Structuring a fund platform for financial inclusion in India

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This study presents the use of structured finance in designing a fund platform for greater capital market access for financial inclusion in India. The use of structured finance can give a fillip to lacklustre bond market and better match the needs of investors and investees. Core to designing such a platform is to estimate the default risk in such structures. Accordingly, this study describes the use of Monte Carlo simulation to estimate such risk. The results highlight the potential that structured fund platforms have in attracting market participants to access the bond market.

This paper presents the design of a fund platform using principles of structured finance to enable greater capital market access for financial inclusion in India. A structured fund platform can tide over a tepid bilateral bond market and match the needs of investors and investees more efficiently. Central to the designing of a structured fund platform is quantifying the default risk in such structures. Accordingly, the paper specifically focuses on using the technique of Monte Carlo simulation to estimate risk. The results highlight the potential that structured fund platforms have in aligning disparate investor and investee needs.

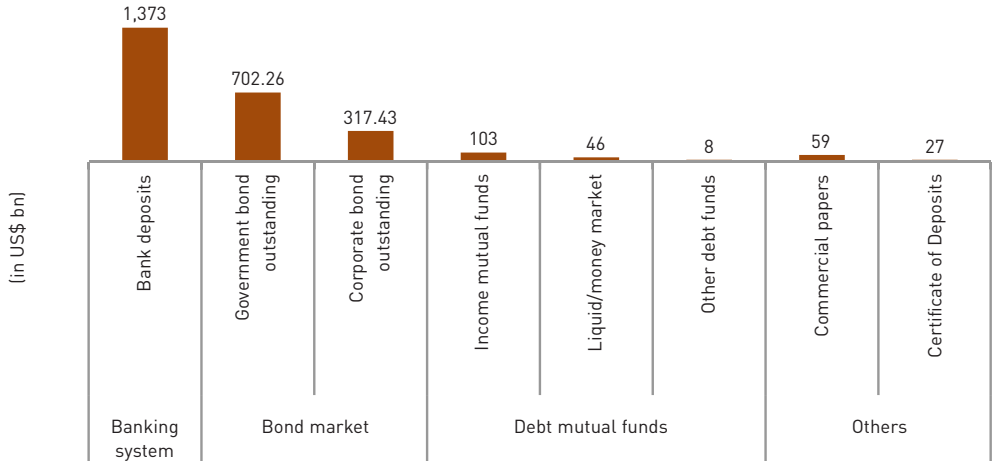
The paper has been divided into five sections. The first section gives an overview of the bond market in India. In the second section, we emphasise on the need for a structured finance approach to tide over frictions in capital markets. The third section provides the broad construct of the fund structure used in this paper to illustrate the methodology for risk estimation in fund structures. The fourth section gives an overview of the rating methodology used. The last section presents the output and concludes.

Corporate bond market in India

The debt capital market in India is dominated by sovereign bond issuances while the corporate bond market is relatively underdeveloped as compared to other markets. Many reasons can be attributed for the same. Khanna et al (2012) argue that post the liberalisation of the Indian economy in 1991, large companies saw more benefits from the opening up of the stock market rather than the bond market. This was primarily due to microstructures being present for the equity markets and not for the bond markets. Even in an overall sluggish bond market however, sovereign bonds have thrived given the need to finance the fiscal deficit and the captive demand for such bonds to meet regulatory requirements, for example banks in India investing in government bonds to meet the requirement for Statutory Liquidity Ratio (SLR)[1].

Mukherjee (2013) mentions that the Indian financial markets offer two binary choices – low-risk low return bank deposits and government securities (apart from a few large issuances by top companies in India) and high risk high

Sizing the various segments of the Indian debt market **Exhibit 1**



Notes: Bank deposits data is as on March 2015 for all commercial banks in India. Government bond outstanding data is as on August 2016. Corporate bond outstanding is as on June 2016. Assets Under Management (AUM) for debt mutual funds is as on July 2016. Commercial papers outstanding is as on July 2016 and Certificate of Deposits outstanding is as on August 2016.

Source: Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Ministry of Finance – India, Association of Mutual Funds in India (AMFI).

return equity markets. Missing in the middle is a healthy corporate bond market to offer a much diverse set of risk-return combinations.

