The Pakistan Credit Rating Agency Limited

Rating Transition & Default Criteria
Methodology

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Summary

This criterion explains PACRA's rating transition & default study. This includes standardized measures and tools for appraising the historical performance of ratings on two parameters – stability and accuracy.

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1. Data Set

Capitalized terms used herein are defined in Annexure I "Defined Terms"

1.1 PACRA's rating opinion is an *objective* view evolving out of a well-defined methodology incorporating both *qualitative* and *quantitative* factors. These include, amongst others, the *macro-operating environment (industry dynamics)* and the *relative positioning* of an entity / issuer viz a viz its peers. For debt instruments, along with all these, the *structure of the debt instrument* is considered, affording security to the lenders / investors in the event of Default.

1.2 Credit rating reflects forward-looking opinion on creditworthiness of underlying entity or debt instrument; more specifically it covers relative ability to honor financial obligations. The primary factor being captured on the rating scale is relative likelihood of Default. Highest-to-Good credit quality comprise **AAA, AA, A,** and **BBB** rating categories (**AAA** *being the highest*; **BBB-** *being the lowest investment* rating), while moderate-to-very high credit risk includes **BB, B** and **CCC** to **C** rating categories (**CCC - C** *being very high credit risk*). The Default category comprises one rating – **D (Default)[i]**

1.3 Data Set: PACRA's Transition & Default Studies are based on information obtained from PACRA's database of ratings. The data consists of the following categories of entities / issuers:
   i. Corporates
   ii. Financial institutions

1.3.1 Within these categories, the study is limited to long-term *entity / issuer* public ratings. In the *context* of debt instruments, Preliminary ratings, *if made public*, are attributed to the entity / issuer for the purpose of this study.

1.3.2 The data set is refined by adjusting for:
   i. Multiple debt instruments for a single entity / issuer
   ii. Debt Instrument-only ratings
   iii. Credit Substitution

i. Multiple debt instruments for a single entity / issuer: Rating transitions and Defaults are tracked at the entity / issuer level. This is because the likelihood of Default is primarily driven by the liability structure and operating performance of an entity / issuer. At the same time, entities / issuers often Default on all their debt due to cross Default provisions in debt instrument trust deeds. Therefore, multiple debt instruments belonging to the same entity / issuer are consolidated as the issuer-level rating (entity / issuer rating) – a single data set point.

ii. Debt Instrument-only ratings: In cases where an entity / issuer rating does not exist in PACRA's universe, but a debt instrument rating belonging to the entity / issuer does, an implied entity / issuer rating is used. Thus, PACRA evolves an entity / issuer rating by adjusting its existing debt instrument rating for the security structure embedded therein and other clauses. It is noteworthy that even if an entity / issuer rating does exist assigned by another CRA (*domestic or international*), PACRA still employs its own adjustment to evolve an entity / issuer rating from the debt instrument-only rating.

iii. Credit Substitution: In case of Credit Substitution, only the rating of the guarantor will form part of the data set. The objective of the *aforementioned* adjustment is to eliminate the impact of the transition of a series of ratings that are ultimately reliant upon a single entity / issuer (*the guarantor*).

1.3.3 For the purpose of this study *Short-term entity / issuer* ratings and *Structured Finance* ratings are not taken into account. Rating Modifiers and Insurer Financial Strength (IFS) ratings of insurance companies are also excluded.

1.4 Each Transition Study issued by PACRA is *self-contained*. PACRA's continuing *data enhancement* efforts may result in slightly different statistics than in previously published studies and statistics. In addition, *comparisons* with earlier studies should be viewed within the context of Methodologies and definitions, employed therein.

2. Static Pool

2.1 PACRA conducts its Transition & Default Studies on the basis of *Static Pools*. Static Pools could be constructed for any time period. Static Pools smaller than one-month time period are not included, as they do not serve any practical purpose. *Generally*, Static Pools are constructed for a *one-to-ten*-year period.

2.2 Formation of Static Pools: The Static Pools are formed by grouping outstanding *entities / issuers by rating notch at the beginning of each period covered by the study*. Each Static Pool is then followed from that point forward. All entities / issuers included in the study are *assigned to one or more* Static Pools. The Static Pools are *"static"* in the sense that once an entity / issuer becomes part of one; it stays there, until withdrawn (due to maturity or otherwise) or defaulted.

For instance, ratings active and outstanding at the beginning of **CY19** (at 12:01 AM on Jan 1, 2019), constitute the **CY19 "original"** (*withdrawal-unadjusted*) Static Pool. Subsequently, **"surviving"** (*not withdrawn*) entities / issuers of **CY19** Static Pool are added to the entities / issuers first rated in **CY19** to form the **CY20** Static Pool.

