.5%	83.9%	7.0%	3.8%	0.3%	0.6%	1.0%
BBB	8670	0.0%	0.5%	5.2%	74.4%	11.5%	2.4%	1.9%	4.1%
BB	3945	0.0%	0.6%	0.0%	2.5%	72.6%	2.6%	5.9%	15.9%
B	625	0.0%	0.0%	0.0%	1.8%	0.6%	74.6%	6.7%	16.3%
C	927	0.0%	0.0%	0.0%	1.3%	0.3%	1.00%	66.2%	31.2%
Total	**62857**								

Source: CRISIL Ratings

As can be seen, between 1988 and 2009, 91 per cent of the instruments rated in the 'AA' category remained in that category at the end of one year; 2 per cent were upgraded to a higher rating ('AAA'), and 7 per cent were downgraded to a lower rating. The highlighted diagonal of Table 2 contains the stability rates of different rating categories.

As with CRISIL's default rates, CRISIL's one-year transition rates are also comprehensive and reliable because they have been compiled using monthly static pools that cover data since the first rating was assigned by CRISIL and include multiple business cycles. For transition rates based on the annual static pools methodology, refer to Tables A7 and A8 in Annexure 4.

Stability of ratings assigned on short-term ratings scale are critical for investors with short-term investment horizon as the sensitivity of the credit risk of their investments to rating transitions is more than that for an investor with a long-term investment horizon. Table 3 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 97.2 per cent over a one-year period, and a 'P1' rating has a 16.1 per cent probability of transition to a higher rating 'P1+' over a one-year period.

Table 3: CRISIL's average one-year transition rates for short-term ratings

One-year average transition rates: between 1988- 2009							
Rating*	**Issuer-months**	**P1+**	**P1**	**P2**	**P3**	**P4**	**P5**
P1+	37598	97.2%	2.2%	0.4%	0.2%	0.0%	0.0%
P1	5357	16.1%	80.3%	3.0%	0.5%	0.0%	0.2%
P2	1367	3.7%	6.8%	79.0%	6.1%	2.3%	2.0%
P3	739	0.0%	0.0%	0.8%	79.7%	12.2%	7.3%
P4	456	0.0%	0.0%	0.0%	0.0%	89.9%	10.1%
Total	**45517**						

Source: CRISIL Ratings
*P2, P3 and P4 include ratings of the respective modifiers levels.

'P1' and 'P2' ratings show stability of 80 per cent and 79 per cent, respectively. The stability rates for 'P1' are higher during the more recent period between 2000 and 2009 in relation to the stability rate in the entire 22-year rating history of CRISIL (refer to Table A9 in Annexure 4). For transition rates based on the annual static pools methodology, refer to Tables A10 and A11 in Annexure 4.

Movement in stability rates over the last four years

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 4 shows CRISIL's one-year stability rates over the past 22 years. On account of the credit turmoil, many entities were downgraded from higher-rated categories in 2009; consequently, the 'AAA' and 'AA' stability rates have reduced marginally for the period between 1988 and 2009.

Table 4 and 5: Stability rates of CRISIL's long-term ratings

Table 4: One-year average stability rates since 1988				
Period	**AAA**	**AA**	**A**	**BBB**
1988-2009	96.1%	91.0%	83.9%	74.4%
1988-2008	97.1%	91.2%	83.4%	72.5%
1988-2007	97.1%	90.8%	83.2%	72.5%
1988-2006	96.8%	90.4%	82.9%	72.1%

Source: CRISIL Ratings

Table 5: One-year average stability rates since 2000				
Period	**AAA**	**AA**	**A**	**BBB**
2000-2009	96.5%	93.8%	88.4%	80.2%
2000-2008	97.9%	94.7%	87.7%	75.8%
2000-2007	98.1%	94.2%	87.3%	75.9%
2000-2006	97.9%	93.7%	86.4%	73.8%

Source: CRISIL Ratings

Considering a shorter period, Table 5 shows the one–year stability rates at individual rating levels since 2000. 'AAA' and 'AA' stability rates have been consistently above 96 and 93 per cent, respectively. Likewise, 'A' and 'BBB' ratings have also displayed high stability rates.

IV. For Structured Finance Instruments

CRISIL was the pioneer in rating several complex structured finance securities in the Indian market and its database comprises 2749 issue-years (including 1540 issue-years for retail asset-backed securities– (ABS) and retail mortgage-backed securities (MBS) spanning 17 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.