Exhibit 1 provides the size of the different segments of the debt market in India. The banking system is the largest as measured by the deposit base. Within the bond market, government bonds segment dominates the corporate bond market. Debt mutual funds along with commercial papers and certificate of deposits represent a miniscule but important section of the debt market.

Several inter-country studies, like Raghavan et al (2014) have pointed out the relative under development of India's corporate bond market as compared to other emerging market countries. The same study highlighted that the value of outstanding corporate bonds as a percentage of GDP in India is as low as 1.6% percent (see Exhibit 2).

Another aspect of India's bond market, as noted by Aacharya (2014), is the low participation by retail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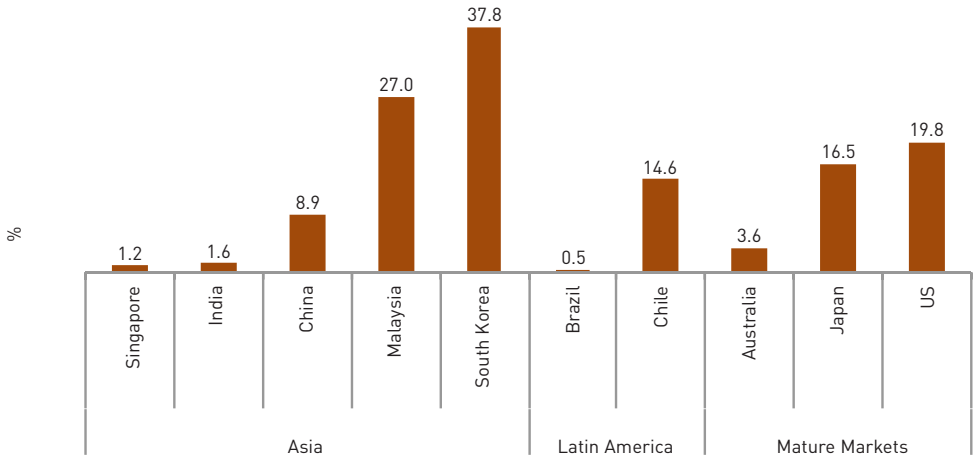
Value of outstanding corporate bonds as a percentage of GDP **Exhibit 2**

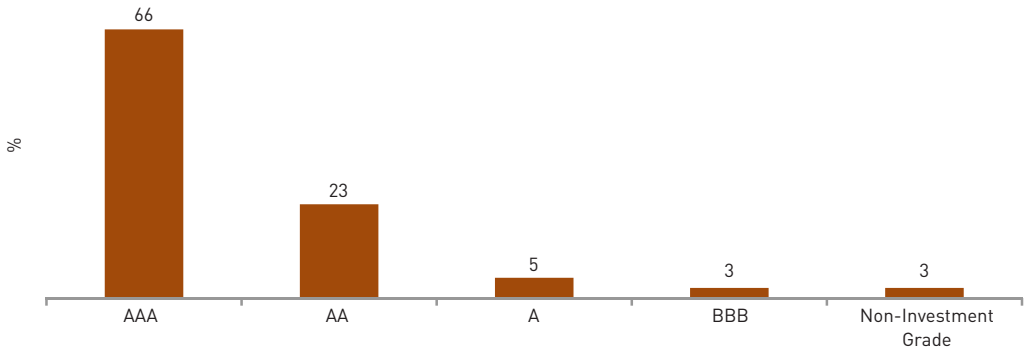


Source: Raghavan et al (2014). Data is from Bank for International Settlements (BIS) and International Monetary Fund (IMF).

investors. The bond market is dominated by institutional investors like mutual funds, insurance companies and pension funds. However, such institutional investors are both required and have a preference for investing in high rated bonds. This effectively ensures that small and mid-sized companies who would attract a low rating remain outside the bond market.