2.3 Withdrawn Ratings[ii]: Entities / issuers that have had ratings withdrawn in a particular period are *excluded* from all subsequent Static Pools including the Static Pool that *corresponds* to the period in which they are withdrawn. The *"original Static Pools"* are thus *adjusted* for *withdrawn* ratings at the appropriate time horizon(s). The *rationale* behind this withdrawal-adjustment practice is to furnish a *truly* reflective base of *"outstanding throughout-the-period ratings"* for calculating Transition and Default Rates.

Withdrawal from **D** category is recorded as **Default** and not *withdrawn* by PACRA.

Withdrawn ratings are not monitored for Defaults by PACRA. Hence, post-withdrawal Defaults on ratings are not assigned back to the Static Pool(s) in which these ratings were *outstanding*.

Consider the following scenario:
- For instance, an entity / issuer is originally rated BB in mid-CY14 and PACRA downgrades the company to B in CY16. This is followed by a rating withdrawal in April CY18 and a Default D in CY20. The last major rating action, prior to withdrawal, was a downgrade to B in CY16 & maintenance that persisted till CY17.
- This hypothetical entity / issuer would be included in the CY15 and CY16 Static Pools with the BB rating, which it was rated at the beginning of those years
- Likewise, it would be included in the CY17 and CY18 (Original Static Pool for CY18 is referred here) Static Pools with the B rating.
- It would not be included in any Static Pool after the last day of CY18 (December 31, 2018) because PACRA had withdrawn the rating by then. Furthermore, it would also be "excluded" in the withdrawal-adjusted Static Pool for CY18.
- The downgrade, just prior to withdrawal, would not be captured in the annual transition of CY18 Static Pool as the pool only captures the first and the last "rating state" during the pool period (January 1, 2018 – December 31, 2018, in this case) and ignores all interim rating states manifesting for the rating.
- Each of the three Static Pools in which this company was included (CY15 – CY17) would not record its CY20 default.
- Lastly, were the entity / issuer to reenlist then that would constitute a second enlistment. This ensures that the static pools remain intact with the passage of time. Otherwise, especially in instances of successive withdrawals, it would result in an inflated and incorrect marginal default rate.

2.4 Initial entities/ issuers: Entities / issuers *initially rated* by PACRA in any given period are included in the subsequent period's Static Pool.

For instance, continuing the example in 4.1.2, the entity / issuer originally rated BB in mid-CY14 would not be part of the CY14 Static Pool because it was not rated as of the first day of that year. Instead, its performance would begin to be followed from the subsequent year, CY15, Static Pool.

3. Rating Transition Analysis

3.1 Rating transition, as exhibited by Transition Rates, is analyzed for the *rating categories* at the modifier (+/-) level, hence, taking into account all rating transitions: (i) through *notches* inside any single rating category, and (ii) across rating categories. The rating transitions represent a *distinct* historical period and are not meant to be *portraying* any predictive information that may represent future rating transition patterns.

3.2 Transition Matrix: The transition matrix *pinpoints* the transition of ratings across the major rating categories (e.g., from **A** to **BBB**), at the modifier level, which counts each notch change (e.g., from **A** to **A-**). The *vertical left-hand column* identifies ratings outstanding at the beginning of the period, while the *horizontal axis* offers information on the *transition pattern* of those (same) ratings by the period's end. In the transition matrix, the diagonal, beginning with **AAA** and followed by **AA+** till **D** shows the *relative stability* of each rating category at the modifier level. The column in the transition matrix marked **"withdrawal-adjusted Static Pool"** exhibits the Static Pool adjusted for withdrawals that are shown in a separate column marked **"withdrawals"**.

- For instance, an entity / issuer continually rated from the middle of **CY14** to the middle of **CY19** would appear in the four consecutive one-year transition matrices from **CY15** to **CY18**. It would not form part of the **CY19** Static Pool, as the rating was not outstanding for the entire Static Pool period.
- Likewise, all **CY05** Static Pool members still rated at 11:59 PM on December 31, 2020, have 16 one-year transitions, while entities / issuers with outstanding Ratings between 12:01 AM January 1, 2020, and 11:59 PM December 31, 2020 have only one.

