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Synthetic CDOs

1. Synthetic CDO

A synthetic CDO securitizes credit risks in which the underlying credit exposures (reference pool) are comprised of credit default swaps (CDS contract) and/or collateral bonds.

SPC purchases CDO through the issuance of bonds to the investors. In normal cases, the CDO will be appropriated to the source of the redemption to the investors, but if any credit event bigger–than initially expected occurs to the underlying reference pool and losses occurs exceeding the deductible amount equivalent to the subordinated tranches, then the relevant CDO will be allocated for the compensation of such losses.

SPC will make a CDS contract on the reference pool with swap counter party. And also an interest rate swap contract (IRS contract) will be concluded to dissolve the miss-match arising from the sum of coupon payments payable to the investor and premium of CDS contract against the sum of the interest revenue receivable from CDO by SPC.

The rating of CDO is assigned about the certainty for full repayment of the principle on the maturity and punctual interest payment of the CDO. In rating, both of a quantitative and qualitative analysis will be conducted for assessment of the creditworthiness of the reference pool, creditworthiness of the swap counter party and the counter measurement in the transaction scheme when the relevant creditworthiness is deteriorated or the creditworthiness of the CDO to be invested.

2. Gist of Structure Analysis

(1) Creditworthiness of Reference Pool

The CDS contract, which is underlying CDO, stipulates on its term and condition to compensate the losses incurred to the specific credit risk in the reference pool. If any credit event occurs to the extent of bigger–than initially expected to the reference pool which is underlying the CDO, then it shall be deducted and allocated such amount from the CDO to compensate the losses with an upper limit to the notional principal amount of CDS contract. In order to contain the probability of occurrence of the credit events to the level equilibrium to the rating level of the CDO, it is structured to create a subordinated tranche out of the reference pool.

The required amount of the subordination can be calculated through the quantitative analysis, deploying the Monte Carlo Simulation, where referring to the presumptions such as composition of each item in the reference pool, frequency of credit event, duration of CDO and presumable correlation among the underlying CDO(for detail refer to " 3. Quantitative Analytical Methodology").

(2) Credit Event

In CDS contract, the credit event is defined as that the reference entity is deemed to be in default.

As to the default rate of the individual reference entity in the CDS contract, the assumed default rate table (the table2) is referred to. The event of default in the assumed default table is defined by JCR as such occasion when a failure of punctual repayment of principal amount and/or interest payment on the maturity or it deemed difficult to perform its obligations including debt and filing of a petition for general legal proceedings.

On the other hand, CDS contract specifies the credit event occurring to the subject reference entity which is to be deemed as the event of "default". ISDA specifies six kinds of credit events normally adopted by CDS contract. Depending on the composition of the individual securities in the reference pool, a different combination of credit event will be selected and a different credit event pertaining to the specific reference pool will be defined accordingly. In an analytical work of CDO, having compared the credit events of reference pool and the definition of default by JCR and confirming the difference of the coverage of default definition, the multiplier of stress is determined so as to be equilibrium to the applying assumed default rate.

For instance, if the reference entity is an ordinal corporation, three cases of default are defined such as (a) Bankruptcy, (b) Failure of Payment, (c) Restructuring. In this case, the "Restructuring" which is prone to become effective with the agreement of the debtor and the creditor only but the risk of "Restructuring" is not covered in the "Default Rate" of JCR. Therefore it is necessary to take into account of those differences and make adjustments onto the default rate before adoption.

(3) Recovery Rate of the Reference Entity

JCR takes a cautious view towards the recovery rate of CDS contract. As a result of that "restructuring" is included in the credit events, the assumed default rate will rise but instead the recovery rate is likely to rise. Provided that the recovery rate is regarded as "expected recovery value", the default rate will rise higher by the effect of inclusion of "restructuring" as an credit event in CDS contract of the reference entity, whose credit worthiness is high and assumed default rate is low, the marginal rise of the default rate itself will not exceed beyond the category of "stress consideration", and it is considered that the impact brought by the increment of the "expected recovery value" will remain insignificant.

Based on these points as a result of investigation mainly of case examples of legal proceedings in the past, JCR decided to presume the recovery rate at 5 % without exception after the occurrence of the credit event specified in CDS contract covering not only corporate bonds but also non-subordinated general obligations. Also such fixed recovery rate should be adopted in rating assessment of CDO (in case a fixed recovery rate is not provided).

If reference obligations of CDS contract are subordinated, instead of not differentiating probability of credit event occurrence of such obligations from assumed default rate of long-term senior (preferred) obligations, it is made a rule to factor the difference in the recovery rate concept. As above mentioned, while the recovery rate of general obligations is presumed at 5 %, the recovery rate of the subordinated

obligations is not accounted and fix at zero %.

