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# APERCU

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## ASSESSING FINANCIAL DISTRESS – THE ALTMAN Z-SCORE

Bankruptcy, insolvency and unemployment are all too familiar terms. Unfortunately, the economic outlook for the coming months remains uncertain, with a continued global slowdown, debt concerns in China, geopolitical risks, weak commodity prices and volatile financial markets.

The normal two-fold assessments of financial distress are:
1) the cash-flow test: whether a company is able to pay its debts as they become due; and
2) the balance sheet test: whether the value of the company's assets is less than its liabilities.

As insolvency and restructuring professionals, we wish to highlight another early-warning test that all investors and stakeholders can use — the Altman Z-score.

### Background

The Altman Z-score (known as the Z-score or Z) combines five weighted business ratios to estimate the likelihood of financial distress.

The Z-score was developed in 1968 by Dr Edward Altman, who applied a set of five financial ratios based on multiple discriminant analysis to a dataset of publicly held manufacturers. It can be used to assess financial health and evaluate a company's likelihood of bankruptcy within two years.

The Z-score assesses companies by analysing the ratios between:
- working capital and total assets;
- retained earnings and total assets;
- earnings before interest and taxes (EBIT) and total assets;
- market value and book value of liabilities; and
- sales and total assets

The basic formula for calculating the Z-score is as follows:

$$Z - \text{Score} = \text{Coeff}_1 \frac{\text{Working Capital}}{\text{Total Assets}} + \text{Coeff}_2 \frac{\text{Retained Earnings}}{\text{Total Assets}} + \text{Coeff}_3 \frac{\text{EBIT}}{\text{Total Assets}} + \text{Coeff}_4 \frac{\text{Equity Value}}{\text{Total Liabilities}} + \text{Coeff}_5 \frac{\text{Sales}}{\text{Total Assets}}$$

## Z-Score analysis

| Business ratios | Measurement | Description |
|---|---|---|
| Working capital/total assets | Liquidity | This measures liquid assets of the firm, as firms in trouble will usually experience shrinking liquidity |
| Retained earnings/total assets | Profitability | This indicates the cumulative profitability of the firm, as shrinking profitability is a warning sign |
| EBIT/total assets | Productivity | This ratio shows how productive a company is in generating earnings, relative to its size |
| Equity value/total liabilities | Solvency | This offers a quick test of how far the company's assets can decline before the firm becomes technically insolvent (ie its liabilities exceed its assets) |
| Sales/total assets | Asset turnover | Asset turnover is a measure of how effectively the firm uses its assets to generate sales |

The original model (Model 1) was designed to assess large listed manufacturing companies. In 1983, a model for privately-held manufacturing companies (Model 2) and a model for privately-held general non-manufacturing companies (Model 3) were developed.

Different values were assigned for the coefficients associated with each model as follows:

| Models | Coeff $_1$ | Coeff $_2$ | Coeff $_3$ | Coeff $_4$ | Coeff $_5$ |
|---|---|---|---|---|---|
| **Model 1** | 1.2 | 1.4 | 3.3 | 0.6 | 0.999 |
| **Model 2** | 0.717 | 0.847 | 3.107 | 0.42 | 0.998 |
| **Model 3** | 6.56 | 3.26 | 6.72 | 1.05 | – |

For Model 1, the equity value is the market value of the company. For Model 2, it is the book value of the company.

There is no coefficient for the ratio between sales and total assets in Model 3 because privately-held non-manufacturing companies tend to be less capital-intensive.

Overall, the Z-score is classified into three "zones" as follows:

| Models | Safe zone | Grey zone | Distress zone |
|---|---|---|---|
| **Model 1** | $Z > 2.99$ | $1.81 < Z < 2.99$ | $Z < 1.81$ |
| **Model 2** | $Z > 2.90$ | $1.23 < Z < 2.90$ | $Z < 1.23$ |
| **Model 3** | $Z > 2.60$ | $1.10 < Z < 2.60$ | $Z < 1.10$ |
| **Possibility of bankruptcy** | Low | Medium | High |

Accordingly, the higher the derived Z-score, the healthier the company is in financial terms. For example, a score above 3 in Model 1 indicates that the company is financially sound, whilst a score below 1.8 indicates that the company is in financial distress and has the potential of bankruptcy.

In general, attention is considered necessary for any company with a Z-score that lies outside of the safe zone.

## Effectiveness of the Z-score

Studies have revealed that the Z-score model has a 70% to 90% reliability for predicting bankruptcy.

However, the Z-score is not intended to predict when a firm will enter bankruptcy. Instead, it is a measure of how closely a firm resembles other firms that have filed for bankruptcy; ie it assesses the likelihood of economic bankruptcy.

As a quick test of its effectiveness, we have randomly selected ten companies whose listing on the Hong Kong Stock Exchange has been suspended and analysed their respective Z-scores for the last two financial years. These companies were suspended for various reasons, including defaulting on loan repayments.

| Z-score | Coy A | Coy B | Coy C | Coy D | Coy E | Coy F | Coy G | Coy H | Coy I | Coy J |
|---|---|---|---|---|---|---|---|---|---|---|
| **Model 1** | | | | | | | | | | |
| **FY 1** | 2.81 | 4.64 | (0.98) | (3.60) | 3.56 | 1.23 | (3.99) | 1.29 | 5.98 | (5.03) |
| **FY 2** | 0.56 | 3.70 | (6.06) | (1.28) | 2.80 | 0.11 | (5.71) | (0.71) | 2.18 | (5.15) |

Based on the Z-score analysis of the ten companies above, we noted that in the second financial year (FY2), seven out of the ten companies fell within the distress zone (ie they had a score of less than 1.81). Another two companies fell into the grey zone, as their score was less than 2.99.

Only one company, Company B, had a score within the safe zone. However, we noted that Company B's Z-score had declined from 4.64 to 3.70 over the two financial years we analysed. This indicated that its financial health was deteriorating.

Overall, based on our analysis above, the Z-score appears to be consistent in assessing potential bankruptcy.

### Limitations of the Z-score

The Z-score model has received several statistical objections over the years. The original model uses unadjusted accounting data that is around 60 years old from firms that are relatively small. Nevertheless, despite these flaws, the original Z-score model is still a widely used measure of corporate financial distress.