One-year, two-year and three-year Cumulative default rates

Table 6 provides the one-, two-, and three-year cumulative default rates at each rating category level for the period between 1993[2] and 2009 (Please refer to Table A12 in Annexure 4 for default rates in the period between 2002 and 2009)

Table 6: CRISIL's average CDRs for ratings on structured finance securities (between 1993 and 2009)

One, Two, and Three-Year CDRs, between 1993 and 2009				
Ratings	**Issue-years**	**One-Year**	**Two-Year**	**Three-Year**
AAA(so)	2017	0.05%	0.22%	0.40%
AA(so)	260	0.00%	0.00%	0.00%
A(so)	324	0.00%	2.68%	5.88%
BBB(so)	116	0.00%	0.00%	0.00%
AAA(so) to BBB(so)	2717	0.04%	0.59%	1.46%
BB(so) and below	32	25.00%	25.00%	25.00%
Total	**2749**			

Source: CRISIL Ratings

The one-year cumulative default rate for securities rated 'AAA(so)' is at 0.05 per cent. This is on account of a central-government-guaranteed 'AAA(so)'-rated instrument that defaulted in 2005, because the trustee delayed the invocation of 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 among instruments rated 'BB(so)' and below, seven of which were guaranteed by state governments. All nine defaults were subsequently cured; the investors have been paid in full and the rated instruments redeemed.

[2]CRISIL assigned its first structured finance rating in Jan 1992, which forms a part of 1993 annual static pool. For calculating default and transition rates for structured finance ratings, CRISIL has used annual static pool methodology as defaults in structured finance securities have been rare.

One year transition rates

Nearly three-fourths of all structured finance ratings—2017 issue-years of the total of 2749 issue-years—are rated 'AAA (so)' and show a high stability rate of 97.5 per cent. Table 7 shows the one-year average transition rates for structured finance securities for the period between 1993 and 2009.

Table 7: CRISIL's average one-year transition rates for structured finance securities

One year Average Transition Rates - 1993 – 2009									
Rating	**Issue-years**	**AAA(so)**	**AA(so)**	**A(so)**	**BBB(so)**	**BB(so)**	**B(so)**	**C(so)**	**D**
AAA(so)	2017	97.5%	2.2%	0.2%	0.0%	0.0%	0.0%	0.1%	0.1%
AA(so)	260	6.9%	83.8%	8.8%	0.4%	0.0%	0.0%	0.0%	0.0%
A(so)	324	0.0%	5.9%	88.0%	0.9%	4.9%	0.3%	0.0%	0.0%
BBB(so)	116	2.6%	1.7%	2.6%	92.2%	0.9%	0.0%	0.0%	0.0%
BB(so)	31	0.0%	0.0%	0.0%	22.6%	54.8%	0.0%	0.0%	22.6%
B(so)	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C(so)	1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Total	**2749**								

Source: CRISIL Ratings

The shaded diagonal in the Table 7 shows the stability rates for various rating categories.

Movement in stability rates over the last four years

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

Table 8: One-Year Stability Rates Since 1993				
Period	**AAA(so)**	**AA(so)**	**A(so)**	**BBB(so)**
1993-2009	97.5%	83.8%	88.0%	92.2%
1993-2008	97.0%	87.6%	88.1%	97.2%
1993-2007	98.6%	86.7%	87.1%	93.9%
1993-2006	98.6%	83.5%	86.1%	92.3%

Table 9: One-Year Stability Rates Since 2000				
Period	**AAA(so)**	**AA(so)**	**A(so)**	**BBB(so)**
2000-2009	97.4%	86.4%	86.8%	93.0%
2000-2008	96.9%	91.8%	86.8%	98.6%
2000-2007	98.6%	91.8%	85.5%	96.9%
2000-2006	98.7%	89.3%	84.2%	100.0%

These stability rates are high; however, the Indian securitisation market is very 'AAA(so)'-centric, reflected in the large number of issue-years for this rating. Data density drops dramatically below the 'AAA(so)' level, largely explaining the non-ordinal stability rates below 'AAA(so)'.

V. Retail ABS and MBS Issuance- One Year Transition Rates

CRISIL's database of retail ABS and MBS transactions consists of 1540 issue-years across 17 years (between 1993 and 2009). There have been no defaults among CRISIL-rated ABS and MBS instruments; the cumulative default rates for these instruments, therefore, stays at zero per cent for all rating categories across all years.

Table 10 shows the transition rates for ABS and MBS ratings for the period between 1993 and 2009. 'AAA(so)'-rated ABS or MBS instruments, which account for more than 90 per cent of the ratings in the database, have stability rates of 97.5 per cent.