(4) Creditworthiness of Collateral Bonds

In case of a general synthetic CDO scheme, the proceeds of the issuance paid by investors are appropriated to the fund for purchase of collateral bonds. If default occurs to the collateral bonds, the principal source of funds to be redeemed to investors will be impaired. Therefore the rating of the collateral bonds should be the same as or even higher than the targeted highest rating of the subject CDO. In a general scheme, Japanese Government Bonds or the bonds of the security company, being arranger, will be collateralized. And overseas subsidiary of the security firms issues the bonds with special warrants.

(5) Creditworthiness of Counter Party

In the general synthetic CDO scheme, a SPC that issues bonds to be rated sets out a CDS and sells protection to swap counterparties. Further, in cases where a CDO's pattern of interest payment which is different from cash flows from collateral notes received by the SPC during its life is adopted, interest rate swap ("IRS") is necessary to be set out separately against cash flows related to such interest payment. As both CDS and IRS exert some impact on interest payment of bonds (notes) to be rated, counterparties are required to have reasonable credit capability.

In case the targeted highest rating of the subject bonds is AA- or higher, JCR set the initial eligible condition as that CDS and IRS of the counter party should be rated higher than J-1 of short-term rating, and it made a judgment that it is not necessary to adopt a weak-link-approach if initial agreements provide that;

(i) in case of CDS, if short-term rating becomes lower than J-1 equivalent, principal payment for each term should be made in advance and if it becomes lower than J-2 equivalent, principal payments of whole terms shall be made in advance, and

(ii) in case of IRS, at the time when short-term rating becomes lower than J-1 equivalent, at the expense of an initial counterparty, such counterparty should be replaced with a counterparty vested with rating of J-1 or higher.

Although counterparties should, in principle, be only those covered by JCR's ratings including "p" rating (mainly ratings based on published information), the relaxation of such qualification for counterparties could be considered for individual item under the premises that the scheme is reinforced by hypothecation, etc.

(6) Bankruptcy Remoteness of SPC

In case the issuer of CDO is overseas SPC, it is necessary to confirm the remoteness from bankruptcy. The operation of the SPC should be limited to the issuance of CDO, redemption and interest payments, the purchase the collateral bonds and conclusion of the swap contract. In other words, for the

purpose of protecting the investors and avoiding a filing of any unexpected petition for bankruptcy by the third party, SPC should not owe any risk other than the risk directly pertaining to the issuance of the subject CDO. If the SPC incurs any liability, a certain measurement should be taken so as to prevent any infection caused from the default of debts other than the subject CDO. When assigning a rating, it is important to confirm whether the necessary legal measurements are taken and to scrutinize the contractual documents whether the operation of SPC is properly confined so that the SPC could smoothly execute the relevant operation with respect to the subject CDO.

And further, the bankruptcy remoteness should be ascertained to the effect of not to be caused infection when the related party of CDO falls into default. Against this risk, normally it is structured that the capital and human resources relationship between SPC and related party of the scheme are isolated to each other.

3. Quantitative Analytical Methodology

(1) Gist of Analytical Methodology

In quantitative analysis, Single Period Type Monte Carlo Simulation will be run, where the unit of period is defined as the transaction period and the analysis is based on two factors corporate value model. This model presumed that the corporate value will fluctuate due to its own inherent factor and further to the following factors, first factor is a business environment, second factor is the correlation among industries to which the respective corporation belongs. As to the each factor, a specific unique co-efficient for each industrial category is given so that it is possible to reflect the likelihood of infection caused by the change of the business environment of the specific industry. In actual simulation, a discrimination of default on the individual entity in the reference pool is determined by applying a sensitivity which is pre-fixed depending on the type of industry and stress level, and thus a presumed loss amount of the entire reference pool will be obtained. (For further detail, refer to the "the mathematical background of corporate value model" at the end of this report)

(2) Allocation of Default Rate to Individual Reference Entity

If a reference entity constituting a portfolio has been provided with JCR's credit rating such as domestic corporations or sovereigns, the default rate corresponding to such rating is to be allocated by referring to Long-term Issuer Rating assigned to such reference entity.

If no credit rating is assigned by JCR, JCR determines a presumable default rate based on a shadow rating by an industry analyst in charge of the reference entity. JCR also adopts the following methods other than shadow rating.

- Estimation of a default rate using JCR's Corporate Default Rate Estimation Model.
- In cases where a rating is assigned to the reference entity by other credit rating agency, JCR maps rating by such credit rating agency to JCR's rating.
- Use of originator's internal rating and estimated default rate, or default rates calculated from

outside credit scoring models.