However, the Z-score analysis is not recommended for financial companies or companies with substantial off-balance-sheet items. Other sophisticated models, such as the Merton model or the Jarrow-Turnbull model, may be used in such instances.

The Merton model and the Jarrow-Turnbull model are complex instruments that price credit risk using a multi-factor and dynamic analysis of interest rates. These models assess a company's ability to meet its financial obligations and service its debt and whether or not the company will go into credit default.

### Recommendations

Even though the Z-score is a commonly used metric with a wide appeal, it is just one of many credit-scoring models in use today that combine quantifiable financial indicators with a small number of variables in order to predict whether a firm will fail.

Our Specialist Advisory Services team can assist in analysing the financial health of various types of companies. We are also able to share valuable advice and experience regarding specific and practical solutions for companies in a distressed situation.


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# BDO HONG KONG NEW APPOINTMENTS

**RICKY CHENG**
Director & Head of Risk Advisory

**Ricky Cheng** has been appointed as Head of Risk Advisory with effect from 1 October 2016.

Ricky is a director and has 20 years of risk and assurance experience. His expertise covers various services such as Sarbanes-Oxley Compliance, risk management assessment, compliance assistance, corporate governance compliance review, internal audit assistance, business process review, Environmental, Social and Governance (ESG) readiness and reporting support services review, stored value facilities (SVF) licence independent assessment review, etc.

The portfolio of clients managed by Ricky comes from various industries including transportation, property development and construction, gaming and entertainment, hospitality, manufacturing, gold and minerals mining, fast moving consumer goods, retailing and department chain stores, financial institutions such as brokerage houses and derivative products companies.

Ricky was a Committee Member of ACCA Hong Kong for the period 2011-2013. He has also been a training committee member of The Hong Kong Institute of Directors since 2013. He is a Fellow of the Hong Kong Institute of Certified Public Accountants and Association of Chartered Certified Accountants; and a Certified Internal Auditor.

**CAROL LAM**
Director
Tax Services

**Carol Lam** was appointed as Director of Tax Services with effect from 1 October 2016.

Carol has extensive experience in taxation practice in Hong Kong providing tax consulting and compliance services to multinational organisations, listed groups as well as private companies from a wide range of industries, including manufacturing, trading, retail, real estate, financial services, transportation, aircraft and logistics and professional firms.

Carol is experienced in advising on tax-efficient operation, holding and financing structure, corporate restructuring, pre-listing tax planning, cross border transactions, transfer pricing, due diligence and mergers & acquisition deals. She also has extensive experience in advising international assignees in structuring tax-efficient remuneration packages, and in representing clients in tax investigation and field audit cases and handling tax dispute settlement.

Carol is a Fellow of the Association of Chartered Certified Accountants, a Hong Kong Certified Public Accountant, and a Fellow Member of The Taxation Institute of Hong Kong.

**WINNIE CHEUNG**
Director
Assurance Services

**Winnie Cheung** was appointed as Director of Assurance with effect from 1 October 2016.

Winnie has extensive experience in handling Hong Kong and Singapore listed company audit assignments for a variety of industries, including manufacturing, electronics, travel-related and consumer products, construction and clinics. She also specialises in transaction support assignments, such as initial public offerings and financial due diligence in acquisitions of companies.

Winnie is a Hong Kong Certified Public Accountant.

**ANITA OR**
Principal
Assurance Services

**Anita Or** was appointed as Principal of Assurance with effect from 1 October 2016.

Anita has extensive experience in handling Hong Kong listed company audit assignments over a wide variety of industries, including trading, manufacturing, pharmaceutical and property investment. She is also involved in transaction support assignments, such as initial public offerings and financial due diligence.

Anita is a Hong Kong Certified Public Accountant and a member of the Association of Chartered Certified Accountants.

**CALVIN CHAU**
Principal
Assurance Services

**Calvin Chau** was appointed as Principal of Assurance with effect from 1 October 2016.

Calvin has extensive experience in handling assignments of listed companies and private companies operating mainly in Hong Kong, Mainland China and a number of overseas countries over a wide variety of industries including construction, manufacturing and trading, mining, public utilities services, advertising and property development.

Calvin also has extensive exposure on initial public offerings, especially on A+H shares listing, merger and acquisition exercises, as well as financial due diligence investigations for listed companies.

Calvin is a Fellow of the Association of Chartered Certified Accountants.

**MARGIE CHOI**
Principal
Assurance Services

**Margie Choi** was appointed as Principal of Assurance with effect from 1 October 2016.

Margie has extensive experience in handling assignments of listed and private companies operating mainly in Hong Kong, Mainland China and a number of overseas countries over a wide variety of industries including financial services, gaming and hospitality, manufacturing and trading, retail, travel and tourist services, property development and construction.

Margie also has extensive exposure on initial public offerings, merger and acquisition exercises, as well as financial due diligence investigations for listed companies.

Margie is a Hong Kong Certified Public Accountant.

**RAYMOND WONG**
Principal
Assurance Services

**Raymond Wong** was appointed as Principal of Assurance with effect from 1 October 2016.

Raymond has extensive experience in handling assignments of listed companies and private companies operating mainly in Hong Kong, Mainland China and a number of overseas countries over a wide variety of industries including manufacturing and trading, hotel operation, telecommunication, toys, construction, garments, natural resources, ship-management and chartering, jewellery, forestry and property development.

Raymond also has extensive exposure on initial public offerings, merger and acquisition exercises, as well as financial due diligence investigations for listed companies.

Raymond is a Hong Kong Certified Public Accountant and a member of CPA Australia.

**SALLY CHAN**
Principal
Assurance Services

**Sally Chan** was appointed as Principal of Assurance with effect from 1 October 2016.

Sally has extensive experience in the audit of listed companies and major private companies in different industries including property development, printing, trading and manufacturing. She has also involved in various transaction support assignments including initial public offerings as well as mergers and acquisitions.

Sally is a Hong Kong Certified Public Accountant and a Fellow of the Association of Chartered Certified Accountants.

**VICKY KWOK**
Principal
Assurance Services

**Vicky Kwok** was appointed as Principal of Assurance with effect from 1 October 2016.

Vicky has extensive experience in handling assignments of listed companies and private companies operating mainly in Hong Kong, Mainland China and a number of overseas countries over a wide variety of industries including trading, manufacturing, natural resources and financial and investment advisory services. Vicky also has engaged in special assignments including financial due diligence of listed companies.

