

**TOWERS
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TILLINGHAST**


Economic Capital (EC)

**ERM Symposium: ERM Workshop
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Role of EC in ERM



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ROLE OF EC IN ERM

ERM Governance and EC

1. An appropriate governance structure should be in place to articulate the policies and procedures for managing the enterprise, supported by appropriate tools and resources
2. An ERM framework should specify the firm's decision criteria for risk taking and capital utilization
3. EC becomes a key metric within ERM for assessment of risk
4. The analytics should generate the financial measures required for making business decisions

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ROLE OF EC IN ERM

EC is a key metric for quantifying risk

Identify
What are the risks?
Who is watching?

Quantify
How much do risks weigh?
What is their impact?
EC is the metric for quantifying risk

Solve
What can be done about risks?
How to decide?

Execute
How to take action?
What value does it create?

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OVERVIEW AND RECENT TRENDS

Application of EC is on the rise globally

Global Survey Results on Use of EC

Response	Percentage
Yes	65%
Considering	19%
No	16%

Source: Tillinghast 2006 ERM Survey.

- 65% calculating EC in 2006
 - ... up from 53% in 2004
- Planning to calculate EC
 - U.K. 90%
 - Bermuda 89%
 - Asia-Pacific 72%
 - U.S. 49%
- Likelihood of calculating EC
 - Reinsurers 80%
 - Multi-line 72%
 - P/C insurers 69%
 - Life insurers 55%
 - No. America 45%
 - EU 61%

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OVERVIEW AND RECENT TRENDS

Market-consistent balance sheet approach is becoming most common method to calculate EC

Economic Capital is...

- Measured as the difference in “market-consistent net assets” between normal conditions and stressed conditions
 - A set of stress tests are applied for each risk, calibrated to a probability level over a one-year time horizon, consistent with the company’s financial strength rating
- Separate stresses are applied to cover a variety of market, credit and insurance risks that might occur over the projected one-year time horizon
- Results are aggregated using a correlation matrix

➡ Commonly used in Europe, increasingly used in North America

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OVERVIEW AND RECENT TRENDS

EC globally: Solvency II also suggests stress testing approach

- Based on European CFO Forum guidance, EC is calculated using the 99.5th percentile in a stress-testing methodology
 - Requirements are specified for use of internal models
- Consistent standard applied for all EU countries
- Assets and liabilities are on a “fair value” basis
- Capital requirements set for timely intervention
- Approach similar to bank “3 Pillars” approach to EC
 1. Technical valuation rules for assets/liabilities solvency margins
 2. Enhanced supervisory review process
 3. Private and public disclosures
- Capital for op risk typically set as a percentage of total capital

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OVERVIEW AND RECENT TRENDS

"Best estimate" liability is still the predominant approach used to calculate EC in North America

Economic Capital is determined as...

- The level of assets, in addition to the Best Estimate Liability, required to pay future policyholder benefits at the chosen Security Factor
- Economic Capital covers the volatility in:
 - The runoff of existing business
 - The future business ("pricing risk")

Best Estimate Liability is...

- The best estimate projection of non-investment cash flows
- Discounted at the asset returns under the best estimate economic scenario

Security Factor is...

- Based on a risk of ruin level that is consistent with the company's financial strength rating

The diagram illustrates the components of Economic Capital. It shows a vertical stack of three yellow boxes: 'Pricing risk' at the top, 'Runoff risk' in the middle, and 'Best Estimate Liability' at the bottom. A bracket on the right side of these three boxes is labeled 'Needed Assets'. To the left of this stack is a taller yellow box representing 'Reserve margins'. A double-headed vertical arrow between the top of the 'Reserve margins' box and the top of the 'Pricing risk' box is labeled 'Economic Capital'.

➡ Mostly used in North America, but with declining frequency

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OVERVIEW AND RECENT TRENDS

The measures of risk tolerance used in calculating EC are fairly evenly divided

- The most common responses among participants were tail value at risk or conditional tail expectation (37%), probability of ruin (37%) and a specified percentile (47%)
 - TVaR or CTE is more commonly used in North America (49%) and in continental Europe (48%)
 - The probability of ruin is used more frequently by participants in Bermuda (75%) and the U.K. (59%)

Measure of Risk Tolerance	Percentage
Specified percentile	47%
Tail value at risk or conditional tail expectation (CTE)	37%
Probability of ruin	37%
Economic cost of ruin	11%
Below target risk	9%

Base: Those that calculate economic capital n = 133 Q.12 What measures of risk tolerance do you use? (Select all that apply.)
Source: Tillinghast 2006 ERM Survey.