3.3 The transition matrix is constructed in the cohort method[iii]. The method considers the rating position at the beginning and end of a period only, excluding the dynamic process (*interim rating actions*) found within the period. Hence, it is limited in the sense that it loses considerable information, specially, in times of increased rating activity and suppresses transition trends. This limitation of the Static Pools can be overcome by increasing the frequency at which Static Pools are formed. Closer Static Pool spacing captures a greater number of rating changes and Default events. Some international and regional rating agencies form monthly Static Pools. PACRA forms annual Static Pools as it believes this adequately reflects its 'through the cycle' approach for ratings

3.4 Transition Rate Calculation: Transition Rates compare entity / issuer ratings at the beginning of a time period with ratings at the end of the period. An entity / issuer that remains rated for more than *one* period is counted *as many times* as the number of periods in which it is rated by PACRA.

3.5 Transition Rates are *categorized* into:
Upgrade Rate
Downgrade Rate

3.6 These Transition Rates are calculated by the number of entities / issuers that experienced rating upgrades (or downgrades) within the Static Pool period, divided by the total number of rated entities / issuers at the beginning of the Static Pool period, adjusted for withdrawals.

3.7 There may be several varieties of rating transitions. A description of theses follows:

i. One-Year Transition Matrix: Each one-year transition matrix displays all rating movements between rating categories at the notch level from the beginning of the year through year-end. For each rating listed in the matrix's left-most column, there are thirteen ratios listed in the rows, *corresponding* to the ratings from **AAA** to **D**.

Transition (Years) : 1	Withdrawal Adjusted Static Pool	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC-C	D	Withdrawals
AAA	8.00	100.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
AA+	11.00	9.1%	90.9%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
AA	22.00	-	9.1%	90.9%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.00
AA-	20.00	-	-	5.0%	95.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
A+	16.00	-	-	-	-	93.8%	6.3%	-	-	-	-	-	-	-	-	-	-	-	-	0.00
A	33.00	-	-	-	-	15.2%	84.8%	-	-	-	-	-	-	-	-	-	-	-	-	0.00
A-	63.00	-	-	-	-	-	17.5%	82.5%	-	-	-	-	-	-	-	-	-	-	-	3.00
BBB+	20.00	-	-	-	-	-	-	10.0%	90.0%	-	-	-	-	-	-	-	-	-	-	1.00
BBB	25.00	-	-	-	-	-	-	-	16.0%	80.0%	4.0%	-	-	-	-	-	-	-	-	3.00
BBB-	17.00	-	-	-	-	-	-	5.9%	5.9%	23.5%	64.7%	-	-	-	-	-	-	-	-	3.00
BB+	5.00	-	-	-	-	-	-	-	-	20.0%	80.0%	-	-	-	-	-	-	-	-	1.00
BB	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.00
BB-	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
B+	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
B	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0%	-	-	-	0.00
B-	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
CCC-C	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00

End of Year (CY21) — *Beginning of Year (CY21)*

For instance, the one-year transition matrix (above) which corresponds to the **CY21** Static Pool, shows that, out of 28 **BBB** rated companies at the beginning of that year, three entities / issuers were withdrawn during the year. Out of the remaining 25 BBB rated companies, **80.0%** were rated the same at year-end, while PACRA has upgraded **16.0%** to **BBB+** and downgraded **4.0%** to **BBB-**. This adds up to **100%** of the transition for the **BBB** notch level.

ii. Multi-year Transition Matrix: Multi-year transitions are also calculated. In this case, the rating at the beginning of the multi-year period is compared with the rating at the end. Otherwise, the technique is *identical* to that used for single-year transitions.

For instance, the three-year transition matrix is the result of comparing Ratings at the beginning of the year CY18 with the Ratings at the end of the year CY20, ignoring all interim rating transitions in between the period (beginning CY18 – end-CY20)

iii. Average Transition Matrix: Average transition matrices (For instance, *an average transition of three one-year transitions; CY18, CY19,* and *CY20*) are calculated on the basis of both single-year and multi-year transition matrices just described. The idea is to *"smooth out"* periods of unusually high/low rating activity.

4. Default Rate

4.1 Withdrawal-adjusted Default Rates: PACRA computes withdrawal-adjusted Default Rates. The withdrawal-adjusted method of calculating Default Rates recognizes that there are three possible *end-of-period outcomes* for an outstanding rating: (i) Default, (ii) survival, and (iii) rating withdrawal. As PACRA considers these three possible outcomes *mutually exclusive*, hence, entities / issuers that Default and have their ratings withdrawn in the same time period are considered as Defaults, not withdrawals (**Also SEE 2.2).**

4.2 PACRA computes the following varieties of Default Rates:

i. Annual Default Rates (ADRs): An ADR captures the Default Rate on a *one-year Measurement Period.* It is computed as the number of entities / issuers defaulting in a year as a proportion of the number of entities / issuers in the Static Pool at the beginning of the year, adjusted for withdrawals.

ii.   **Marginal Average Default rates (MDRs):** A one-year MDR (MDR1) and an ADR is one and the same thing.

iii.   **Cumulative Average Default Rates (CDRs):** CDRs are calculated by subtracting from one, the compounding of the inverse of *constituent* weighted average MDRs. For instance, a three-year CDR (CDR-3) has a Measurement Period of three years and would take into account only those Static Pools that have been seasoned for three-years. The average Cumulative Default Rate represents an estimate of expected cumulative Default probabilities. It is calculated by taking the averages over many pool periods. This serves to capture the effects of several macroeconomic and credit cycle peaks and troughs[iv].