Table 10 : CRISIL's average one-year transition rates for ABS and MBS ratings

One-year average transition rates between 1993 and 2009						
Rating	**Issue-years**	**AAA(so)**	**AA(so)**	**A(so)**	**BBB(so)**	**BB(so) and below**
AAA(so)	1413	97.5%	2.1%	0.4%	0.0%	-
AA(so)	32	25.0%	59.4%	12.5%	3.1%	-
A(so)	6	0.0%	16.7%	50.0%	33.3%	-
BBB(so)	89	3.4%	2.2%	3.4%	91.0%	-
BB(so) and below	0	-	-	-	-	-
Total	**1540**					

Source: CRISIL Ratings

Thes tabilityr ateso ft heser atingsa rec omparablet ot hoseo fo therr atingsa ssignedb yC RISIL.T hef requencyo f downgrades on these ratings has increased somewhat in the recent past, from a historical level closer 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. Data density is very sparse 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.

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. This study is based on CRISIL's ratings assigned over the last 22 years, covering more than one full credit cycle. Because of the quality, vintage, and diversity of the instruments, the size of the database, use of monthly static pool methodology as well as a strict default definition and transparent default recognition practices, this remains the most comprehensive study on corporate defaults and rating transitions in India.

VI. Annexures

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 last 22 years, five industries (textiles; non-banking financial companies; metals, mining and steel; construction and construction material; and consumer products) accounted for a little less than half of the defaults on CRISIL-rated debt instruments, as shown in Table A1.

Table A1: Industry-wise and chronological break-up of defaults over the last 22 years.

Industry	1988 to 1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Sum
Textile				3	1	3	1	2		1					3	8	22
Non Banking Finance Company				4	14	2											20
Metals, mining, and steel			2	1	6	2	2	2								1	16
Construction and construction material			1		3	3	1	1								5	14
Consumer products		2	1	1	5				1								10
Chemicals				1	1	1	3	2	1								9
Pharmaceuticals			1		1	3		1								3	9
Automotive			1	1	2	1		1			1					1	8
Engineering					2	3	1	1								1	8
Diversified					3											4	7
Miscellaneous			1		1											4	6
Paper & Paper Products				1	1	1			1						1	1	6
Sugar						3										3	6
Power and power equipment							1	2							1	1	5
Steel, Non- Ferrous Metals and Mining															1	3	4
Hotels						1										2	3
Packaging					2	1											3
Computers - Hardware					2												2
Gems & Jewellery																2	2
Telecommunication - Services - Equipments/Cable					1	1											2
Courier & Express Services				1													1
Fire Protection							1										1
Glass																1	1
ITES																1	1
Oil & Refining						1											1
Printing						1											1
Real Estate Developers Project																1	1
Roads																1	1
Shipping							1										1
Total Defaults	**0**	**2**	**7**	**13**	**45**	**27**	**11**	**12**	**3**	**1**	**1**	**0**	**0**	**0**	**6**	**43**	**171**

Source: CRISIL Rating Rationales
A textile sector entity that had defaulted in 2000 again defaulted in 2009. As, it is the same entity, it is shown only once in the year 2000.

The year 2009 saw the highest number of defaults since inception except for 1998. Both these years were marked by a difficult credit environment. However, the defaults of 2009 were on a much higher base of more than 2800 ratings as compared to 1998 when the defaults were on a base of less than 450 ratings.

Annexure 2: Analysis of Defaults: Time to Default and Rating Before Default

Higher ratings farther away from default

Since CRISIL's inception in 1988, there have been 171 defaults by issuers carrying a long-term rating. An analysis of these defaulted issuers indicates that amongst the entities that defaulted, the higher-rated entities were farther away from default in terms of number of months than the lower-rated entities. While issuers rated in the 'B' or 'C' categories that defaulted, did so in about 15 months on an average, the few entities that defaulted from higher categories did so after a much longer period. For instance, the 2 per cent (approximately) of entities that defaulted from the 'AA' category did so after 57 months on an average (see Table A2).

Table A2: Time to Default (of Defaulted Entities) (In number of months)

Rating Category	Months to Default
AAA	No defaults
AA	57
A	47
BBB	32
BB	18
B	14
C	15