Vicky is a Hong Kong of Certified Public Accountants and a Fellow Member of the Association of Chartered Certified Accountants.

**NAVY TANG**
Principal
Tax Services

**Navy Tang** was appointed as Principal of Tax Services with effect from 1 October 2016.

Navy has extensive experience in the provision of Hong Kong corporate tax compliance services and advisory services to local and multinational companies in various industries, including financial institutions, insurance companies, manufacturing, telecommunication, trading and retailing.

Navy also has extensive experience in tax due diligence reviews on mergers and acquisitions, conducting operational review, identifying tax efficient restructuring opportunities, tax return filing and handling tax disputes and enquiries.

Navy is a Fellow of the Association of Chartered Certified Accountants.

**DANIEL MARTIN**
Principal
Specialist Advisory Services

**Daniel Martin** was appointed as Principal of Specialist Advisory Services with effect from 1 September 2016.

Daniel has extensive experience in providing valuation, due diligence, business recovery and related advisory services to the corporate sector including, private equity, multinationals and listed companies.

Daniel has gained knowledge and experience in dealing with corporate finance issues of companies operating in different sectors, geographical locations and at various stages of their life cycles. He has worked on assignments with small to very large organisations covering, entertainment, financial services, information technology, mining, manufacturing, and retail.

Daniel is a Hong Kong Certified Public Accountant and a Chartered Accountant Australia & New Zealand.

**ALICE CHOI**
Principal
Quality Assurance

**Alice Choi** was appointed as Principal of Quality Assurance Department with effect from 1 October 2016.

Alice focuses on quality assurance and risk management. She has extensive experience in the audit of both listed and privately-owned enterprises operating in Hong Kong and Mainland China across a wide range of industries, including manufacturing and trading business, infrastructure, property development and natural resources.

Alice is a Hong Kong Certified Public Accountant and a Fellow member of the Association of Chartered Certified Accountants.

**SIMON FUNG**
Principal
Quality Assurance

**Simon Fung** was appointed as Principal of Quality Assurance Department with effect from 1 October 2016.

Simon has ten years' audit experience in audits of private and listed companies over a wide variety of industries, including manufacturing, trading, advertising, retailing, logistics, telecommunication and construction.

Simon is principally involved in evaluating the quality of the professional work carried out by assurance division, sharing best practices and experience among different teams, providing practical advice to professionals in enhancing work quality and efficiency.

Simon is a Hong Kong Certified Public Accountant and a Fellow of the Association of Chartered Certified Accountants.

**GUY PIESSE**
Principal
Technical and Training

**Guy Piesse** was appointed as Principal of Technical and Training Department with effect from 1 October 2016.

Before joining BDO Hong Kong's technical team, Guy built up ten years of audit experience with BDO London, handling assignments of listed and private companies operating mainly in the UK.

Guy is now responsible for providing HKFRS reviews for listed issuers in Hong Kong and has substantial experience in this field.

Guy is a member of the Institute of Chartered Accountants in England and Wales.

**TONY CHING**
Principal
Technical and Training

**Tony Ching** was appointed as Principal of Technical and Training Department with effect from 1 October 2016.

Tony is responsible for the compliance of auditing standards of the firm. He also provides audit and assurance (A&A) advisory services to the firm's A&A practice and delivers related training to the professional personnel.

Tony has over 10 years experience in assurance practice. His portfolio of clientele covers a broad spectrum of business sectors including manufacturing, trading, agriculture, natural resources, education, entertainment, consumer markets and network infrastructure. He has extensive experience in auditing business enterprises listed in Hong Kong, Mainland China and the United States. He was also involved in other assignments including initial public offerings and capital market transactions.

Tony is a Fellow of the Association of Chartered Certified Accountants.

# THE MPF DEFAULT INVESTMENT STRATEGY FOR ENHANCEMENT OF THE HONG KONG MANDATORY PROVIDENT FUND SYSTEM

In our April 2016 publication on updates of amendments to Mandatory Provident Fund (MPF) legislation, we highlighted the major initiatives to be implemented by the Mandatory Provident Fund Schemes Authority (MPFA) for enhancement of the MPF system. These include (i) the introduction of a Default Investment Strategy (DIS); and (ii) the introduction of an electronic platform for centralising members' access to their MPF-related information, processing of transactions and payments.

The MPFA has recently announced that the Mandatory Provident Fund Schemes (Amendment) Ordinance 2016 was passed by the Legislative Council and will take effect from 1 April 2017. The Default Investment Strategy will be launched on the same day. According to the Amendment Ordinance, each MPF scheme has to offer the DIS to scheme members as an investment choice.

### About the DIS

The DIS is designed in response to the criticisms of the MPF system among the 2.6 million Hong Kong employees, such as high fees and low returns, administrative inefficiency, etc. The DIS is a standardised, low cost investment choice designed for MPF scheme members who have difficulty in making investment decisions (eg lack of knowledge or lack of time). For scheme members who do not provide their investment choice to their trustees, their MPF benefits will default to be invested according to the DIS funds. Existing scheme members may also choose to switch their investments to the DIS funds at any time.

The DIS contains two constituent funds (CF): the Core Accumulation Fund (CAF) and the Age 65 Plus Fund (APF).

Table 1

| Constituent funds of DIS | Lower risk assets (eg global bonds) | Higher risk assets (eg global equities) |
|---|---|---|
| Core Accumulation Fund | 40% | 60% |
| Age 65 Plus Fund | 80% | 20% |

Table 2

| Age of scheme members | Investment strategy | Investment allocation | |
|---|---|---|---|
| | | Lower risk assets (Predominantly in global bonds) | Higher risk assets (Predominantly in global equities) |
| Under 50 | Relatively aggressive | 40% | 60% |
| 50 to 64 | Gradual risk reduction | Progressive and regular percentage of switching from 60% higher risk assets to 20% higher risk assets (at around 6.7% of assets each year) | |
| 65 and above | Relatively conservative | 80% | 20% |

The CAF will hold around 60% assets in higher risk assets, such as global equities, and 40% in lower risk assets, such as global bonds. The APF will hold 20% in higher risk assets and 80% in lower risk assets (see **Table 1**).