- For instance, if 2 entities Defaulted in **CY20** and 1 was withdrawn, and the **CY20** original Static Pool consisted of 100 entities / issuers at the beginning of the year, the resulting Annual Default Rate for all Ratings in **CY20** would be **2.02% (2 / 99)**, adjusting the denominator for withdrawals.
- For instance, a **CDR-3** calculated for the last three years at the end of **CY20** would include only one Static Pool, that of **CY18** with three complete years of seasoning (**CY18, CY19** and **CY20**). **CY19** and **CY20** have only been seasoned two and one year(s), respectively. Similarly, a **CDR-5** calculated for the last ten years at the end of **CY20** would include six Static Pools, that of **CY11, CY12, CY13, CY14, CY15** and **CY16** with five complete years of seasoning. **CY17, CY18, CY19** and **CY20** pools have only been seasoned four, three, two and one year(s) respectively, hence, do not qualify for being included in the calculation of **CDR-5**. Furthermore, **CDR-5** would reflect the probability of Default of each constituent Static Pool from the time of its formation up to and including the subsequent five-year time horizon.
- REFER TO ANNEXURE – Calculating Cumulative Average Default Rates.

4.3   Time-to-Default: Time-to-Default is *exhibited* in units of months and years. The higher / lower a rating is on the rating scale, the farther / nearer it should be to Default in terms of this measure. PACRA *calculates* the following time-to-Default statistics:

Time-to-Default from Initial ratings

Time-to-Default from All ratings

4.4   PACRA's Default Rates are *entity / issuer-weighted Default rates*, that is, they are calculated based on the number of entities / issuers rather than the Rupee amounts affected by Defaults or rating changes. Although Rupee amounts provide information about the *portion of the market* that is affected by Defaults or rating changes, issuer-weighted averages are considered by PACRA a more useful measure of the performance of ratings.

5. Regulatory Requirements

Regulatory Requirements & Best Practices for PACRA Performance Disclosure A *Snapshot*		
Jurisdiction / forum	**Regulatory requirement / international best practice**	**Implementation**
Pakistan (SECP) *[SECP Credit Rating Companies Regulations, 2016, August 05, 2016]*	**11-A: Conduct of business:** A credit rating company shall; (k) upon the occurrence of default of an entity/instrument rated by it, the credit rating company shall prepare a descriptive default note and disseminate the same to the securities exchange, the Commission, State Bank of Pakistan, Mutual Fund Association of Pakistan, Pakistan Banking Association, NBFI and Modaraba Association of Pakistan and publish the same on its website for public	PACRA publishes Default Studies *"Transition to Default"* within two months after occurrence of a Default

	information. The default notes must describe the definition of default, the reasons for the defaults, historical transitions and the factors overlooked, if any, by the credit rating company;	
	(1) publish annually, within one month of calendar year, a comprehensive default and transition study developed in line with methodologies practiced by credit rating agencies globally. The annual default and transition study must contain cumulative default rates (CDRs) and transitions for each rating grade for periods 1, 3 and 5 years	
	ANNEXURE H	
	Other information to be disseminated on the website of a credit rating company / agency:	
	In addition to the information mentioned in regulation 14 of these regulations, credit rating companies shall disseminate on their websites the following information:	
	(3) Detail of transitions/changes in the credit ratings reviewed during the last five years. The detail should contain the ratings upgraded, downgraded and those remained unchanged. For ease of comparison both the rating i.e. before and after the review and the number of notches upgraded or downgraded should be disclosed.	
Pakistan (SBP) *[SBP Eligibility Criteria for recognition of External Credit Assessment Institutions (ECAIs), July 2005]*	d) Disclosure: ECAI should demonstrate that it provides access to information that are sufficient to enable its stakeholders to make decision about the appropriateness of risk assessments. The purpose of this disclosure requirement is to promote transparency and bring in market discipline. ECAI is therefore expected to make public following information: 2. Definition of default 6. Actual default rates experienced in each assessment category 7. Transition matrices a) Objectivity of the methodology: ECAI should have methodology of assigning credit rating that is rigorous, systematic, continuous and subject to validation. To establish that ECAI fulfills this primary component of eligibility criteria, it must demonstrate that it meets minimum standards given below: 5. ECAI should demonstrate that the rating methodologies are subject to quantitative back testing. For this purpose, ECAI should calculate and publish default studies, recovery studies and transition matrices. For the purpose, the ECAI should have a definition of default that is equivalent to international standard and is relevant to domestic market.	