Annexure 3: List of Defaults in CRISIL's Ratings in 2009

Sr. no.	Company	Rating prior to Default	Date of Default	Reason for Default
1	Arvind Products	BBB-	10-Feb-09	Weak Liquidity
2	Arvind Limited	BBB-	10-Feb-09	Weak Liquidity
3	Vijayeswari Textiles	BB	17-Feb-09	Weak Liquidity
4	Marck Biosciences Limited	B+	19-Feb-09	Weak Liquidity
5	Decolight Ceramics Limited	BBB-	6-Mar-09	Management Willingness Issue
6	Kaneria Granito Limited	BB+	18-Mar-09	Weak Liquidity
7	Fine Jewellery Manufacturing Ltd	BBB+	6-Apr-09	Weak Liquidity
8	Rishi Laser Ltd	BBB-	9-Apr-09	Management Misrepresentation#
9	Todays Writing Products Ltd	BB	13-Apr-09	Weak Liquidity
10	Todays Petrotech Ltd	BB	13-Apr-09	Weak Liquidity
11	Macrotech Construction Pvt Ltd	BB	14-Apr-09	Weak Liquidity
12	Maneesh Pharmaceuticals Ltd	BBB+	17-Apr-09	Weak Liquidity
13	Parabolic Drugs Ltd	BBB-	4-May-09	Management Misrepresentation#
14	Vishnu Priya Hotels & Resorts Pvt Ltd	BB-	6-May-09	Management Misrepresentation#
15	Novopan Industries Ltd	BBB+	29-May-09	Management Misrepresentation#
16	C M Smith and Sons Limited	BB+	24-Jul-09	Weak Liquidity
17	Reliable Paper India Limited	BB+	21-Jul-09	Weak Liquidity
18	Bangalore Elevated Tollways Limited	BB	10-Jul-09	Weak Liquidity
19	ARSS Infrastructure Projects Limited	BB	8-Jul-09	Weak Liquidity
20	API Ispat and Powertech Private Limited	BBB-	6-Jul-09	Management Misrepresentation#
21	Shakumbhri Straw Products Ltd.	C	4-Aug-09	Weak Liquidity
22	Firepro Systems	BBB	10-Aug-09	Weak Liquidity
23	Aanjaneya Biotech Private Limited	B+	11-Aug-09	Weak Liquidity
24	Classic Diamonds India Limited	BB-	21-Aug-09	Weak Liquidity
25	Sejal Architectural Glass Limited	B	24-Aug-09	Management Misrepresentation#
26	Shree Balaji Engicons Private Limited	BB	25-Aug-09	Weak Liquidity
27	Cheran Spinner Limited	BB-	25-Aug-09	Management Misrepresentation#
28	Best Cheran Spintex India Limited	BB-	25-Aug-09	Management Misrepresentation#
29	Dee Development Engineers Private Limited	C	1-Sep-09	Weak Liquidity
30	Net 4 Communications Limited	BBB+	1-Sep-09	Management Misrepresentation#
31	Indian Sugar Manufacturing Company Limited	B-	1-Sep-09	Weak Liquidity
32	AMR Power Private Limited	BBB-	2-Sep-09	Weak Liquidity
33	Metal Closures Private Limited	BB-	3-Sep-09	Weak Liquidity
34	Brijsons Hotel	BB-	10-Sep-09	Weak Liquidity
35	Gujarat Eco Textile Park Limited	BB-	7-Oct-09	Weak Liquidity
36	Sri Ganesh Sponge Iron Private Limited	BB+	7-Oct-09	Weak Liquidity
37	PBA Infrastructure Limited	BBB-	8-Oct-09	Weak Liquidity
38	Sabare International Limited	B	9-Oct-09	Weak Liquidity
39	Aditya Vidyut Appliances Limited	BB+	20-Oct-09	Weak Liquidity
40	Pandesara Infrastructre Limited	B	30-Oct-09	Weak Liquidity
41	Nizam Deccan Sugars Limited	B	11-Nov-09	Weak Liquidity
42	Bemco Hydraulics Private Limited	B-	20-Nov-09	Weak Liquidity
43	Indian Cane Power Limited	BB+	8-Dec-09	Management Misrepresentation#
44	Suriya Textiles Processing Mills	BBB	17-Dec-09	Weak Liquidity
	Defaults in Short Term Ratings*			
1	Chhaya Gems	P4	14-Dec-09	Weak Liquidity
2	Diastar Jewellery Private Limited	P4	23-Dec-09	Weak Liquidity

Defaulted entities which did not have a CRISIL Long Term rating

These entities were already in default at the time of rating; however they misrepresented to CRISIL that they were making timely debt repayments, which was found to be untrue in the subsequent rating surveillance process of CRISIL.

Annexure 4: Comparative Default and Transition Rates for different periods and based on Annual Data

Three-year CDRs for long-term ratings—monthly static pools

Table A3: CRISIL's average CDRs

For long-term ratings (withdrawal-adjusted)

One, Two, and Three-Year CDRs, between 2000 and 2009				
Rating	**Issuer-months**	**One-Year**	**Two-Year**	**Three-Year**
AAA	7281	0.00%	0.00%	0.00%
AA	10208	0.02%	0.17%	0.23%
A	5243	0.25%	0.56%	1.13%
BBB	2801	3.89%	7.69%	9.36%
BB	1351	8.81%	14.26%	17.34%
B	300	18.67%	23.38%	23.38%
C	382	31.41%	46.53%	50.01%
Total	**27566**			

Source: CRISIL Ratings

Table A4: CRISIL's average CDRs

For long-term ratings (withdrawal-adjusted)