(3) Correlation among Industrial Categories

In corporate value model, it is possible to reflect the correlation of default among industrial categories, by fixing a sensitivity of the influence brought by macroeconomic factor as a first factor. The sensitivity is fixed at a different level for each different industry. The probability of default caused by the business environment will become larger, provided the sensitivity of the industrial category, to which the individual reference entity belongs, is higher.

The sensitivity brought by the respective industrial factor is also fixed as a second factor. By this factor, the correlation of default, caused by a concentration of a certain particular industry, can be properly gauged and reflected. Since the parameter of the same industry shows an identical movement, in case the concentration of the specific industry is high and with the effect of the random numbers inherent to each specific industry, it is structured that default in such sample occurs more easily and at larger number of times. To the second factor, an upper level co-efficient is allocated in addition to the usual allocation of co-efficient (representing a neutral level). The upper level co-efficient is the co-efficient allocated when the creditworthiness of the corporation, belonging to the specific industry categories, is anticipated to deteriorate by the peculiar factor pertaining to such industry. Likewise at the time of CDO arrangement, appropriate co-efficient are allocated by taking the business environment into account.

(4) Monte Carlo Simulation

Monte Carlo Simulation will be run under the above mentioned presumptions.

In simulation, the followings are confirmed.

· The rating, default rate, industrial category and notional principal amount of each reference entity from which the reference pool is composed;

· The duration of CDO;

· The recovery rate;

· The credit events;

· The correlation among industrial categories, the level of co-efficient with respect of the inter-industry correlation

On each trial run, the possible losses incurred to the reference pool will be computed. The simulation will be repeatedly run with sufficient times until the result of computation converges to the level corresponding to the default rate assumed to the respective CDO rating. Given the distribution of the possible loss (risk curve) which is obtained from the simulation, the necessary amount of the buffer(subordinated tranche) should be calculated so as to lower the risk curve level lower than the assumed default rate of the relevant CDO.

4. Outline of Monitoring Method

JCR monitors synthetic CDOs through periodic review once a year, periodic monitoring once a quarter, and ad hoc review.

(1) Periodic Review

Taking into consideration remaining period, creditworthiness of each reference entity constituting reference pool, subordination ratio of each rated bonds, JCR makes analysis of creditworthiness of the rated bonds at the time of the periodic review.

In principle, JCR upgrades, downgrades or affirms the rating as a result of the analysis.

After approval at the rating committee, JCR's responsible analyst informs the arranger of the rating result immediately.

The industrial analysts covering shadow rating of the reference entities also review ratings on such entities before the periodic review.

(2) Periodic Monitoring

JCR adopts periodic monitoring system where JCR examines carefully changes in rating on the reference pool in addition to the periodic review.

JCR checks changes made after the last review in rating on the reference pool once every three months. As a result of the examination, JCR will make an ad hoc review as described below and revise the rating when such changes can cause deterioration in creditworthiness above a certain level.

The periodic monitoring can allow JCR to avoid changing its rating on the bonds significantly at the time of periodic review.

(3) Ad hoc Review

When it is deemed that a rating on the bonds might be lowered as a result of a rating on a reference entity constituting the reference pool having been downgraded by a certain notches or to a certain level, JCR makes an ad hoc review of such bonds.

At the ad hoc review, JCR places the rating on the bonds that could change under Credit Monitor. JCR will then examine carefully the rating on the overall reference pool and holds a rating committee to review the rating.

At each time of placement of Credit Monitor and review of rating, JCR's responsible analyst informs the arranger of such rating results.

When it is deemed that the rating on the bonds might be lowered below a certain level at the time of periodic monitoring, JCR also makes an ad hoc review and changes the rating.

Table1: JCR's Classification Table of Business Categories for CDO

	JCR's Classification Table of Business Categories for CDO
1	Agriculture & forestry, fishery, and mining
2	Foods
3	Textiles
4	Wood products, paper, and pulp
5	Petroleum and chemistry
6	Ceramics, and soil & stone
7	Iron and steel
8	Nonferrous metals and metals
9	Automobiles and parts of automobiles
10	Industrial machinery, manufacturing machinery, and transportation machinery (excluding automobile-related machinery)
11	Electric machinery, precision machinery, optical machinery, and business machinery
12	Medicines and cosmetics
13	Other manufacturing industries
14	Civil engineering and construction
15	Real estate
16	Railway
17	Transportation
18	Printing and publishing
19	Telecommunication and broadcasting
20	Wholesales
21	Retails
22	Restaurants
23	Services for corporations
24	Services for individuals
25	Banks
26	Securities companies
27	Life insurance companies and non-life insurance companies
28	Non-banks
29	Public utilities (electricity, gas, and local public-interest companies)
30	Others (public corporations, publicly-owned corporations)
31	Others (local public authorities)
32	Others (individuals, schools)