Before age 50, all MPF contributions made by the scheme members will be invested into the CAF. However, starting from age 50 up to and including 64, accrued MPF benefits of scheme members in the CAF will automatically and gradually be switched to the APF. This switch will be based on a specified percentage to accomplish the objectives of progressive reduction of exposure to higher risk investments, thus achieving the purpose of de-risking (see **Table 2**).

### Statutory management fee cap

The DIS also features a statutory management fee cap, as the amount of management fee charges to an MPF constituent fund (CF) has a significant impact on long-term investment outcomes. On this basis, the amount of management fee charges to the CFs in the DIS is capped at 0.75% of net asset value (including asset based fees paid for services of trustee, administrator, investment fund manager, etc but excludes out-of-pocket expenses). This fee cap is approximately half of the average fee level currently charged to existing MPF funds and is subject to regular reviews for downward adjustment in the future.

The strategy of DIS, after consideration of the needs of average MPF scheme members, is aimed at balancing the risks and returns in the long-term investment objective of retirement savings through the above two CFs.

However, employees should be aware that although the investment strategy is highly standardised, the funds under different schemes adopt different investment approaches. Thus a standardised investment strategy does not equate to standardised investment returns. Employees should keep an eye on the performance of their investment funds under their MPF schemes and may switch investment portfolios based on their investment choices in order to yield better returns.

We believe that the MPFA will continue to launch reform measures to enhance the MPF system in future. It is therefore important for both employers and employees to keep abreast of the forthcoming changes in MPF requirements, as these will impact their margins and future retirement benefits respectively.

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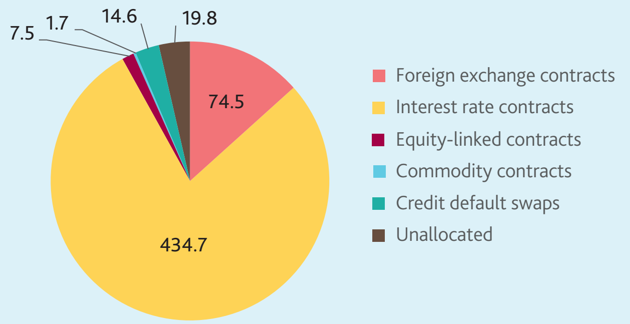
# INTRODUCTION TO COUNTERPARTY RISK AND CREDIT VALUE ADJUSTMENT

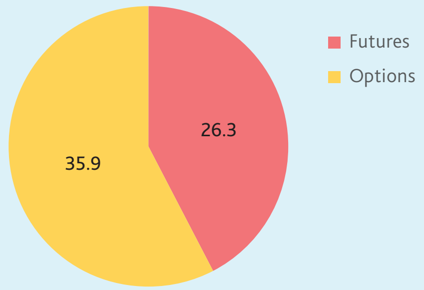
## 1. Introduction to the Over The Counter (OTC) derivatives market

With the advent of margin trading and an increasing range of derivative products available, more and more market participants are enrolling in the trading of derivatives. Growth in the volume of OTC derivative trading has exploded over the last two decades, and, according to statistics from the Bank for International Settlements, in the first half of 2015 the total notional value of OTC derivatives traded was US$553tn, including credit default swaps and foreign-exchange, interest-rate, equity-linked, commodity and other contracts, as shown in the chart below. This significantly exceeded the amount of US$62tn for exchange-traded instruments over the same period, which includes futures and options.

**Global OTC market derivatives - notional outstanding in H1 2015 (in trillions of US dollars)**




**Global exchange traded instrument - notional outstanding in H1 2015 (in trillions of US dollars)**




The popularity of OTC markets is partly driven by the ability to customise contracts according to the specific needs of participants. In the OTC market, interest-rate contracts are the most common instrument (80%), with foreign-exchange contracts (13%) ranking second.

Following the global financial crisis in 2008, policymakers, regulators and market participants began to realise that no counterparties were completely protected from or immune to financial distress. A stable and healthy derivatives market should not simply rely on large dominant financial institutions; rather, it should comprise a full range of small, medium and large institutions, which should be capable of weathering financial storms with less dramatic consequences. Due to the size of the OTC derivatives market that has emerged over the last decade, industry participants have begun to highlight counterparty risk in the pricing of derivatives and in trading regulations – even for entities with high credit ratings that were previously deemed to be "too big to fail".

Counterparty risk is the risk faced by both parties to a contract should one party default and not be able to meet all of its obligations under the contract. Counterparty risk is a combination of market risk, which is represented by the expected exposure, and credit risk, which is represented by the default probability of the counterparty.

When valuing derivative instruments, a key component is a credit valuation adjustment (CVA), which attempts to quantify the impact of counterparty risk.

In a CVA valuation, the following three key assumptions are applied:

a. The institution in the subject contract cannot default (whilst the counterparty could default).
b. A risk-free valuation can be performed in a straightforward way.
c. There is no correlation between credit exposure and default probability, or there is no wrong-way risk. Wrong-way risk is a type of risk that occurs when exposure to the counterparty is adversely correlated with its credit quality; ie, when the credit quality of the counterparty deteriorates, the exposure is more likely to rise.

The standard equation applied in a CVA is shown below. For simplicity, this article does not include the detailed mathematical derivation of this equation.

**Equation 1**

$$\textit{Credit Value Adjustment} \cong \textit{Loss Given Default} * \sum_{i=1}^{m} \textit{Discount Factor}\,(t_i) * \textit{Expected Exposure}\,(t_i) * \textit{Default Probability}\,(t_{i-1}, t_i)$$

Each key component of the above is explained further in the following section, with simple numerical examples included to illustrate the key concepts.

## 2. Key CVA components

### A. Loss given default (LGD)

LGD = 1 – Recovery Rate

The recovery rate refers to the percentage of contractual claims that would be recovered if the counterparty defaults. LGD, therefore, represents the percentage that would be lost if the counterparty defaults. Recovery rates can show wide variation within the same industry sector and between different industries, and they may also be affected by the seniority, settlement type (netting, collateral) and settlement time of the claim.

### B. Expected exposure

Credit exposure is the market risk component of counterparty risk. In order to understand expected exposure, we must first understand the concept of current exposure. To illustrate, we will use two entities, Institution A (Entity A) and Counterparty B (Entity B), who have entered into a fixed-to-floating swap contract, in which Entity A acts as the fixed-rate payer (floating-rate receiver) while Entity B acts as the floating-rate payer (fixed-rate receiver).