One, Two, and Three-Year CDRs, between 2002 and 2009				
Rating	**Issuer-months**	**One-Year**	**Two-Year**	**Three-Year**
AAA	5941	0.00%	0.00%	0.00%
AA	8039	0.00%	0.00%	0.00%
A	3573	0.11%	0.22%	1.04%
BBB	2201	4.50%	6.95%	6.95%
BB	894	5.03%	8.24%	14.22%
B	189	7.41%	7.41%	7.41%
C	147	16.33%	19.32%	19.32%
Total	**20984**			

Source: CRISIL Ratings

Three-year CDRs for long-term ratings—annual static pools

Table A5: CRISIL's average CDRs

For long-term ratings (withdrawal-adjusted)

One, Two, and Three-Year CDRs, between 1988 and 2009				
Rating	**Issuer-months**	**One-Year**	**Two-Year**	**Three-Year**
AAA	873	0.00%	0.00%	0.00%
AA	1748	0.00%	0.34%	1.11%
A	1661	0.72%	3.84%	8.22%
BBB	907	3.86%	10.21%	18.26%
BB	413	14.77%	26.17%	34.19%
B	73	17.81%	48.63%	65.75%
C	87	28.74%	49.10%	66.07%
Total	**5762**			

Source: CRISIL Ratings

Table A6: CRISIL's average CDRs

For long-term ratings (withdrawal-adjusted)

One, Two, and Three-Year CDRs, between 2000 and 2009				
Rating	**Issuer-months**	**One-Year**	**Two-Year**	**Three-Year**
AAA	669	0.00%	0.00%	0.00%
AA	977	0.00%	0.14%	0.30%
A	597	0.34%	0.95%	1.78%
BBB	439	4.33%	6.39%	7.90%
BB	204	6.86%	15.03%	17.61%
B	50	16.00%	40.00%	40.00%
C	51	27.45%	51.63%	61.31%
Total	**2987**			

Source: CRISIL Ratings

One-year transition rates for long-term instruments—annual static pools

Table A7: One-year average transition rates: between 1988 and 2009

One-year average transition rates: between 1988 and 2009									
Rating	**Issue-years**	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**C**	**D**
AAA	873	96.3%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
AA	1748	2.0%	90.9%	5.7%	1.0%	0.2%	0.1%	0.0%	0.0%
A	1661	0.1%	3.3%	84.2%	7.0%	3.7%	0.3%	0.7%	0.7%
BBB	907	0.0%	0.3%	5.0%	76.7%	10.4%	2.2%	1.5%	3.9%
BB	413	0.0%	0.5%	0.0%	2.2%	75.1%	3.6%	3.9%	14.8%
B	73	0.0%	0.0%	0.0%	2.7%	0.0%	72.6%	6.8%	17.8%
C	87	0.0%	0.0%	0.0%	1.1%	1.1%	4.6%	64.4%	28.7%
Total	**5762**								

Source: CRISIL Ratings

Table A8: One-year average transition rates: between 2000 and 2009

One-year average transition rates: between 2000 and 2009									
Rating	**Issue-years**	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**C**	**D**
AAA	669	96.9%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
AA	977	2.5%	92.9%	3.4%	1.2%	0.0%	0.0%	0.0%	0.0%
A	597	0.2%	4.7%	87.4%	5.7%	0.8%	0.3%	0.5%	0.3%
BBB	439	0.0%	0.2%	3.9%	82.7%	5.9%	2.3%	0.7%	4.3%
BB	204	0.0%	1.0%	0.0%	4.4%	83.3%	3.4%	1.0%	6.9%
B	50	0.0%	0.0%	0.0%	4.0%	0.0%	74.0%	6.0%	16.0%
C	51	0.0%	0.0%	0.0%	2.0%	2.0%	7.8%	60.8%	27.5%
Total	**2987**								

Source: CRISIL Ratings

One-year transition rates for short-term instruments—monthly static pools

Table A9: CRISIL's average one-year transition rates for short-term ratings, between 2000 and 2009

One-year average transition rates between 2000 and 2009—Monthly Static Pools							
Rating*	**Issue-months**	**P1+**	**P1**	**P2**	**P3**	**P4**	**P5**
P1+	23363	98.1%	1.3%	0.2%	0.3%	0.0%	0.0%
P1	2593	9.6%	87.0%	2.6%	0.8%	0.0%	0.0%
P2	1004	2.0%	5.5%	79.5%	7.2%	3.1%	2.8%
P3	730	0.0%	0.0%	0.8%	79.7%	12.3%	7.1%
P4	449	0.0%	0.0%	0.0%	0.0%	89.8%	10.2%
Total	**28139**						

Source: CRISIL Ratings
*P2, P3 and P4 include ratings of the respective modifiers levels.