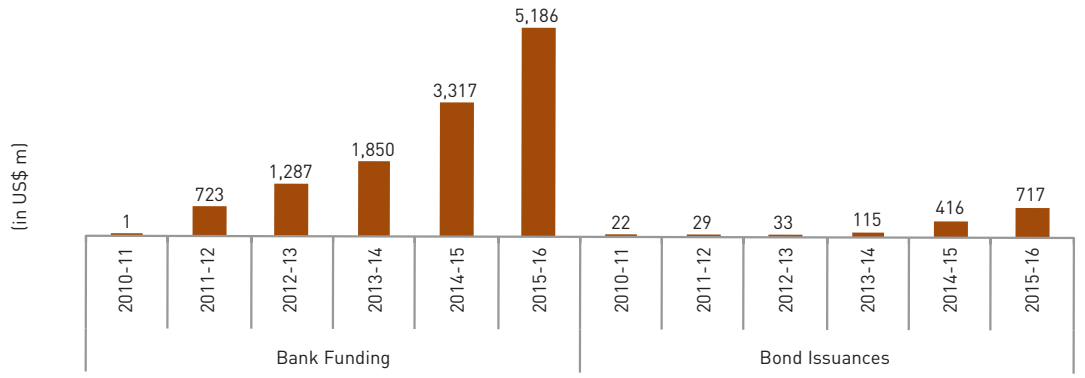
An analysis of the debt fund raising in India's microfinance sector brings to the fore some of the problems in India's corporate debt market. While the microfinance sector in India has grown from about US$500m in 2007 to US$10bn in 2016, the amount of funding raised by microfinance institutions by issuing bonds in the corporate bond market is small (see Exhibit 4).

Distribution of ratings on corporate debt securities (Maturity > 1 year) **Exhibit 3**



Source: Securities and Exchange Board of India (SEBI). Data is for corporate bond issuance (maturity > 1 year) in 2014-15 based on funding raised.

Bonds issued by microfinance institutions in India as compared to bank funding **Exhibit 4**



Source: Microfinance Institutions Network (MFIN), Bombay Stock Exchange (BSE)

The preference for high rated bonds has meant that issuers from the microfinance sector who are of relatively low vintage and small size get "rated" out of the bond market. In such situations, setting up a fund platform that makes use of structured finance can play an important role in increasing the penetration of bond funding.

Need for structured finance

As opposed to the perfect capital market scenario (Modigliani and Miller, 1958) where the structuring of capital is not relevant, DeMarzo (2005) lists three primary market frictions that explain the existence of structured finance products – transactions costs, market incompleteness and asymmetric information.

Among these three reasons, as per DeMarzo and Duffie (1999) and DeMarzo (2005), asymmetric information is the most important driver behind the existence of structured finance products. This is because market incompleteness in itself does not increase the span of tradeable claims and hence cannot explain pass-through pools while transaction costs can explain pooling but not tranching.

Structured finance can play an important role in tiding over the obstacles in the corporate bond market by identifying information asymmetry, providing for credit enhancements and offering a risk-return combination that acts as a bridge between low rated issuers and capital market investors. Mishkin (2006) in his study highlights that the use of credit enhancements can make corporate bond market attractive to investors by meeting different risk preferences. The Bank for International Settlements (BIS) further highlights two core advantages of structured finance – transformation of an illiquid asset into a relatively liquid instrument and creation of high rated securities out of low rated debt. In the case of securitisation, gains from diversification across individual loans and across originators have been described by Anand and Fernandes (2012) in multi originator securitisation transactions in India.

Fund structure

Having looked at the state of the corporate bond market in India and the need for a structured finance solution, in this section we describe the broad construct of the fund that is used for the purpose of this study (see Exhibit 5). Fund structures in India can be set up under two regulatory frameworks – Mutual Fund Regulations (MF), 1996 or Alternative Investment Fund (AIF) Regulations, 2012. In both structures, the fund is structured as a special-purpose vehicle (SPV) with the purpose of holding the underlying

investments as assets and issuing units against them to investors. These units represent the beneficial ownership that investors hold in the assets of the SPV. The AIF route is amenable for the investment manager to use structuring and different classes of investors can be created with varying rights on the fund's cash flows.

Under the AIF regulations, a trustee is also appointed with fiduciary duties to ensure that the rights of the investors are protected and all applicable regulations are adhered to. The trustee in turn appoints an investment management company for the day to day operation of the fund and to discharge the investment function.