At the initiation of the swap contract, Entities A and B both have zero exposure. As time passes, any changes between the fixed rate and the floating rate will result in a positive exposure for one party and a corresponding negative exposure for the other. **Table 1** summarises the exposure, impact and payoff in four different scenarios:

**Table 1 Swap contract exposure scenarios and default payoffs**

| Scenario | Default party | Exposure | Impact | Payoff at default* |
|---|---|---|---|---|
| 1 | $V_{Fix} > V_{Float}$<br>A defaults | A: negative exposure<br>B: positive exposure | Entity A: Gain<br>Entity B: Loss | $-Rec_A * (V_{Fix} - V_{Float})$ |
| 2 | $V_{Fix} > V_{Float}$<br>B defaults | A: negative exposure<br>B: positive exposure | Entity A: No gain<br>Entity B: No loss | $-(V_{Fix} - V_{Float})$ |
| 3 | $V_{Fix} < V_{Float}$<br>A defaults | A: positive exposure<br>B: negative exposure | Entity A: No loss<br>Entity B: No gain | $+(V_{Float} - V_{Fix})$ |
| 4 | $V_{Fix} < V_{Float}$<br>B defaults | A: positive exposure<br>B: negative exposure | Entity A: Loss<br>Entity B: Gain | $+Rec_B * (V_{Float} - V_{Fix})$ |

*Note: payoff is shown from the point view of Entity A. For example, a minus sign refers to cash outflows for Entity A (Entity A pays Entity B) while a plus sign refers to cash inflows for Entity A (Entity B pays Entity A).

In the table above, $V_{Fix}$ represents the value of the fixed-rate receiver's contractual position (or the value of the fixed leg) on the specific date selected during the term of the swap, whilst $V_{Float}$ represents the value of the floating-rate receiver's position (or the value of the floating leg). $Rec_A$ represents the recovery rate of Entity A, whilst $Rec_B$ represents the recovery rate of Entity B.

In Scenario 1, when $V_{Fix} > V_{Float}$, Entity A is obligated to make the full contractual payment (after any netting) to Entity B. At that moment, Entity A has negative exposure and is not subject to any counterparty risk (which assumes that Entity B will not default in this position), while Entity B has positive exposure and is subject to the counterparty risk of Entity A. If Entity A defaults, Entity B would only be able to recover a percentage of the total claim from Entity A, which is represented by the payoff formula $-Rec_A * (V_{Fix} - V_{Float})$. Entity B would then incur a loss, since it would be claiming less than the full amount $(V_{Fix} - V_{Float})$ owed by Entity A, while Entity A would gain, since it would be paying less than the full amount $(V_{Fix} - V_{Float})$ owed to Entity B under the contract.

Scenarios 2 and 3 in the table above illustrate that when one party that has positive exposure (ie, when the counterparty is obligated to pay) defaults, neither party in the contract would gain or lose. Scenarios 1 and 4 illustrate that when one party that has negative exposure (the party obligated to pay) defaults, this party would gain and the counterparty would lose.

Current exposure is, then, straightforward, representing the known exposure of either party to a specific contract under current market conditions. Future exposure, however, remains uncertain, given that exposure will change as $V_{Fix}$ and $V_{Float}$ change in the market. The expected exposure at a specific point in time is then calculated as the average of all positive future exposure values. The expected exposure is a key component of a CVA, which is usually the most complicated element of a CVA calculation. We provide a numerical example in Section 3 below.

**C. Default probability**
Default probability describes the likelihood of a default (failure to meet repayment/debt obligations) during a particular period of time.

To calculate default probability, two different default probabilities first need to be compared: real-world default probabilities and risk-neutral default probabilities. Real-world default probabilities are derived from historical data and are used in risk management or scenario analysis, while risk-neutral default probabilities are implied from market prices and are used for hedging purposes.

A real-world default probability is usually smaller than a risk-neutral default probability due to the fact that investors holding a bond, for example, are compensated for components other than just the expected default loss, including an illiquidity premium or a default risk premium. These are premiums that investors would usually require when accepting the potential default risk of the underlying bond.

A risk-neutral default probability is the probability used in a CVA calculation. The most common way to derive this is to use bond prices and their respective credit spreads.

The calculation formula for $Default\ Probability\ (t_{i-1}, t_i)$ is shown in Equation 2 below. For the purpose of simplicity, this article has not included details of the derivation of this formula.

**Equation 2**

$$Default\ Probability\ (t_{i-1}, t_i) = \exp\left[-\frac{Spread_{ti-1}}{(1 - Recovery\ Rate)}\, t_{i-1}\right] - \exp\left[-\frac{Spread_{ti}}{(1 - Recovery\ Rate)}\, t_i\right]$$

In **Equation 2** above, $Spread_{ti}$ represents the credit spread implied by the prices of bonds issued by the counterparty at time $t_i$, whilst Recovery Rate represents the recovery rate of the counterparty when it defaults.

## 3. Practical numerical example

The traditional valuation method adopted when valuing convertible bonds (CBs) uses two separate discount curves: (i) a risk-free discount curve for the equity component of the bond; and (ii) a risked discount curve for the debt component.

The paragraph above assumes that counterparty default risk has no impact on the equity component of the bond, for which a risk-free rate can then be applied to discount the equity component. However, this assumption is unsatisfactory, as research has demonstrated that share prices of listed companies decline prior to any negative news event and may even experience a significant decline upon the announcement of such an event, since the financial market is not perfectly efficient or fast enough to reflect all the market information that is available. From this perspective, the stock options or underlying embedded equity components of a CB are not totally risk-free; they are subject to counterparty default risk, similar to other corporate bonds.

In this section we provide a simple numerical example to illustrate the process of calculating a CVA for the equity component of a CB. The following assumptions are adopted in our example and are further explained below:

1. The credit spread and recovery rate are constant; therefore, the hazard rate is also constant.
2. There are only five points in time, matching the five time steps in the binomial tree, when the counterparty is likely to default.

