Forward-Looking Measurement of Corporate Sector Soundness

The Bank continues to accord emphasis on enhancing the forward-looking capability of its surveillance framework. This includes having a more robust assessment of risks in the corporate sector, which may have an impact on the stability of the overall financial system. Forward-looking models such as the z-score and modified distance to default provide important insights on emerging stress and risks, thereby providing sufficient lead time for the Bank to formulate appropriate policy measures pre-emptively to avert, mitigate or manage such threats. The quantification and measurement of risks enable more robust stress tests to be performed to assess the direct and possible feedback effects from plausible shocks to the system. The predictive power of the z-score and modified distance to default models in assessing future levels of credit risk have been established in numerous research and academic literature.

Z-score for Emerging Markets

The z-score measures the degree of vulnerability of a particular business or an industry segment by categorising firms into two distinct clusters, namely strong and vulnerable firms, based on the historical default experience. The construction of the z-score used by the Bank is referenced on the model developed by Altman for emerging markets[1] and employs the multiple discriminant analysis as an underlying statistical tool to derive a linear combination of financial ratios that best discriminate between the two categories. The multiple discriminant analysis improves on the traditional approach of individual or sequential analysis of financial ratios by reducing the reliance on rules of thumb and subjective judgement in determining the threshold levels and relative importance of the ratios. Selected key financial ratios are subsequently consolidated into a composite score to provide a snapshot of a firm's financial health. The discriminant function for the z-score for emerging markets based on the study conducted by Altman is given by the following equation:

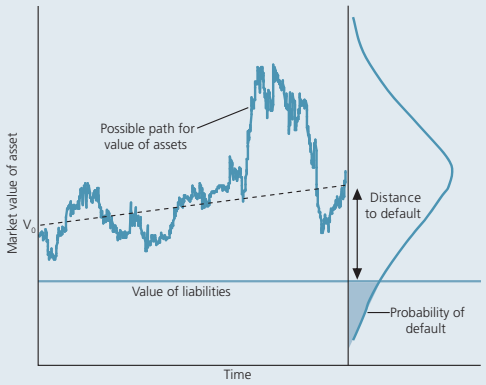
$$3.25 + 6.56\left(\frac{\textit{Working Capital}}{\textit{Total Assets}}\right) + 3.26\left(\frac{\textit{Retained Earnings}}{\textit{Total Assets}}\right) + 6.72\left(\frac{\textit{Operating Income}}{\textit{Total Assets}}\right) + 1.05\left(\frac{\textit{Equity}}{\textit{Total Assets}}\right)$$

Based on the z-score, both strong and vulnerable firms can be identified, whereby a higher z-score indicates a lower likelihood of the firm encountering financial distress.

Modified Distance to Default

The distance to default, based on the methodology developed by Merton[2], measures the potential default by a firm on its debt obligations using the option pricing model. The equity value of a firm is assumed to equal the value of a European call option on the firm's assets, with the value of its debts as the strike price. The incidence of default is said to occur when the value of the firm's debts exceeds the market value of its assets. The distance to default reflects the extent to which the market value of a firm's assets exceeds its debts, measured in terms of standard deviation of the asset value. The graphical representation of this concept is illustrated in Chart 1.

Chart 1
Merton's Distance to Default



[1] Altman, Hartzell and Peck (1995) "Emerging Markets Corporate Bonds: A Scoring System"
[2] Merton (1974) "The Pricing of Corporate Debt: The Risk Structure of Interest Rates"

Using the Black-Scholes-Merton methodology and applying simplifying assumptions as proposed by Byström[3], the modified distance to default is calculated as expressed by the following equation:

$$DD_{MODIFIED} = \frac{\ln(L)}{(L-1)} \frac{1}{\sigma_E}$$

where L is the leverage ratio (book value of debts expressed as a percentage of market capitalisation and the book value of debts) and σ_E is the annualised 90-day historical volatility of equity returns. Firms with shorter distances to default are assessed to be associated with higher credit risk and hence a greater probability of default.