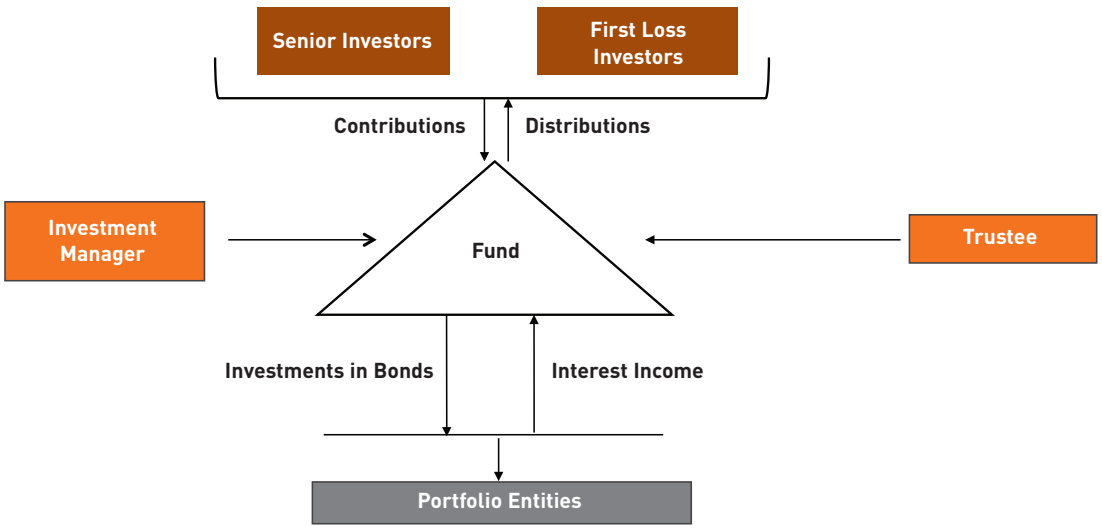
Rating methodology

Rating a fund structure can be complicated. Unlike a single bond whose rating is sufficient to communicate risk, estimating riskiness for a collection of such bonds cannot be directly imputed. For instance, even if a weighted-average rating (WAR) of such bonds is computed, the measure does not adequately capture credit quality. Two portfolios with the same WAR could have very different risk and return characteristics. A portfolio with only BB rated securities compared to a portfolio with some AA and many CCC rated securities can have the same WAR, but will have very different volatility indicators. On top of this is the added complication of a waterfall that determines the cashflows to different grade of investors.

The complexity in imputing a credit rating for a fund tranche from the credit rating of the underlying portfolio has led to wide adoption of simulation in the rating process. However, is the use of simulation appropriate for rating of structured finance transactions? Rubinstein (1981) lists out certain criteria to be satisfied, along the lines of Myers (1976), to check if the use of simulation is appropriate for the mentioned purpose. As per the listed criteria, it is appropriate to use Monte Carlo simulation when:

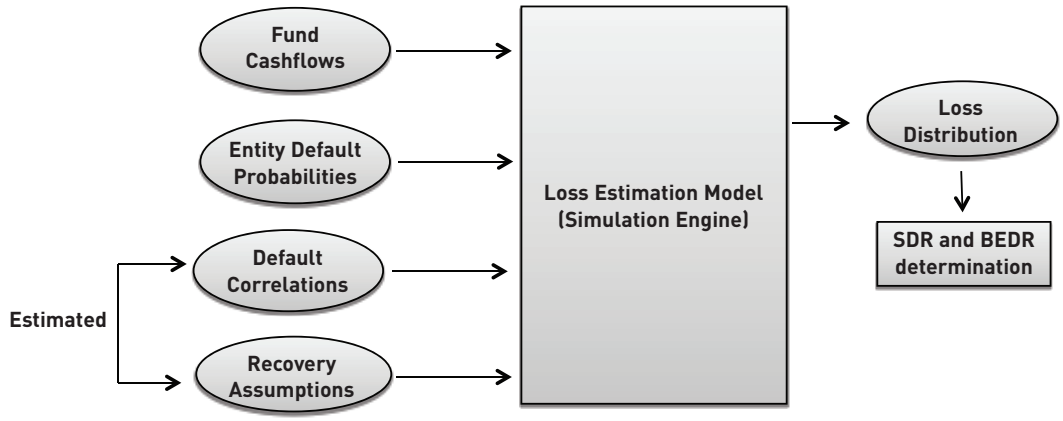
1) Data is unavailable, unreliable or too expensive to obtain

Fund structure **Exhibit 5**



Source: IFMR Capital

Rating process **Exhibit 6**



Source: IFMR Capital

2) Observed system is too complex
3) Analytical solution is difficult to obtain
4) Mathematical experimentation is difficult or impractical to conduct

Funds have varied structures and the lack of standardisation means that there is little historical data for different fund structures on which to base analysis. Thus the first condition is satisfied. The second and the third condition is satisfied as cash flow modelling in a fund can be very complicated and analytical solutions cannot be arrived at using mathematical equations. The last condition is also satisfied as fund transactions cannot be set up as a laboratory experiment.