One-year transition rates for short-term instruments- annual static pool

Table A10: CRISIL's average one-year transition rates for short-term ratings, between 1988 and 2009

One-year average transition rates between 1988 and 2009—Annual Static Pools							
Rating*	**Issue-months**	**P1+**	**P1**	**P2**	**P3**	**P4**	**P5**
P1+	3329	97.3%	2.0%	0.3%	0.3%	0.0%	0.0%
P1	528	13.8%	82.6%	2.7%	0.9%	0.0%	0.0%
P2	202	2.5%	5.9%	80.7%	6.9%	1.5%	2.5%
P3	180	0.0%	0.0%	1.1%	82.2%	11.1%	5.6%
P4	121	0.0%	0.0%	0.0%	0.0%	90.9%	9.1%
Total	**4360**						

Source: CRISIL Ratings
*P2, P3 and P4 include ratings of the respective modifiers levels.

Table A11: CRISIL's average one-year transition rates for short-term ratings, between 2000 and 2009

One-year average transition rates between 2000 and 2009—Annual Static Pools							
Rating*	**Issue-months**	**P1+**	**P1**	**P2**	**P3**	**P4**	**P5**
P1+	2213	97.9%	1.4%	0.2%	0.5%	0.0%	0.0%
P1	288	10.1%	86.5%	2.4%	1.0%	0.0%	0.0%
P2	169	1.2%	5.3%	81.1%	7.7%	1.8%	3.0%
P3	179	0.0%	0.0%	1.1%	82.7%	11.2%	5.0%
P4	120	0.0%	0.0%	0.0%	0.0%	90.8%	9.2%
Total	**2969**						

Source: CRISIL Ratings
*P2, P3 and P4 include ratings of the respective modifiers levels.

Three-year CDRs for ratings of structured finance securities

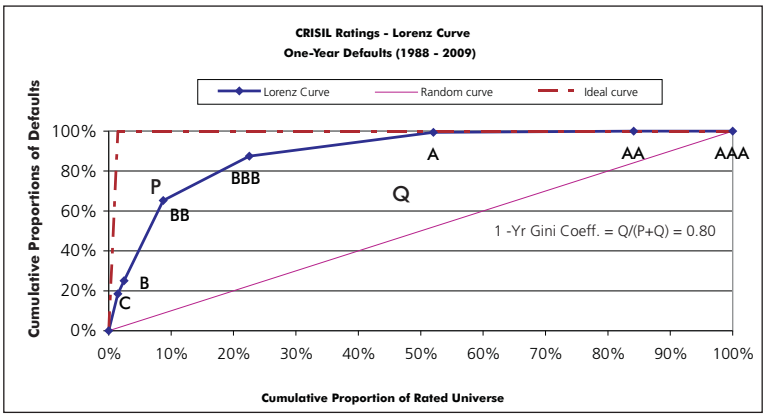
Table A12: CRISIL's average CDRs for structured finance ratings (withdrawal-adjusted)

One, Two, and Three-Year CDRs, between – 2002 and 2009				
Rating	**Issue-years**	**One-Year**	**Two-Year**	**Three-Year**
AAA(so)	1847	0.05%	0.25%	0.45%
AA(so)	225	0.00%	0.00%	0.00%
A(so)	218	0.00%	0.00%	0.00%
BBB(so)	115	0.00%	0.00%	0.00%
AAA(so) to BBB(so)	2405	0.04%	0.19%	0.32%
BB(so) and below	30	26.67%	26.67%	26.67%
Total	**2435**			

Source: CRISIL Ratings

Annexure 5: Lorenz Curve and Gini Coefficient for CRISIL Ratings – Inception to 2009

Chart 3: Graphical Representation of Gini Coefficient-Lorenz Curve



Source: CRISIL Ratings

How to read the chart on Gini Coefficient, a measure of rating accuracy

If ratings had no ability to predict default, then default rates and ratings would not be correlated. For example, consider that 30 defaults occur in one year out of 1000 ratings (that is, a default rate of 3 per cent). For a randomly selected set of 100 companies (10 per cent of the rated population), one would expect to have 3 defaulted companies (10 per cent of the defaulted population), since the number of defaults one would expect 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, in the aforementioned example, the lowest 30 ratings should capture all the defaults. This is represented by the ideal curve.

Since no rating system is perfect, the actual predictive power of ratings lies between these two extremes. The cumulative curve (Lorenz curve) represents the actual case. 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 'Q' in Chart 3) in relation to the area between the ideal curve and random curve (the sum of the areas 'P' and 'Q' in Chart 3). This ratio of Q/(P+Q), 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 the superior predictive ability of any rating system.