Observations on Corporate Sector Soundness

Movements in the median z-score and weighted average modified distance to default are tracked to detect changes in the direction and average level of credit risk both at the macro as well as industry and company specific levels. In addition, Altman z-scores at the 75th and 25th percentile are also used to monitor the changes in the level of credit risk for firms with higher and lower credit quality, enabling a more complete assessment across different credit qualities.

The series of structural, operational and financial reform measures instituted following the 1997 Asian financial crisis have substantially contributed to the strengthened performance and financial health of Malaysian corporations. Over the 1997 to 2008 period, the z-score and modified distance to default calculated for more than 230 companies listed on Bursa Malaysia (accounting for over 80% market capitalisation) have improved (Chart 2 and Chart 3). The improvement in credit risk levels is also reflected in the improving credit quality of the banks' business loan portfolios during the period. The level of non-performing business loans has declined at an annual pace of 7%. As at end-2008, the gross non-performing business loans ratio has declined to 6% from its peak of 15.3% in 1998.

Chart 2
Business Sector Gross NPL Ratio and Z-score

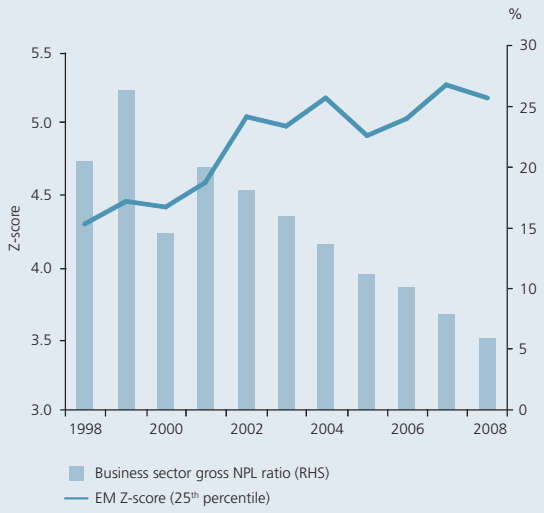
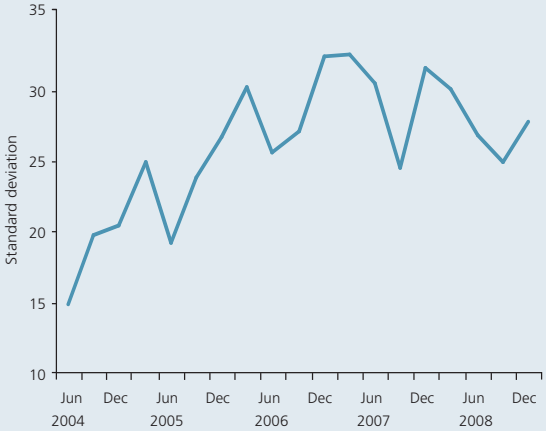


Chart 3
Weighted Average Modified Distance to Default



[3] Byström (2006) "Merton Unravelled: A Flexible Way of Modelling for Default Risk"

Refinements to Z-score and Modified Distance to Default Models

While there is useful information that can be derived from the usage of such models in carrying out surveillance and risk assessments, such models primarily complement the main efforts in fundamental analysis of quantitative and qualitative factors. Experiences during the current global financial turmoil have underscored the importance of having in place financial and risk models that remain sufficiently robust and dynamic in extreme market conditions where specifications and assumptions tend to deviate from the norm.

As the discriminant function of Altman's emerging market z-score was developed using data drawn from various emerging markets, an area of focus now is the development of a model which more accurately reflects the specific conditions, risk characteristics and phase of development of Malaysian businesses. Given the varying business characteristics across different industries, the Bank would also develop industry specific z-scores based on the financial statements and default experiences of Malaysian businesses.

Recognising that the modified distance to default model relies on equity prices, which do not necessarily embody all information relevant to a firm's future performance but includes other factors such as market liquidity and investor sentiment, the Bank will be implementing enhancements to the model. The Bank will embark on an exercise to map the modified distance to default model to historical incidences of bond and loan defaults by Malaysian businesses, thereby enabling estimates of default probability and frequency to be more reflective of the future level of non-performing loans in the corporate sector.

These efforts in enhancing the accuracy and predictive power of the models would contribute to the Bank's effective use of surveillance and risk assessment tools in its continuous monitoring of the stability of the financial system.