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Simulation technology helps upgrade insurers' ERM

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Executive Summary

Amid a global trend toward stricter solvency regulation, Japanese insurers are strengthening their enterprise risk management. A new simulation technology is a key driving force behind increasingly high-speed risk quantification.

Trend toward more sophisticated ERM among insurers

Japan's Financial Services Agency (FSA) has adopted the solvency margin ratio (SMR), a measure of financial soundness, as one component of insurers' enterprise risk management (ERM) programs. SMR is calculated as solvency margin, a measure of claims paying capacity, divided by one half of risk exposure. The FSA has directed insurers to maintain an SMR of at least 200%. However, a life insurer with an SMR in excess of 200% went bust amid the financial crisis that ensued from Lehman Brothers' 2008 bankruptcy. This incident revealed the SMR to be deficient as a measure of financial soundness.

The measure of risk used as the SMR's denominator is calculated in two steps. First, certain balance sheet carrying values are multiplied by risk coefficients set by the FSA for each of the risks listed in Exhibit 1. Second, the resultant products are summed. One cause of the SMR's aforementioned deficiency was that these risk coefficients

Exhibit 1. Risks included in the SMR's risk measure (for life insurers)

Insurance risk	Asset management risk
	Price fluctuation risk
Third-sector insurance risk	Credit risk
Assumed interest rate risk	Subsidiary risk
Minimum guarantee risk	Derivative risk
Operational risk	Other risks

Note: Asset management risk currently includes credit spread risk also (it was added when risk coefficients were revised in 2010).
Source: NRI, based on FSA documents

were set too low. To rectify this shortcoming, the FSA decided in April 2010 to adopt more stringent risk coefficients. Revised SMR standards that use new risk coefficients took effect from March 31, 2012.

The FSA is now preparing to eventually adopt economic-value-based solvency regulation in recognition that the SMR's risk measurement method itself is deficient. Economic-value-based solvency regulation is a framework that accurately gauges insurers' financial condition by uniformly measuring their assets and liabilities at fair value. It also promotes more sophisticated risk management by insurers.

Challenge posed by measuring insurance liabilities on an economic value basis

Economic-value-based measurement requires insurance liabilities to also be measured at present value based on their future cash flows. In 2010, the FSA decided to field-test[1] measurement of insurers' insurance liabilities on an economic value basis to ascertain the insurers' state of readiness for an economic-value-based regulatory regime.

The field tests revealed that while many insurers recognize the significance of measuring insurance liabilities on an economic value basis, estimating future cash flows for every single insurance policy is a burdensome process. For life insurers with large portfolios of long-term insurance policies, the requirement to estimate individual policies' cash flows imposes an especially onerous burden if they estimate cash flows over the entire remaining duration of their existing insurance policies.

For example, to estimate insurance policies' value by probabilistically generating cash flows on a monthly basis over a 100-year timeframe, an insurer would have to estimate 1.2 billion cash flows by conducting a million-iteration Monte Carlo simulation[2]. Measuring assets and liabilities' total risk entails probabilistically calculating a huge number of investment products' returns and insurance claims payouts every time cash flows are calculated. The FSA's field tests thus revealed that economic-value-based measurement poses a major challenges in terms of executing detailed calculations at a fast enough processing speed. During the field testing, more than a few insurers apparently used simplified methodologies to lessen the computational burden, but such methods are not conducive to sophisticated risk management.

Upgrading insurers' ERMs

In the first half of the 2000s, financial institutions embraced grid computing (parallel

NOTE

1) FSA, "Field Tests of Economic Value-Based Solvency Regime," May 2011.

2) The greater the number of iterations, the more stable the results of Monte Carlo simulations. In VaR measurement, determining the required confidence level is always an issue, but one million is generally regarded as a sufficient number of iterations.

processing by multiple computers) to perform voluminous risk measurement calculations. However, large-scale grid computing systems were extremely costly to install and maintain.

In recent years, however, general-purpose graphic processing units[3] (GPGPUs) have garnered attention as an inexpensive means of high-volume parallel processing. In contrast to conventional graphic processing units (GPUs) used largely for image processing, GPGPUs are GPUs applied to general-purpose computing. They are distinguished by having more processor cores than the CPUs used for ordinary arithmetic processing, as shown in Exhibit 2. They are consequently capable of high-speed, parallel computational processing, making them suitable for performing the aforementioned Monte Carlo simulations for estimating insurance liabilities. Parallel computational processing can also be used for measuring asset management risk (e.g., VaR) through Monte Carlo simulations. GPGPUs thus have many applications. In the financial sector, a foreign investment bank is in fact already using GPGPUs for pricing financial derivatives[4].

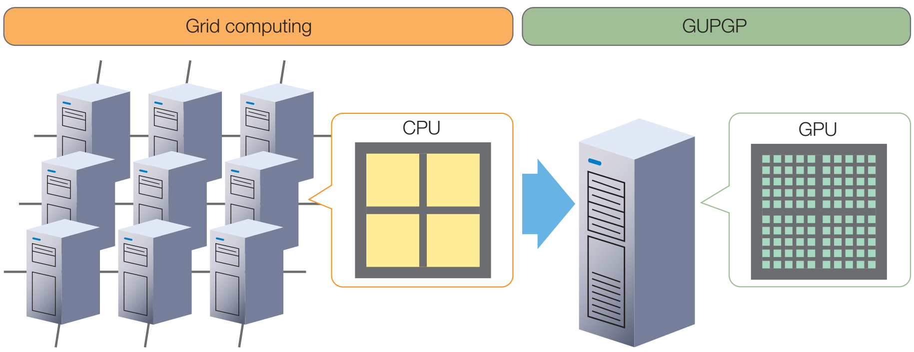
3) A GPGCU is a GCU whose processing capacity is used for non-graphic, general-purpose processing.

4) Source: http://www.nvidia.co.jp/object/computational_finance_jp.html

However, GPGPUs pose their own set of challenges, including the difficulty of GPU programming itself and the need to reduce conditional branch processing to maximize GPU performance. It is therefore advisable to partner with a vendor that possesses GPGPU programming expertise when developing a risk measurement system using GPGPUs.

In sum, GPGPUs have broad applicability to insurers' risk measurement. Utilization of GPGPUs should accelerate ERM upgrades among insurers.

Exhibit 2. Evolution of parallel processing systems



Source: NRI

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