Table2: The Assumed Default Rate Table

	1	2	3	4	5	6	7	8	9	10
AAA	0.002%	0.008%	0.017%	0.032%	0.050%	0.073%	0.100%	0.132%	0.168%	0.209%
AA+	0.007%	0.027%	0.058%	0.100%	0.152%	0.213%	0.285%	0.366%	0.457%	0.557%
AA	0.019%	0.065%	0.133%	0.221%	0.327%	0.451%	0.591%	0.747%	0.918%	1.104%
AA-	0.035%	0.110%	0.213%	0.341%	0.490%	0.659%	0.847%	1.052%	1.274%	1.512%
A+	0.045%	0.135%	0.257%	0.404%	0.575%	0.767%	0.978%	1.206%	1.452%	1.713%
A	0.082%	0.225%	0.407%	0.618%	0.856%	1.115%	1.395%	1.692%	2.007%	2.336%
A-	0.127%	0.324%	0.561%	0.827%	1.118%	1.428%	1.757%	2.102%	2.461%	2.833%
BBB+	0.151%	0.375%	0.638%	0.929%	1.243%	1.576%	1.926%	2.291%	2.669%	3.059%
BBB	0.233%	0.537%	0.876%	1.238%	1.619%	2.014%	2.422%	2.841%	3.269%	3.705%
BBB-	0.642%	1.386%	2.167%	2.971%	3.789%	4.617%	5.450%	6.288%	7.127%	7.966%
BB+	0.957%	2.011%	3.095%	4.192%	5.295%	6.399%	7.501%	8.598%	9.689%	10.772%
BB	2.541%	5.013%	7.422%	9.769%	12.056%	14.284%	16.456%	18.572%	20.635%	22.645%
BB-	4.541%	8.421%	11.984%	15.310%	18.440%	21.399%	24.206%	26.877%	29.422%	31.852%
B+	5.713%	10.340%	14.490%	18.296%	21.825%	25.121%	28.214%	31.125%	33.874%	36.476%
B	10.077%	17.185%	23.186%	28.447%	33.146%	37.392%	41.259%	44.801%	48.061%	51.072%
B-	14.388%	23.044%	29.914%	35.682%	40.665%	45.044%	48.940%	52.437%	55.597%	58.470%
CCC	20.104%	30.031%	37.411%	43.345%	48.306%	52.553%	56.250%	59.507%	62.404%	65.000%
CC	30.284%	43.224%	52.133%	58.862%	64.188%	68.529%	72.139%	75.187%	77.792%	80.038%
C	40.196%	58.130%	69.420%	77.108%	82.568%	86.554%	89.522%	91.765%	93.482%	94.809%

Appendix : Mathematical Background of Corporate Value Model

Corporate value mode is called structural model that is a modeling of occurrence of default event, which is defined that a corporate asset value decreases below face value of the debt. This model assumes that the asset values change stochastically. There are many factors for changes in corporate asset value including equity and claims. It decides the corporate default by whether the corporate value at a specific time point falls below a predetermined debt value, expressing all these factors in a single stochastic process. It can be thought of as a European call option with the corporate value as the underlying asset and the debt value as the strike price, because default occurrence is defined only at maturity of CDOs.

Under the assumption that the corporate value changes stochastically due to factor X whose changes are uncertain, the corporate value model defines the corporate value of a reference entity as follows:

$$V = a \cdot X + \sqrt{1 - a^2} \cdot \varepsilon$$

Where,

V : Corporate Value

X : Systematic Factor

ε : Residual Factor

X, ε follow normal distributions and they are independent from each other.

X is assumed to be an environmental factor such as economic conditions, and the corporate value is expressed as a sum of changes due to this macro environment (the first factor) and changes due to individual factor of the corporation that is not affected by the first factor.

To reflect the sectoral concentration risk in the portfolio further, the following two-parameter corporate value model is assumed.

$$V = a \cdot X + \sqrt{1-a^2} \cdot b \cdot \varepsilon_1 + \sqrt{1-a^2} \cdot \sqrt{1-b^2} \cdot \varepsilon_2$$

Where,

$X, \varepsilon_1, \varepsilon_2$ follow normal distributions and they are independent from one another.

This model expresses changes due to inter-industry correlation by setting an industrial factor, the second factor. The coefficient of the second factor, b, is the same for corporations in the same industry. If there are many reference entities belonging to the same industry, the corporate value fluctuates easily due to the same industrial factor for this reason. In cases where this change is extreme, fluctuations in the same direction increase for default rates so that it can indicate the sectoral concentration risk.

JCR determines the possibility of default occurrence by comparing result of V calculated by substituting standard normal random variables generated into $X, \varepsilon_1, \varepsilon_2$ and the default threshold (calculated from assumed default rate for each reference entity).

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