Association of Credit Rating Agencies in Asia (IOSCO) *[ACRAA Code of Conduct Fundamentals for Domestic Credit Rating Agencies, April 2011 (Section 3; pp.31-33)*	The Default study should provide details of the following: ▪ Annual Default rates for each rating category ▪ 3-year average cumulative Default rates ▪ 1-year transition rates	
International Organization of Securities Commission (IOSCO) *[IOSCO Code of Conduct Fundamentals for Credit Rating Agencies, March 2015, Section 3; (p.A-14)]*	**5. DISCLOSURE AND COMMUNICATION WITH MARKET PARTICIPANTS** 3.18 To promote transparency and to enable investors and other users of credit ratings to compare the performance of different CRAs, a CRA should disclose sufficient information about the historical transition and default rates of its credit rating categories with respect to the classes of entities and obligations it rates. This information should include verifiable, quantifiable historical information, organized over a period of time, and, where possible, standardized in such a way to assist investors and other users of credit ratings in comparing different CRAs. If the nature of the rated entity or obligation or other circumstances make such historical transition or default rates inappropriate, statistically invalid, or otherwise likely to mislead investors or other users of credit ratings, the CRA should disclose why this is the case. 5.4 A CRA should publicly and prominently disclose free of charge on its primary website: c. information about the CRA's historic performance data; and	

6. Computing Cumulative **A**verage Default Rates (CDRs)

6.1 The *basis* for calculating cumulative average default rates **(CDRs)** is the marginal default rates **(MDRs).** Depending upon the *Measurement Period* to be covered by the CDR, the first step is to calculate MDRs for each *successive* time interval. The MDRs then require *averaging* across similar time intervals and weighed by the size of the *withdrawal-adjusted static pool* to reach weighted average MDRs **(WMDRs)** for each time interval. These WMDRs are then **chain-linked** into survival rates and *subtracted* from one (1) to get the CDR for a particular time interval.

6.2 The **computation of three (3) year CDR (CDR-3)** for the *last four years* at the end of *CY17 (December 31, 2017)* passes through the following *schematic* steps:

STEP 1: Selecting the appropriate static pools for CDR-3

Which Static Pools[1] are to participate in calculating CDR-3		
Static pools (For last four years)	**Static pool Notation**	**Status**
CY14 static pool	C^{CY14}	Included
CY15 static pool	C^{CY15}	Included
CY16 static pool	C^{CY16}	Excluded as these two static pools have not experienced three years of seasoning
CY17 static pool	C^{CY17}	

STEP 2: Calculate MDRs for each static pool (included) separately

MDRs for C^{CY14}

$$MDR1^{CY14} = \frac{\text{Defaults in CY14 out of } C^{CY14}}{C^{CY14} - W^{CY14}{}_{CCY14}}$$

$MDR1^{CY14}$ = Marginal Default Rate for Year 1 of CDR-3

$W^{CY14}{}_{CCY14}$ = Withdrawals in CY14 out of C^{CY14}

$$MDR2^{CY14} = \frac{\text{Incremental Defaults in CY15 out of } C^{CY14}}{(C^{CY14} - W^{CY14}{}_{CCY14} - W^{CY15}{}_{CCY14}) * (1 - MDR1^{CY14})}$$

$MDR2^{CY14}$ = Marginal Default Rate for Year 2 of CDR-3

$W^{CY15}{}_{CCY14}$ = Withdrawals in CY15 out of C^{CY14}

$$MDR3^{CY14} = \frac{\text{Incremental Defaults in CY16 out of } C^{CY14}}{(C^{CY14} - W^{CY14}{}_{CCY14} - W^{CY15}{}_{CCY14} - W^{CY16}{}_{CCY14}) * (1 - MDR1^{CY14}) * (1 - MDR2^{CY14})}$$

$MDR3^{FY14}$ = Marginal Default Rate for Year 3 of CDR-3

$W^{CY16}{}_{CCY14}$ = Withdrawals in CY16 out of CCY14

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[1]Original *(withdrawal-unadjusted)* static pools are to be considered here, that are later on adjusted for withdrawals.