Definitions

Cumulative default curve (also called Lorenz curve)

The Lorenz curve is a plot of the cumulative proportion of defaults category-wise (of issuers with 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, 87 per cent of the defaults recorded were in the 'BBB' and lower categories; these categories included only 23 per cent of the total ratings outstanding. In other words, the bottom 23 per cent of the ratings accounted for 87 per cent of all the defaults that occurred.

Random curve

The random curve is a plot of the cumulative proportion of issuers against the cumulative proportion of defaulters, assuming that defaults are distributed equally across rating categories. In such a plot, the bottom 23 per cent of the issuers would account for exactly 23 per cent of the defaults; the plot would, therefore, be a diagonal straight line, and the ratings would have no 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. As CRISIL's overall default rate is 2.5 per cent, the bottom 2.5 per cent of issuers would have accounted for all the defaults if the 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 the Lorenz curve and the random curve)/(Area between the ideal curve and the random curve)

Annexure 6: Methodology used by CRISIL in this study

Concept of static pools

CRISIL, for calculating default and transition rates, has moved to a monthly static pool methodology from the annual static pool methodology, since the 2009 edition of the default and transition study. The monthly static pool methodology captures more granular monthly data such as intra-year transition and defaults, rendering default and transition rate estimates more accurate and useful.

A static pool of a particular date is composed of a set of entities with a given rating outstanding as on that date. CRISIL forms static pools on the first day of every month for its default and transition study. As CRISIL calculates one-, two-, and three-year cumulative default rates, the static pools formed are of one-, two-, and three-year lengths. Once formed, the pool does not admit any new entities. 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 month is counted as many times as the number of months over which it was rated. The methodology assumes that all ratings are current through an ongoing surveillance process, which, in CRISIL's case, is the cornerstone of the ratings' value proposition.

For instance, an entity that had ratings alive (not withdrawn) from January 1, 2000, to January 1, 2002, would appear in twelve consecutive static pools of one-year lengths, such as January 2000 to January 2001; February 2000 to February 2001; March 2000 to March 2001. On the other hand, a company first appearing on January 1, 2002, and having an outstanding rating until February 1, 2003, will appear only in the January 2002 to January 2003 and February 2002 to February 2003 static pools of one-year lengths. The static pools of two-year and three-year lengths are formed in a similar manner.

Weighted average marginal default rate

Notations:
For CRISIL's data,
M: Month of formation of the static pool (between 1988 and 2009)
R: A given rating category on the rating scale ('AAA' to 'C')
t: Length of the static pool in years on a rolling basis (1, 2, 3)
$P_t^m(R)$ = Defaults from rating category 'R' in the t^{th} year of the M-month static pool
$Q_t^m(R)$ = Non-defaulted ratings outstanding at the beginning of the t^{th} year in the rating category R from the M-month static pool

Illustration[3]: Consider a hypothetical static pool formed in January 2000, and having 100 companies outstanding at a rating of 'BB' at the beginning of the month. Suppose that, in this pool, there is one default in the first year (ending December 2000), three in the second year (ending December 2001), and none in the third year (ending December 2002). Also, assume there are no withdrawals in any year. Then, using the above notation,

$P_1^{Jan\text{-}2000}(BB) = 1$; $P_2^{Jan\text{-}2000}(BB) = 3$; and $P_3^{Jan\text{-}2000}(BB) = 0$
$Q_1^{Jan\text{-}2000}(BB) = 100$; $Q_2^{Jan\text{-}2000}(BB) = 99$; and $Q_3^{Jan\text{-}2000}(BB) = 96$

For rating category R, the t^{th} year marginal default rate for the M-month static pool is the probability of an entity, in the static pool formed in the month M, not defaulting until the end of period (t-1), and defaulting only in year t.

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

[3]This illustration is for explanation only, and does not indicate the actual or observed default rates in any rating category

$MDR_t^m(R) = P_t^m(R)/Q_t^m(R)$

Therefore, $MDR_1^{Jan\text{-}2000}(BB) = P_1^{Jan\text{-}2000}(BB)/Q_1^{Jan\text{-}2000}(BB) = 1/100 = 0.01$

The average marginal default rate is calculated as the weighted average of the MDRs of all the static pools of similar lengths in the period, with the number of ratings outstanding at the beginning of the period (with appropriate withdrawal adjustments discussed later) as weights.

Cumulative average default rate

The concept of survival analysis is used to compute the cumulative default probabilities. Using the average marginal default rate, we calculate the cumulative probability of an entity defaulting as follows:

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

Further, for an entity to default in the (t+1)th year, it should survive until the end of t years. So,

Probability of the entity defaulting in the $(t+1)^{th}$ year	=	[Probability of the entity not defaulting until the end of the tth year * Marginal probability of the entity defaulting in the $(t+1)^{th}$ year]

Now,

Probability of the entity not defaulting until the end of the tth year	=	1- Cumulative probability of the entity defaulting by the end of t years

Hence,

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

Therefore, returning to the first expression,

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

Restating the above in notation, if $CPD_{t+1}(R)$ = cumulative default probability of an entity 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.