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Insurance companies and regulators use a range of different confidence levels

- Choice of confidence level and implied rating:
 - Most European insurers are using one-year confidence levels ranging from 99.5% to 99.99%
 - European regulators and CRO Forum are advocating a one-year 99.5% confidence level for Solvency II
 - Confidence levels are typically linked to a target risk appetite and financial strength rating
 - Rating agencies are evaluating tail risk like bond default risk, using CTE or percentile criteria
 - Where longer time horizons are used, a lower multi-year confidence level can be justified (e.g., AA over five years vs. AA over one year)

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The calculation of EC should include all material risks

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graph TD
    ORP[Overall Risk Profile] --> RA([Risk Aggregation])
    RA --> MR[Market Risk]
    RA --> CR[Credit Risk]
    RA --> LR[Liquidity Risk]
    RA --> IR[Insurance Risk]
    RA --> OR[Operational Risk]
    MR --- MR_L["Interest Rates<br/>Equities<br/>Real Estate<br/>..."]
    CR --- CR_L["Defaults<br/>Spreads<br/>Counterparty<br/>..."]
    LR --- LR_L["Asset/Liability Risk<br/>Hedging Programs<br/>..."]
    IR --- IR_L["Mortality<br/>Lapses<br/>Reserves<br/>..."]
    OR --- OR_L["Distribution<br/>Systems<br/>People<br/>..."]
    
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OVERVIEW AND RECENT TRENDS

Interest rate, equity and credit (asset default) risk were the market/credit risks most often included in EC calculations

- Almost all the participants include interest rate risk in their EC calculations (97%)
 - Up from 2004, when 90% of respondents included interest rate risk
- A large majority of the respondents also include equity risk (81%) and credit (asset default) risk (80%) in their EC calculations
- The use of credit (counterparty) risk has increased to 63% of respondents, as compared to 49% in the 2004 survey

Risk Category	Percentage
Interest rate	97%
Equity	81%
Credit (asset default)	80%
Credit (counterparty)	63%
Property/real estate	51%

Source: Tillinghast 2006 ERM Survey.

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Mortality, lapse/surrender, longevity, expense and morbidity were the life insurance risks commonly included in EC calculations

- Mortality risk (92%) is the life insurance risk most often included in EC calculations, followed by lapse/surrender risk (84%)
 - Lapse/surrender risk is particularly frequently included in North America (96%), as compared to Asia-Pacific (73%)

Risk Category	Percentage
Mortality	92%
Lapse/surrender	84%
Longevity	73%
Expenses	73%
Morbidity	70%
Policyholder behavior	58%

Source: Tillinghast 2006 ERM Survey.

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Globally, the most common P/C insurance risks included in EC calculations were catastrophe, reserving and pricing

- About three-quarters of the respondents include catastrophe (78%), reserving (78%) and pricing (74%) risks in their EC calculations
 - Catastrophe risk is included by 97% of respondents in North America, as compared to only 8% of Asia-Pacific respondents

Risk Category	Percentage
Catastrophe	78%
Reserving	78%
Pricing	74%
Expenses	53%
Correlation of liability lines or concentration	49%

Source: Tillinghast 2006 ERM Survey.

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The majority of firms are now including event and business operational risks in their EC calculations

- The vast majority of the respondents that calculate EC use event risks (82%) and business risks (70%) in their EC calculations for operational risks
 - In 2004, less than half of the respondents included event and business risk
 - Multi-line companies on a global basis more frequently included event risk in their EC calculations (91%); this statistic increases to 94% of the multi-line companies in Europe
 - Almost all of the U.K. insurers (96%) include event risk in their calculations
 - Life insurers (81%) and multi-line companies (87%) were more likely to include business risks than P/C insurers (48%) on a global basis

Risk Category	Percentage
Event	82%
Business	70%
Other	14%

Source: Tillinghast 2006 ERM Survey.

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There is no "right" or "wrong" approach to building an EC model

Decision 1: Period for assessment	Decision 2: Definition of capital	Decision 3: Measure of risk	Decision 4: Risks to include	Decision 5: Quantification methodology	Decision 6: Aggregation
One year n years Run-off of portfolio	Statutory GAAP Economic	Risk of ruin VAR TVaR or CTE	Market Credit Insurance Operational Liquidity	Stochastic modelling Stress Testing Factor based	Additive Variance/Covariance Stochastic

Six key decisions need to be made, and the approach taken should reflect the nature of the company and management's objectives