In our July 2015 issue of APERCU, we introduced the Binomial Model valuation methodology for CBs, which covered the step-by-step formation of the stock-price tree and backward induction at each node of the binomial tree. This article will not cover these points again; it will focus only on the calculation of the expected exposure for the equity component and the CVA. The parameters of a vanilla-type CB are listed in **Table 2**:

**Table 2 Basic terms of our example CB**

| Parameter | Value | Parameter | Value |
|---|---|---|---|
| Issue date | 31/12/2014 | Volatility | 60.0% |
| Maturity date | 31/12/2015 | Risk-free rate | 2.0% |
| Principal amount | HK$50m | Credit spread of issuer | 7.0% |
| Face value | 100 | Dividend yield | 0.0% |
| Stock price | HK$50 | Coupon rate | 0.0% |
| Number of steps | 5 | Recovery rate | 40% |
| Conversion price | HK$80 | | |

A binomial tree is constructed as shown below, with the numbers shown in blue in each node representing the equity component of that specific node. This is equal to the conversion value (the stock price at the corresponding node multiplied by the number of convertible shares) if the behaviour in this node is "conversion", or it is equal to the discounted value (the discounted value of the probability-weighted average payoffs of the two attached nodes in the next time interval) if the behaviour in this node is "hold". The numbers in black below show the probability of a specific node, derived by the equity price movement up or down using risk-neutral probabilities (as also covered in our July 2015 APERCU article).

| 0 | | 1 | | 2 | | 3 | | 4 | | 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 18.35 | 100.00% | 35.22 | 44.07% | 65.23 | 19.42% | 114.43 | 8.56% | 182.82 | 3.77% | 239.08 | 1.66% |
| | | 5.19 | 55.93% | 11.82 | 49.30% | 26.93 | 32.59% | 61.36 | 19.15% | 139.79 | 10.55% |
| | | | | 0.00 | 31.28% | 0.00 | 41.36% | 0.00 | 36.45% | 0.00 | 26.77% |
| | | | | | | 0.00 | 17.50% | 0.00 | 30.84% | 0.00 | 33.98% |
| | | | | | | | | 0.00 | 9.79% | 0.00 | 21.56% |
| | | | | | | | | | | 0.00 | 5.47% |

In each node, the equity exposure is equal to the equity component value. Therefore, in each time interval, we could derive the expected exposure using the equity component value (blue) and the probability (black). For example, in the third time interval, the expected exposure is calculated as (114.43*8.56%) + (26.93*32.59%) + (0.00*41.36%) + (0.00*17.50%) = 18.57. If the face value of the CB is US$100, the expected exposure is US$18.57. The expected exposure in other time intervals can be calculated in the same way.

The marginal default probability for each time interval could be derived using a delta t of 0.2, an issuer's credit spread of 7% and a recovery rate of 40%. For example, in the third time interval, and using Equation 2,

$$Default\ Probability\ (t_2,t_3) = \exp[-\frac{Spread_{t2}}{(1-Rec)}t_2] - \exp[-\frac{Spread_{t3}}{(1-Rec)}t_3] = \exp[-\frac{7.0\%}{(1-40\%)}*(0.2)*2] - \exp[-\frac{7.0\%}{(1-40\%)}*(0.2)*3] = 2.20\%$$

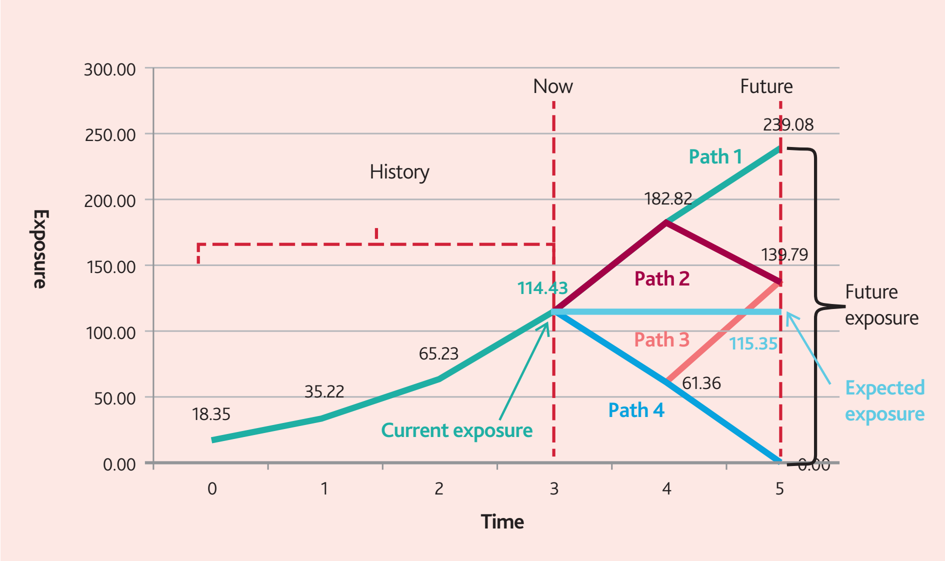
The default probability for other time intervals could be calculated in the same way, as listed in **Table 3** below.

Once the expected exposure, default probability and discount factor have been determined, **Equation 1** above can be applied to calculate the CVA. The CVA in this case is derived to be 1.21. This is applied as a basis of 100, with the CVA being equivalent to 1.21% of the face value of the CB. **(Table 3)**

**Table 3 CVA calculation**

| Time interval | $t_1$ | $t_2$ | $t_3$ | $t_4$ | $t_5$ |
|---|---|---|---|---|---|
| (1) Discount factor | 0.9960 | 0.9920 | 0.9881 | 0.9841 | 0.9802 |
| (2) Expected exposure | 18.42 | 18.50 | 18.57 | 18.64 | 18.72 |
| (3) Default probability | 2.31% | 2.25% | 2.20% | 2.15% | 2.10% |
| Product of (1), (2) and (3) | 0.42 | 0.41 | 0.40 | 0.39 | 0.39 |
| Loss given default (LGD) | 40% | 40% | 40% | 40% | 40% |
| CVA | | | 1.21 | | |

To further understand the concepts of current exposure, future exposure and expected exposure, we could assume that we are now at the third time interval, with the current equity component value and the historical path already known to be 114.43 and "up-up-up" respectively, as illustrated in the adjacent chart. The future path in the binomial tree is still uncertain at this moment, with four possible paths from the third time interval to the fifth time interval. We plot the future paths and mark the current exposure, future exposure and expected exposure in the following chart and table.