With the increase in computing power, implementing a Monte Carlo simulation has become much easier. Once a system has been modelled and set up, Monte Carlo permits observing the output by putting in a large number of differentiated and random events in the system. The single largest advantage of a Monte Carlo simulation is to avoid the need to analytically arrive at a solution while at the same time giving virtually the same output as that an analytical solution (if available) would have provided.

While there are numerous methods of using the technique of simulation, for the purpose of this paper, we have used Standard & Poor's (S&P's) methodology for rating fund structures as detailed in Global Cash Flow and Synthetic CDO Criteria.

The first step in the rating process is to use the historical default probabilities of each instrument in the fund to arrive at a loss distribution for the aggregate portfolio. To model this, a Monte Carlo simulator is used to generate a matrix of random numbers (with the dimension of the matrix equal to the number of securities times number of repayment periods). For each such matrix, based on the value of the random number generated, another matrix is generated which indicates for each security and each repayment period, whether or not there has been a default. This is done in a manner so as to be consistent with the historical default probability of the securities in the fund. The matrix of default indicator is applied on the expected cash flows of the fund to arrive at the losses for each simulation trail. The portfolio default rate is then computed as the total cumulative loss by end of the pool tenure (adjusted for the loss given default) divided by the total expected pool cash flows in a no-default situation.

After arriving at the loss distribution for the fund's aggregate portfolio, the Scenario Default Rate (SDR) is calculated for each tranche of the fund. The SDR for a target rating indicates the level of default that a tranche should be able to withstand to attain that rating. It is estimated from the loss distribution of the portfolio such that the probability of default in the aggregate portfolio exceeding the SDR is no greater than the probability of default of a corporate bond with the same target rating as is sought for the tranche.

As an example, consider that based on historical default probabilities, the cumulative default rate for a five-year AA rated corporate bond of tenure p is x percent. For obtaining the AA SDR for the fund portfolio, we compute from the loss distribution the level of default for which there is no greater than x percent chance of exceeding. This is to say that if a tranche can withstand defaults upto the AA SDR, then its probability of default would be no greater than x percent, as would be appropriate for AA rating.

Post the calculation of the SDR, the next step is to calculate the Break Even Default Rate (BEDR). While the SDR gives us the quantum of default in the fund portfolio which a tranche must withstand to achieve the target rating, the BEDR gives us the actual quantum of default in the fund portfolio which a tranche is able to withstand. Thus, for a tranche to achieve its desired rating, the BEDR for that rating should be higher or equal to the SDR.

Output

We have constructed a fund structure with five years as tenure, quarterly surplus payouts to the investors and bullet principal repayment at the end of the fund tenure. The fund makes investment in a pool of plain vanilla bonds whose cash flow mirror the cash flows due from the fund- bullet bonds with five-year tenure and quarterly interest payments.

The underlying securities are described in Exhibit 7.

The fund consists of 12 bond investments with underlying principal of US$100m. The weighted average rating of the portfolio is CRISIL BBB and weighted average yield is 15%. The funds are deployed in the first three months from the commencement date of the fund.

In our structure, we have constructed two tranches – senior investors and equity (or first loss) investors. The

Investment pipeline for the fund **Exhibit 7**

Instrument	Type	Amount (US$m)	Nominal pricing (%)	Tenure (years)	Rating
Bond 1	Senior debt	7.5	12	5	AA
Bond 2	Senior debt	7.5	14	5	A
Bond 3	Senior debt	7.5	16	5	BBB
Bond 4	Senior debt	7.5	18	5	BB
Bond 5	Senior debt	10.0	12	5	AA
Bond 6	Senior debt	10.0	14	5	A
Bond 7	Senior debt	10.0	16	5	BBB
Bond 8	Senior debt	10.0	18	5	BB
Bond 9	Subordinated debt	7.5	12	5	AA
Bond 10	Subordinated debt	7.5	14	5	A
Bond 11	Subordinated debt	7.5	16	5	BBB
Bond 12	Subordinated debt	7.5	18	5	BB

Source: IFMR Capital

construction of tranches in the fund allows us to split the underlying cash flows in an order of priority. If this is not done, then each investor in the fund will face a risk equal to the weakest credit in the portfolio. Tranching allows us to pre-define how losses will be absorbed by different tranches or classes (as per a "waterfall"), thereby endowing each class with a different risk-return characteristics. In our case, the cash flows of the fund will be split based on the waterfall as described below.