MDRs for C^{CY15}

$$MDR1^{CY15} = \frac{\text{Defaults in CY15 out of } C^{CY15}}{(C^{CY15} - (W^{CY15}_{CCY15}))}$$

$MDR1^{CY15}$ = Marginal Default Rate for Year 1 of CDR-3

W^{CY15}_{CCY15} = Withdrawals in CY15 out of C^{CY15}

$$MDR2^{CY15} = \frac{\text{Incremental Defaults in CY16 out of } C^{CY15}}{(C^{CY15} - W^{CY15}_{CCY15} - W^{CY16}_{CCY15}) * (1 - MDR1^{CY15})}$$

$MDR2^{CY15}$ = Marginal Default Rate for Year 2 of CDR-3

W^{CY16}_{CCY15} = Withdrawals in CY16 out of C^{CY15}

$$MDR3^{CY15} = \frac{\text{Incremental Defaults in CY17 out of } C^{CY15}}{(C^{CY15} - W^{CY15}_{CCY15} - W^{CY16}_{CCY15} - W^{CY17}_{CCY15}) * (1 - MDR1^{CY15}) * (1 - MDR2^{CY15})}$$

$MDR3^{CY15}$ = Marginal Default Rate for Year 3 of CDR-3

W^{CY17}_{CCY15} = Withdrawals in CY17 out of C^{CY15}

STEP 3:   Compute WMDRs for each time interval

Static Pools	Sets of MDRs (As calculated in STEP 2)		
C^{CY14}	$MDR1^{CY14}$	$MDR2^{CY14}$	$MDR3^{CY14}$
C^{CY15}	$MDR1^{CY15}$	$MDR2^{CY15}$	$MDR3^{CY15}$

WMDR1 = Weighted Average MDR for Year-1
WMDR2 = Weighted Average MDR for Year-2
WMDR3 = Weighted Average MDR for Year-3

$$WMDR1 = \frac{[MDR1^{CY14} * (C^{CY14} - W^{CY14}_{CCY14})] + [MDR1^{CY15} * (C^{CY15} - W^{CY15}_{CCY15})]}{(C^{CY14} - (W^{CY14}_{CCY14}) + (C^{CY15} - (W^{CY15}_{CCY15}))}$$

$$WMDR2 = \frac{[MDR2^{CY14} * (C^{CY14} - W^{CY14}_{CCY14} - W^{CY15}_{CCY14})] + [MDR2^{CY15} * (C^{CY15} - W^{CY15}_{CCY15} - (W^{CY16}_{CCY15}))]}{(C^{CY14} - W^{CY14}_{CCY14} - (W^{CY15}_{CCY14}) + (C^{CY15} - W^{CY15}_{CCY15} - (W^{CY16}_{CCY15}))}$$

$$WMDR3 = \frac{[MDR3^{CY14} * (C^{CY14} - W^{CY14}_{CCY14} - W^{CY15}_{CCY14} - W^{CY16}_{CCY14})] + [MDR3^{CY15} * (C^{CY15} - W^{CY15}_{CCY15} - W^{CY16}_{CCY15} - W^{CY17}_{CCY15})]}{(C^{CY14} - W^{CY14}_{CCY14} - W^{CY15}_{CCY14} - W^{CY16}_{CCY14}) + (C^{CY15} - W^{CY15}_{CCY15} - W^{CY16}_{CCY15} - W^{CY17}_{CCY15})}$$

STEP 4:   Computation of CDR-3

CDR-3 = 1 – [(1-WMDR1) *(1-WMDR2) *(1-WMDR3)]

6.3 *A numerical example* illustrates the computation of CDR-3:

NUMERICAL EXAMPLE: Calculating CDR-3 for the last three years at the end of CY17

STEP 1: Data input for Original static pool C^{CY17} for each year covered by this CDR-3

Year	Defaults	Withdrawals
CY15	$D^{CY15} C^{CY15} = 2$	$W^{CY15} C^{CY15} = 7$
CY16	$D^{CY16} C^{CY16} = 1$	$W^{CY16} C^{CY16} = 8$
CY17	$D^{CY17} C^{CY17} = 1$	$W^{CY17} C^{CY17} = 10$

STEP 2: Calculating:
(i) Withdrawal-adjusted static pool
(ii) Survivors at risk of default (SRD)

Year	Withdrawal adjusted static pool	Survivors at the risk of default (SRD)
CY15	$C_1 = C_0 - W^{CY15} C^{CY15}$ $= 100 - 7 = 93$	$SRD_1 = C_1$ $= 93$
CY16	$C_2 = C_0 - W^{CY15} C^{CY15} - W^{CY16} C^{CY16}$ $= 100 - 7 - 8 = 85$	$SRD_2 = C_2 * S_1$ $= 85 * 97.85\% = 83.20$
CY17	$C_3 = C_0 - W^{CY15} C^{CY15} - W^{CY16} C^{CY16} - W^{CY17} C^{CY17}$ $= 100 - 7 - 8 - 10 = 75$	$SRD_3 = C_3 * S_1 * S_2$ $= 75 * 97.85\% * 98.80\% = 72.50$