The expected exposure is then calculated as a probability weighting of each of the four future exposure steps, covering the remaining time intervals in the binomial tree, with an expected exposure of 115.35 at $t_5$. **(Table 4)**

In Hong Kong, most CBs issued by listed companies are not freely traded in the exchange or OTC markets. Most bonds are issued to one or several subscribers for refinancing or for funding acquisitions, with the fair value of the CB usually only needed for financial reporting purposes. Therefore, the market in Hong Kong will have less emphasis on pricing accuracy than markets such as the US, where a higher proportion of bonds are traded and where even a minor difference in pricing could result in large gains or losses for traders.

**Table 4 Calculation of expected exposure**

| Possible path from time to $t_3$ to $t_5$ | Probability | Future exposure at $t_5$ |
|---|---|---|
| Path 1 | 19.42% | 239.08 |
| Path 2 | 24.65% | 139.79 |
| Path 3 | 24.65% | 139.79 |
| Path 4 | 31.28% | 0.00 |
| Expected exposure at $t_5$ | 115.35 | |

The traditional CB valuation method already accounts for the default risk on the debt component of the bond by including a credit spread and other applicable premiums in the discount rate applied in the valuation of the debt component. Using the binomial model workings introduced in our July 2015 article, the value of the CB in this example was 98.58 (based on a face value of 100).

The above value does not, however, account for any counterparty default risk in the equity component. Our CVA calculation above, provides one method of quantitatively measuring the counterparty default risk. Based on the CVA of 1.21 in **Table 3** (again based on a face value of 100), this would generate a 1.23% (1.21/98.58) decrease in the CB value, resulting in a CB value of 97.37.

The CVA formula we have introduced in this issue could also be adopted for valuations of other types of instruments, including interest-rate or currency swaps.

## 4. Applying CVAs for financial reporting purposes

In the above numerical example, we adopted several simplified assumptions for ease of understanding, including fewer time steps in the binomial model, a constant credit spread, and the use of a CB with simple terms and no exotic features.

In reality, CBs and other financial instruments may have more complex features, which could make calculating a CVA more complex. For example, if the default probability and the expected exposure have an adverse correlation (when the credit quality deteriorates, the exposure is more likely to increase), as witnessed with credit default spread products in the 2008 global financial crisis, the credit exposure and default probability cannot be considered separately as we have done in our example above, and the inter-connectedness of these components will also need to be considered.

HKFRS 13 has highlighted that fair value measurement shall include the effect of the entity's net exposure to the counterparty's credit risk in financial derivative valuations. Unfortunately, no specific guidelines on the estimation methods to be used to calculate the CVA are yet in circulation. In valuations being prepared for financial reporting purposes, CVAs are not usually included, given the complexity of calculating a CVA and that valuation accuracy for financial reporting purposes is less stringent than for derivative instruments traded in an active market.

However, the recognition of CVAs is gaining traction globally, and CVAs may be expected to become increasingly common components of valuations prepared for financial reporting purposes in the future.

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# FINTECH之網絡借貸

網絡借貸（又稱“P2P網貸”，即Peer-to-Peer）早於2007年在中國開始發展，其最初目的在於協助那些未能成功從正式金融渠道籌集資金的中小企業提供借貸以滿足其營運需要。網絡中介機構在當中擔當的角色為出借方及借款方建立橋樑，按各自需要，撮合借貸項目。據了解，借貸金額一般以人民幣100萬或以上為主，平均利率為15-20%左右。經過幾年的發展，網貸企業於2014年已超過1,500家，而累計成交量亦超過3,800億人民幣。與此同時，涉及網貸的問題亦隨之而來，包括：

- 違規貸款（高利貸）
- 虛假陳述，例如出借資金保本
- 拆標操作，旨在把單一出借資金分拆以滿足不同貸款項目資金需求
- 透過網貸平台非法融資

為促進網絡商貿/服務健康發展及就相關活動進行監督，中央政府相關部委在近月就網絡借貸於2016年8月17日推出了《網絡借貸信息中介機構業務活動管理暫行辦法》（下稱“網貸辦法”）。鑒於互聯網科技及應用平台的發展一日千里，智能手機的普及及移動應用程式的開發，大大提升了普羅大眾對網上信息的認知及互動，中央政府亦同時推出了其他網絡業務管理辦法，包括：

- 《互聯網廣告管理暫行辦法》— 於2016年7月11日推出
- 《網絡預約出租汽車經營服務管理暫行辦法》— 於2016年7月14日推出

該網貸辦法自公布之日起施行，並一共包含了八個章節。主要內容包括：

- 備案管理
- 業務規則與風險管理
- 出借人與借款人保護
- 信息披露
- 監督管理
- 法律責任

網貸辦法主要適用於在中國境內從事網絡借貸信息中介（下稱“中介”）業務活動。活動是指透過中介機構的互聯網平台實現個體和個體之間的直接借貸。中介機構只須在領取營業執照後，向工商登記註冊地的地方金融監管部門備案，及後申請相應的電訊業務經營許可便可展開中介業務。網絡借貸信息中介機構只可就相關借貸提供信息搜集、信息公布、資訊評估、信息交互、借貸撮合等服務。而借貸所涉及的風險，例如違約風險，則由借款人及出借人自己承擔。此外，中介亦有責任執行以下工作，撮要包括：

(1) 提供直接借貸信息的採集整理、甄別篩選、網上發佈，以及資訊評估、借貸撮合、融資諮詢、在線爭議解決等相關服務；
(2) 對出借人與借款人的資格條件、信息的真實性、融資項目的真實性、合法性進行必要審核；
(3) 採取措施防範欺詐行為；
(4) 持續開展網路借貸知識普及和風險教育活動；
(5) 有關債權債務信息需要及時向有關數據統計部門報告並登記；
(6) 妥善保管出借人與借款人的資料和交易信息，不得刪除、篡改、非法買賣、泄露出借人與借款人的基本信息和交易信息；
(7) 依法履行客户身份識別、可疑交易報告、客户身份資料和交易記錄保存等反洗黑錢和反恐怖融資義務；
(8) 配合相關部門做好防範查處金融違法犯罪相關工作；及
(9) 妥善處理互聯網信息內容管理、網路與信息安全相關工作。