Till such time as the senior and equity investors have outstanding beneficial interest in the fund, all cashflows will be distributed as follows:

i. for payment of all statutory and regulatory dues;
ii. for the payment of any fees and expenses incurred by the fund or any fees payable to service providers and/ or any other amounts expressly provided for in the transaction documents;
iii. payment of risk premium to equity investors;
iv. for payment of overdue interest payouts due to senior investors;
v. for payment of interest payouts due to the senior investors;
vi. for payment of unpaid expected interest payouts due to equity investors;
vii. for payment of expected interest payouts due to equity investors;
viii. payment of principal to senior investors on final maturity date
ix. payment of principal to equity investors on final maturity date

Tranche structure **Exhibit 8**

Investor category	Proportion (%)	Amount (US$m)
Senior	85.0	85.0
Equity	15.0	15.0

Source: IFMR Capital

This is a typical waterfall where senior tranche investors have the highest priority over cash flows followed by the equity tranche investors. The equity investors act as a sponge to absorb losses upto a pre-defined limit.

The fund incurs annual operational expenses of 0.25% per annum and senior investors pay 0.35% per annum (calculated on their capital contribution) as risk premium to equity investors for taking higher risk. The entity level portfolio default rate is obtained from CRISIL'S[2] historical default rates for similar rated bonds with the same weighted average maturity. These default probabilities are only available for upto three year tenures. In order to extrapolate the default probabilities to five years (which is the tenure of the fund), we have used the technique of cubic spline.

For simulating random numbers, we have used a 0.33 correlation[3] factor as the underlying investments are assumed to be in the same sector. Correlation can have a significant impact on the loss distribution of the portfolio and is important to stress the portfolio in a robust manner for estimating its rating. In Exhibit 10, we can see that the tail of the distribution with correlation is longer than without correlation, implying a higher SDR for any given level of probability of default. For instance, with no correlation the 'AA' SDR is 17.6%. Assuming a correlation of 0.33, the AA SDR increases to 20.7% (see Exhibit 10).

For implementing the Monte Carlo simulation and arriving at the loss distribution curve, a random number generator is used for every repayment period. Each security's default status is represented by a uniformly distributed random variable between 0 and 1. If the default probability of the entity for the term of the repayment period is 'p' then for every random number:

Status of the entity at the end of the period:

Default	*if* $r < p$
No Default	*if* $r \geq p$

The random number generator incorporates a correlation factor of 0.33 to give us a set of correlated random numbers for each repayment period. Each set has one random number for one security. Since the numbers are