*S = Survivors (to be calculated in STEP 3 NEXT)

STEP 3: Calculating: **(iii)** MDRs, **(iv)** Survivors (S)

Relevant Static Pool	Ratings Outstanding (As on static pool formation date) *(January 1, 2015)*	
C^{CY15}	$C_0 = 100$	
Year	MDRs	Survivors (S)
CY15	$MDR1^{CY15} = D^{CY15} C^{CY15} / SRD_1$ $= 2 / 93 = 2.15\%$	$S_1 = 1 - MDR1^{CY15}$ $= 100\% - 2.15\% = 97.85\%$
CY16	$MDR2^{CY15} = D^{CY16} C^{CY15} / SRD_2$ $= 1 / 83.2 = 1.20\%$	$S_2 = 1 - MDR2^{CY15}$ $= 100\% - 1.20\% = 98.80\%$
CY17	$MDR3^{CY15} = D^{CY17} C^{CY15} / SRD_3$ $= 1 / 72.50 = 1.38\%$	$S_3 = 1 - MDR3^{CY15}$ $= 100\% - 1.38\% = 98.62\%$

STEP 4: Calculating: **(v) CDR-3**

<u>PLEASE NOTE:</u> Since CDR-3 is based on only one static pool, **MDRs = WMDRs**

CDR-3 = $1 - [(1-WMDR1^{CY15}) * (1-WMDR2^{CY15}) * (1-WMDR3^{CY15})]$

$= 100\% - [97.85\% * 98.80\% * 98.62\%] = $ **4.66%**

DEFINED TERMS	
Accuracy	Ratings accuracy refers to the correlation between ratings and the risk of Default
Annual Default Rates *(ADRs)*	An ADR reflects "actual" default experience over a one-year measurement period of an entity / issuer that is part of a Static Pool in the beginning of a particular year by the end of the same year. This empirical information may serve as an estimate of the probability of default of the measurement period underlying the ADR
Credit Rating	"A process of evaluating credit worthiness of a person which expresses its ability or willingness to meet financial obligations in full and on time;" *Credit Rating Companies Regulations, 2016*, **Regulation Chapter I, 2-1-(b)**
Credit Substitution	Passing through the guarantor's applicable credit rating to the principal obligor (entity / issuer whose obligations are guaranteed) under the expectation that the guarantor will not assert any defenses to payment in the event that the principal obligor defaults. Hence, if the guarantor is rated Triple A 'AAA'; the same rating would be applied to the principal obligor "A guarantee is a legally enforceable promise in which one party (the guarantor) agrees to fulfill the obligations of another party (the principal obligor) should it fail to pay or perform under the terms of its indenture, debt agreement or other contract with a third party. Guarantees appear in a wide variety of transactions that Moody's rates. The intent of a guarantee is to enhance credit by substituting the obligor's credit profile with that of the guarantor, typically a more creditworthy entity. Credit substitution can result from unambiguously worded guarantees in which the guarantor has the unconditional and irrevocable obligation to pay or perform on a full and timely basis without the ability to raise defenses to its liability." **Adapted from SPECIAL COMMENT:** *Moody's Identifies Core Principles of Guarantees for Credit Substitution*; pp. 1 & 2; Moody's investors Services, November 11, 2010
Cumulative Default Rates *(CDRs)*	A CDR reflects "actual" default experience over one / multiple-years measurement periods of an entity / issuer that has survived in a Static Pool up to the beginning of each subsequent year of the Measurement Period underlying the CDR by the end of last year of such Measurement Period. This empirical information may serve as an estimate of the probability of default of the measurement period underlying the CDR **Marginal Default Rates (MDRs):** A MDR is an incremental default rate for each year covered by the Measurement Period underlying a CDR. For instance, a CDR-3 has three constituent MDRs: MDR1 reflects "actual" default experience of an entity / issuer that has survived in the Static Pool (C0) up to the beginning of Year 1 covered by CDR-3 by the end of Year 1 MDR2 reflects "actual" default experience of an entity / issuer that has survived in the Static Pool (C0) up to the beginning of Year 2 covered by CDR-3 by the end of Year 2 MDR3 reflects "actual" default experience of an entity / issuer that has survived in the Static Pool (C0) up to the beginning of Year 3 covered by CDR-3 by the end of Year 3