為了更明確中介機構的業務範圍，網貸辦法明確指出以下中介機構不能參與的業務，撮要包括：

(1) 為自身融資；
(2) 歸集出借人的資金；
(3) 向出借人提供擔保或者承諾保本保息；
(4) 自行或委託授權第三方在互聯網、固定電話、行動電話等電子渠道以外的物理場所進行宣傳或推介融資項目；
(5) 發放貸款；
(6) 將融資項目的期限進行拆分；
(7) 自行發售理財等金融產品募集資金；
(8) 開展類資產證券化業務或實現以打包資產、證券化資產、信託資產、基金份額等形式的債權轉讓行為；
(9) 除法律法規和網路借貸有關監管規定允許外，與其他機構投資、代理銷售、經紀等業務進行任何形式的混合、綑綁、代理；
(10) 虛構、誇大融資項目的真實性、收益前景，隱瞞融資項目的瑕疵及風險；
(11) 向借款用途為投資股票、場外配資、期貨合約、結構化產品及其他衍生品等高風險的融資提供信息中介服務；
(12) 從事股權眾籌等業務；及
(13) 法律法規、網絡借貸有關監管規定禁止的其他活動。

在業務方面，網貸辦法制定了以下業務規則及風險控制措施，撮要包括：

(1) 關於借款人：
（一）通過故意變換身份、虛構融資項目、誇大融資項目收益前景等形式的欺詐借款；
（二）同時通過多個網絡借貸信息中介機構，或者通過變換項目名稱、對項目內容進行非實質性變更等方式，就同一融資項目進行重複融資；及
（三）在網絡借貸信息中介機構以外的公開場所發佈同一融資項目的信息。

(2) 關於出借人：
（一）參與網絡借貸的出借人，應當具備投資風險意識、風險識別能力、擁有非保本類金融產品投資的經歷並熟悉互聯網；
（二）出借資金為來源合法的自有資金；
（三）了解融資項目信貸風險，確認具有相應的風險認知和承受能力；
（四）自行承擔借貸產生的本息損失；及
（五）不得向未進行風險評估的出借人提供交易服務。

(3) 關於網絡借貸金額方面：
（一）同一自然人在同一網絡借貸信息中介機構平台的借款餘額上限不超過人民幣20萬元；同一法人或其他組織在同一網絡借貸信息中介機構平台的借款餘額上限不超過人民幣100萬元；及
（二）同一自然人在不同網絡借貸信息中介機構平台借款總餘額不超過人民幣100萬元；同一法人或其他組織在不同網絡借貸信息中介機構平台借款總餘額不超過人民幣500萬元。

(4) 關於中介機構的系統及網絡安全方面：
（一）開展信息系統定級備案和等級測試，具有完善的防火牆、入侵檢測、數據加密以及災難恢復等網絡安全設施和管理制度，建立信息科技管理、科技風險管理和科技審計有關制度，配置充足的資源，採取完善的管理控制措施和技術手段，保障信息系統安全穩健運行，保護出借人與借款人的信息安全；
（二）記錄並留存借貸雙方上網日誌信息，信息交互內容等數據，留存期限為借貸合同到期起5年；
（三）每兩年至少開展一次全面的安全評估；
（四）加强與金融信用信息基礎數據庫運行機構、徵信機構等的業務合作；
（五）需要對出借人與借款人的基本信息和交易信息等使用電子簽名、電子認證時；及
（六）對第三方數字認證機構進行定期評估。

(5) 關於中介機構：
（一）不得將出借人與借款人提供的信息作提供服務以外的用途；
（二）不得向境外提供境內出借人和借款人信息；及
（三）實行自身資金與出借人和借款人資金的隔離管理，並選擇符合條件的銀行業金融機構作為出借人與借款人的資金存管機構。

實際考慮因素：

(1) 借貸項目內容審核
中介必須對融資項目的真實性及合法性進行審核，這可理解為該項目有實質活動支撐及貸款將使用於指定用途，例如因購買房地產而引發融資需要，而証明文件可

能包括臨時買賣合約、預付按金証明等。此外，中介亦有責任確保項目內容合法，例如確保利息及費用條件不達到高利貸水平。

(2) 欺詐行為難防

網貸辦法要求中介就欺詐行為採取防範措施。一般的網貸欺詐行為例如，借款人在獲得款項後失聯、誇大借款項目的回報以增加成功貸款機會、未經許可的債權轉讓等。由於往往在出事後才得知情況，所以中介要預防這些詐騙是較為困難。

(3) 沒有全國統一借貸數據庫

鑒於國內並沒有一個統一的信貸系統儲存借款者的借款餘額資料，中介機構較難確保借款人有否虛報在不同網絡上的借款餘額或總餘額是否已超出網貸辦法設定的上限。此外，中介亦無法確保相同借款項目有否在不同網絡上發佈，唯有依賴借款人的個人誠信。

(4) 與出借人和借款人資金隔離

在網貸辦法中提及到若中介機構解散或宣告破產，在清算時，出借人與借款人的資金均不屬於中介，不列入清算財產。這意味著出借人可能先把資金轉交與中介的獨立銀行帳戶；或借款人在歸還貸款時亦有可能把資金轉入該獨立帳戶。資金儲存於獨立帳戶時應該如何管理，網貸辦法對上述操作並沒有詳細列明要求。

(5) 資金用途難追蹤

網貸辦法列明不得向借款用途為投資股票、場外配資、證券產品等，提供中介服務。然而，在現實中，中介難以確認借款項目資金的最終用途。當資金落入借款人手中，有多少用在申報的貸款項目，什麼時候用該筆資金，中介機構並沒有法定權力干預或作出調查。

**結論**

綜合上述內容及考慮因素，中介營運者若計劃營運網貸信息中介業務，必須對網貸辦法有充分了解並加強與監管機構溝通以確保營運合法合規。此外，我們建議中介機構應在企業管治、電腦系統及信息保安方面加強相關措施，以確保出借人及借款人的資金安全及資訊安全。

如若查詢上述內容，請與鄭文漢先生（電郵：rickycheng@bdo.com.hk 或電話：2218 8266）聯繫。

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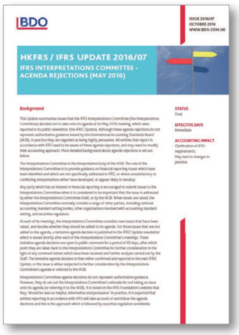


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