CRISIL's average cumulative default rate (CDR) (1988-2015) **Exhibit 9**

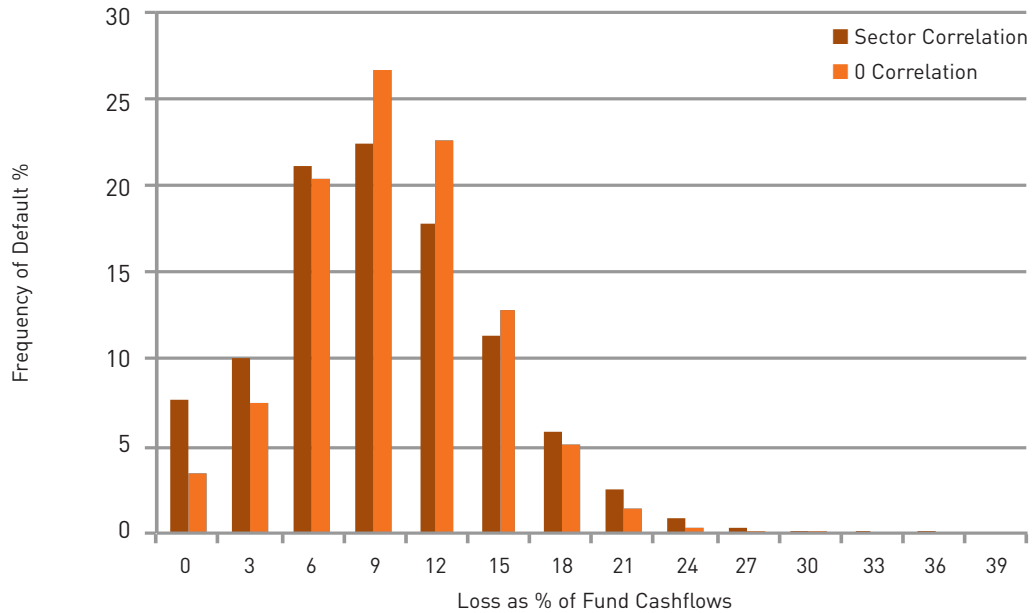
	One year (%)	Two year (%)	Three year (%)	Four year (%)*	Five year (%)*
AAA	0.00	0.00	0.00	0.00	0.00
AA	0.03	0.27	0.77	1.27	1.44
A	0.56	2.31	4.79	7.27	9.06
BBB	1.09	2.98	5.72	8.46	10.16
BB	4.17	8.64	13.07	17.50	22.11
B	7.95	15.85	21.82	27.79	36.83
C	20.60	32.84	40.42	48.00	59.69

Source: CRISIL Rating, "Crisil Default Study 2015". * The four year and five year CDRs are based on cubic spline extrapolation of the 1-3 year values

correlated in a set, the chances of concurrent default by the correlated securities during a period are higher as compared to a case if the securities were not correlated.

Post the operation of the random number generator, for each simulation, if there is a default during a repayment period, then it is assumed that entity will default subsequently for all repayments. Exhibit 11 illustrates a sample default indicator matrix.

Loss distribution – With and without correlation **Exhibit 10**



Source: IFMR Capital

Default indicator matrix **Exhibit 11**

Instrument	Quarter 13	Quarter 14	Quarter 15	Quarter 16	Quarter 17	Quarter 18	Quarter 19	Quarter 20
Instrument 1	0	0	0	0	0	0	0	0
Instrument 2	0	0	0	0	1	1	1	1
Instrument 3	0	0	0	0	0	0	0	0
Instrument 4	1	1	1	1	1	1	1	1

0 indicates no default. 1 indicates default

Source: IFMR Capital

For each simulation, the final loss number is calculated by multiplying the above matrix with the expected cash-flow (see Exhibit 12) and loss given default matrix. We have assumed loss given default of 60% for senior debt and 80% for subordinated debt[4].

The losses are aggregated for each simulation and the loss distribution is arrived at. The present value of the loss given default numbers (discounted at a risk free rate of 8%[5]) is given in Exhibit 13.

Based on this methodology, the loss distribution curve for

Expected cashflow matrix (in US$m) **Exhibit 12**

Instrument	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 17	Quarter 18	Quarter 19	Quarter 20
Instrument 1	0.22	0.22	0.23	0.23	0.22	0.22	0.23	7.73
Instrument 2	0.26	0.26	0.26	0.26	0.26	0.26	0.26	7.76
Instrument 3	0.30	0.30	0.30	0.30	0.30	0.30	0.30	7.80
Instrument 11	0.10	0.30	0.30	0.30	0.30	0.30	0.30	7.80
Instrument 12	0.11	0.34	0.34	0.34	0.34	0.34	0.34	7.84

Source: IFMR Capital

Loss given default matrix **Exhibit 13**

Instrument	Type	Quarter 3	Quarter 4	Quarter 5	Quarter 14	Quarter 18	Quarter 19	Quarter 20
Instrument 1	Senior	0.5774	0.5663	0.5556	0.4672	0.4326	0.4244	0.4163
Instrument 2	Senior	0.5774	0.5663	0.5556	0.4672	0.4326	0.4244	0.4163
Instrument 3	Sub Debt	0.7698	0.7551	0.7407	0.6230	0.5768	0.5658	0.5550
Instrument 4	Sub Debt	0.7698	0.7551	0.7407	0.6230	0.5768	0.5658	0.5550

Source: IFMR Capital

the fund is given in Exhibit 14. The expected default rate (cumulative) for a CRISIL rated A and AA bond (based on cubic spline extrapolation) with maturity of five years is 9.06% and 1.44% respectively. Based on the below loss distribution, the 'A' SDR is 15.19% (the probability of exceeding 15.19% default is no greater than 9.06%) and the 'AA' SDR is 20.66% (the probability of exceeding 20.66% default is no greater than 1.44%).