Default	PACRA defines **DEFAULT** as: Failure of an obligor to make timely payment of principal and/or interest under contractual terms of any financial obligation A distressed restructuring whereby the restructuring has the effect of allowing the obligor to avoid a payment default This definition is uniformly applied both for capital market instruments and bank facilities.
Initial Rating	The rating assigned by PACRA for the first time *Ratings are also termed "Initial" when a previously:* Private rating converts into a Public rating Preliminary rating is finalized Withdrawn rating comes back to PACRA with a fresh Mandate Defaulted rating emerges from Default and assigned a rating
Measurement Period	The time horizon between the beginning and end of a Static Pool formation. It also refers to the time period measured by a CDR.
Methodology	The analytical framework used to specify various factors to analyze and assess the relative standing of the underlying entity/issue on the basis of qualitative and quantitative factors.
Model	An aggregator, derived from the Methodology, that converts qualitative and/or quantitative input factors into quantitative estimates based on pre-assigned formulae and weightages.
Preliminary Rating	The rating assigned to a debt instrument / mutual fund yet to be issued based upon its proposed terms and conditions
Public Rating	A rating opinion available in the Public Domain
Rating Criteria	A set of standards, established by PACRA, ensuring that a given Methodology and Model is applied in a careful, uniform and consistent manner, as determined by PACRA
Rating Factors	Factors being assessed as per PACRA established Methodology to reach a rating decision
Rating Modifiers	Rating Modifiers are refinements about a rating opinion that PACRA may use: *PACRA employees two modifier listings:* **Rating Outlook:** Indicates the potential and direction of a rating over the intermediate term in response to trends in economic and/or fundamental business/financial conditions. It is not necessarily a precursor to a rating change **Rating Watch:** Alerts to the possibility of a rating change subsequent to, or in anticipation of, a) some material identifiable event and/or b) deviation from expected trend. But it does not mean that a rating change is inevitable
Stability	Stability refers to the frequency and magnitude of rating changes, as well as the likelihood that these rating changes would prove enduring. Hence, Stability is the ability of a rating to maintain itself where it was originally assigned

Static Pool *also termed* Cohorts	Static Pools are groupings of data that stay together in the group for the entire length & breadth of the Measurement Period of the pool
Time-to-Default	Time-to-Default is a general term referring to how far a rating lies from the time of its Default. It can be calculated both in terms of rating categories and at the notch level. There are various Time-to-Default statistics that are preferred. However, PACRA chooses to publish Time-to-Default as follows: **Time-to-Default from Initial ratings**: Measures the time elapsed between the Initial rating (*As assigned by PACRA*) and Default **Time-to-Default from all ratings**: Measures the rating path to Default, tracking from the time of Initial rating to all successive rating changes / transitions on the rating scale prior to Default
Transition & Default Study	A Set of Standardized tools & analyses for a CRA ratings' performance appraisal
Transition Rates	Statistics quantifying the migration of ratings on the rating scale. There are three kinds of Transition Rates: *Upgrade Rate:* The rate of upward rating migration (*Ceiling:* Triple A **"AAA"**) *Downgrade Rate:* The rate of downward rating migration (*Floor:* Single C **"C"**) *Default Rate:* Proportion of entities / issues that have been assigned a Default **"D"** rating (*As per PACRA Default Policy* **"What is Default"**) to the total entities / issuers
Vintage	The year in which the CRA assigns an Initial rating

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[i] See PACRA's Methodology - **"Recognition of Default"** @ www.pacra.com.

[ii] A Withdrawn rating means that a previously issued rating has been withdrawn and no longer outstanding in PACRA's universe. A rating is withdrawn on: a) termination of rating Mandate, b) cessation of underlying entity, c) the debt instrument is redeemed, d) the rating remains suspended for six months, or e) the entity/Issuer Defaults. PACRA considers Default an "all consuming" state for the rating which stands Withdrawn at the time of this event. Any rating review is considered an Initial rating. Debt instruments, assigned a D rating, remain under surveillance (till fully settled) and are updated using both public and non-public sources, on a best effort basis

[iii] The cohort method is based on Jafry and Schuermann (2004) work. It offers a simple estimation process. However, the method has a very rigid assumption that time is discrete; therefore, rating activity cannot be analyzed holistically. The method considers the rating position at the beginning and end of a period only, excluding the dynamic process found within the period in the form of interim rating actions

[iv] PACRA derives its methodology for calculating CDRs using Moody's discrete-time hazard rate method as described in Moody's publication **SPECIAL COMMENT** – Measuring Corporate Default Rates, November 2006