Withdrawal adjustment

In the year subsequent to its having obtained the rating, the entity 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 entities are not monitored post-withdrawal, the 'true state' (whether default or no default) of an entity whose rating has been withdrawn remains unknown in subsequent months. Therefore, a modified $MDR_t^m(R)$ that ignores withdrawn entities is an appropriate measure of marginal default probability. As mentioned earlier, $Q_t^m(R)$ is also adjusted for the entities that belong to the static pool and have defaulted by the start of year t. The modified $Q_t^m(R)$ is as follows:

$Q_t^m(R)$ = Number of entities in the static pool formed at the beginning of month m with rating category R

less Number of defaults till the end of period (t-1)

less Number of withdrawn entities until the end of period t

CRISIL uses full-year withdrawal adjustment, as against no-withdrawal adjustment or mid-year withdrawal adjustment since the issuers whose ratings were withdrawn are not immune to the risk of default Moreover, reliable information meeting CRISIL's stringent requirements is not available post-withdrawal.

Post-default return of an entity

Post-default, entities 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, an entity cannot come back to its original static pool post-default. In static pool methodology, the recovered entity is considered a new entity, which, if 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 a static pool, is the proportion of entities 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 entities that are withdrawn at the end of the t years. In the computation of t-year transition rates, ratings at a point of time, and at the end of the t^{th} year thereafter, are considered.

Table A13 lists various elements of default rate computation and the competing approaches.

Table A13: Various Approaches to Computing Default Rates

Withdrawal Adjustments	**Approach1: Full-year withdrawal adjustments** Exclude all the ratings withdrawn during a year from the base for calculating default rates. **Approach 2: Mid-year withdrawal adjustments** Exclude half of the ratings withdrawn during a year from the base for calculating default rates. **Approach 3: No withdrawal adjustments** Take all the ratings outstanding at the beginning of a year as the base, notwithstanding some of them were withdrawn during the course of the year.	CRISIL follows Approach 1 since it believes that the issuers whose ratings were withdrawn are not immune to the risk of default subsequent to the withdrawal. More importantly, reliable information about the timeliness of debt repayments, which meets CRISIL's stringent requirements, is not available post withdrawal of the rating. Approach 1 results in the most conservative estimate of the default rates among the three approaches.
Calculating Cumulative Default Rate (CDR)	**Approach 1: Calculate CDR directly, without using Marginal Default Rate (MDR)** Calculate CDR over a period as the number of entities defaulting as a ratio of the number of entities at the beginning of the period, ignoring intra-period withdrawals. **Approach 2: Weighted Average MDR Methodology** Calculate MDR, weigh it by sample size and accumulate it over a period to arrive at average CDR.	CRISIL follows Approach 2, which takes into account only the ratings that are were not withdrawn at the end of each year as the base. So it results in a more accurate and conservative estimate of default rate. Approach 1 is not comprehensive since it ignores a large portion of the credit history of entities who may have been rated just a little while after the formation of the static pool.
Post Default Return of an Entity	**Approach 1: Treat default as an 'Absorbing State'** Retain the status of a defaulted entity as default even after recovery. Treat the recovered entity as a new entity from the point of recovery. **Approach 2:** Treat a defaulted and subsequently recovered entity as a non-defaulted entity from the point of recovery. So, if a non-defaulted entity defaults in the 2nd year and recovers in the 3rd year, it will not be treated as a defaulted entity in the 3rd year MDR calculation.	CRISIL follows Approach 1. Since credit ratings are an opinion of the likelihood of default, the default state is treated as an absorbing state or an end point, and the entity's rating continues to be in 'default.' If an entity emerges from default and has a non-default rating on its debt instruments, this entity is treated as a new company forming a part of a different static pool from the time its rating is revised from 'D'.
Data Pooling	**Approach 1: Static Pool** Charge defaults against all the ratings of the issuer during the period. **Approach 2:** Charge defaults against the initial rating of the issuer. **Approach 3:** Charge defaults against the most recent year's rating of the issuer.	CRISIL follows Approach 1. Debt instruments are tradable in nature and can be held by different investors at different points of time. Since credit ratings, which convey an opinion on the likelihood of default are intended to benefit the investors through the life of the instrument, CRISIL believes that charging defaults against all the ratings of the issuer during the period is the most appropriate approach in computing default rates. Other approaches may have limited utility. For instance, Approach 2 may be of relevance only to the investor who invests in the first-rated debt issuance of an entity and holds it to maturity. Approach 3 may be relevant only to those investors who happen to be holding the instrument just a year prior to its default.

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