This implies that to achieve the target rating of A for the senior tranche, the fund requires to structure an equity tranche of 15% Thus, the fund structure built for this analysis will achieve a rating of A.

Conclusion

Our study on S&P's rating methodology provides an insight into how structured finance can be used to construct higher-rated securities. Given the lack of a well-diversified and mature corporate bond market in India, this structured finance approach can play an important role in incentivising high quality credit origination and pooling, and in attracting mainstream and large capital market participants in nascent sectors like financial inclusion where the lack of presence of a developed bond market is felt most. The benefits of structure finance exist beyond doubt (Salleo, 2011). This study sheds light on how a fund in India with a portfolio of weighted average rating BBB is converted into a tranche with credit quality equivalent to an A rated bond. Using structured finance along with a robust methodology for quantifying the credit enhancement and the attendant improvement in credit risk can play an important role in increasing the penetration of the bond market and diversifying the sources of capital.

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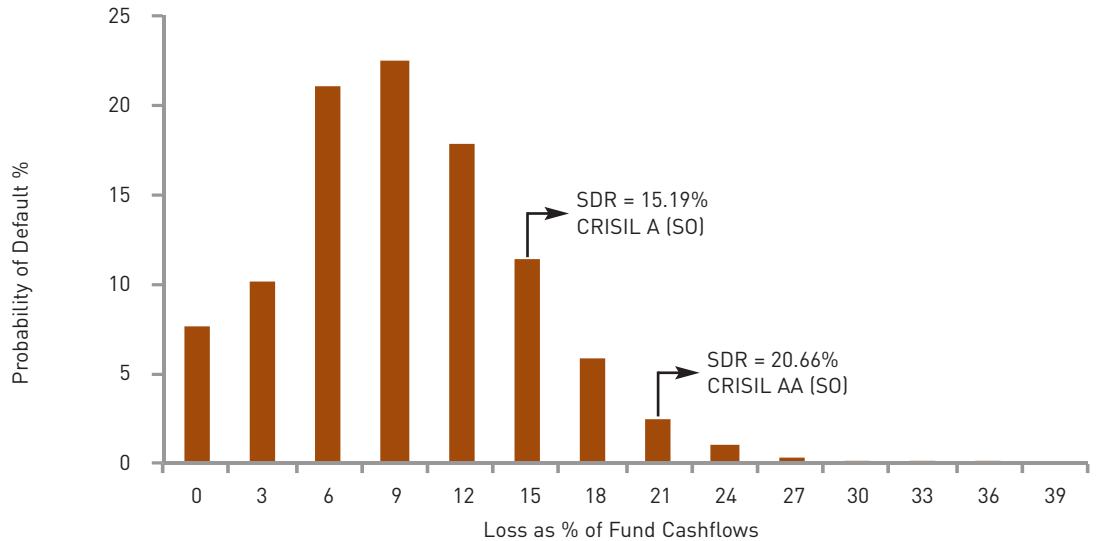
Loss distribution for the fund portfolio **Exhibit 14**



Source: IFMR Capital

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Notes:

1 Banks in India are required to maintain a SLR of 23% of their net demand and time liabilities in government approved securities and/or gold.

2 CRISIL is a global analytical company providing ratings, research, risk and policy advisory services. CRISIL is a subsidiary of S&P.

3 As per S&P Global Cashflows and Synthetic, a correlation factor of 0.15 is used for same sector securities.

4 As per Moody's Investor Service's Corporate Default and Recovery Rates, 1920-2010, the issuer-weighted average corporate debt recovery rate for the period 1982-2010 was 50.8% for senior secured bonds and 31.3% for subordinated bonds.

5 We have used a higher risk free rate of 8% based on the 10-year Indian government bond yield which closed at a YTM of ~7% in July-end 2016.

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