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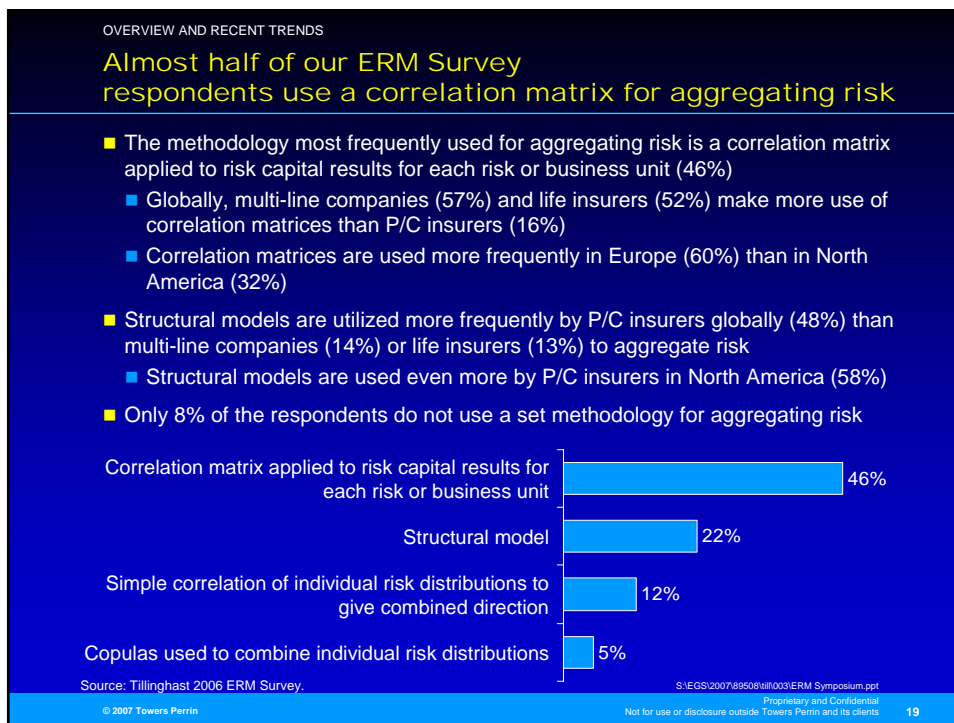
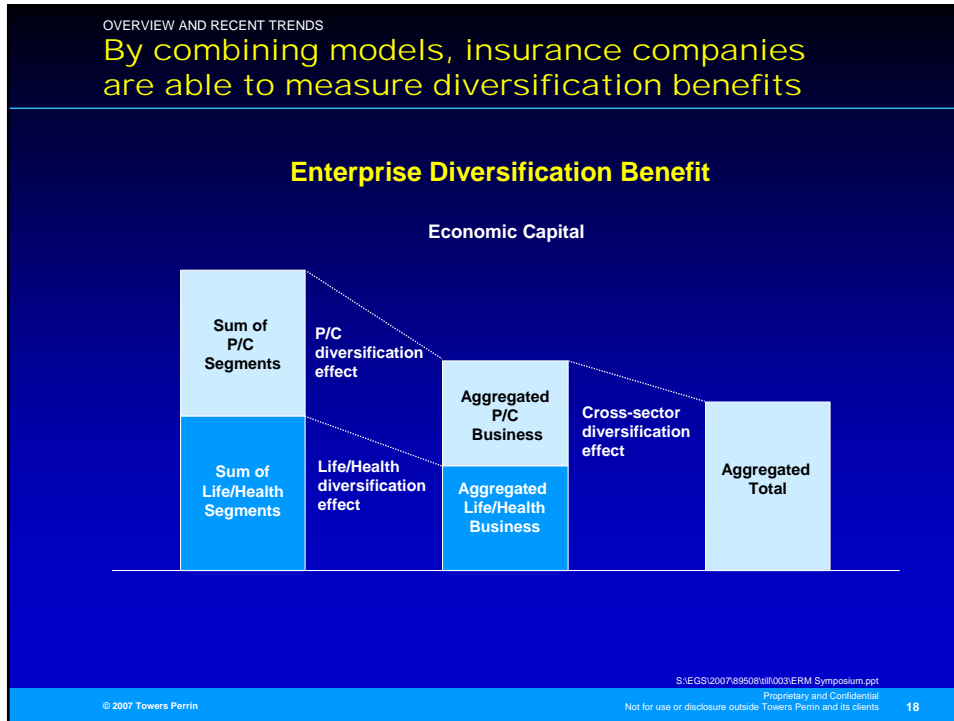
One year has become the most frequent risk assessment period

- More than half (56%) of respondents assess risk over a one-year period
 - This is a sharp increase from 2004, when only 32% of the respondents indicated they assessed risk over a one-year period
 - Since 2004, assessing risk over a two- to five-year period has decreased from 22% to 12%, and the run-off of portfolio from 29% to 14%
 - Respondents based in continental Europe (84%) were more likely to use a one-year period than their counterparts in the U.K. (48%)
- This is based on the widespread use of the Solvency II methodology worldwide

Assessment Period	Percentage
Instantaneous	1%
1 year	56%
2 – 5 years	12%
6 – 10 years	1%
10 – 20 years	2%
Run-off of portfolio	14%

Source: Tillinghast 2006 ERM Survey.

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Almost all of the respondents that calculate EC are planning to make further improvements

- 89% of the survey participants that calculate EC are planning to make further improvements or enhancements to their EC calculations or framework
 - This is a particular focus of the participants in Asia Pacific (96%) and Canada (100%)
 - North American life insurers (93%) indicate an even higher propensity for wanting to improve their EC calculations or framework, as did 95% of the multi-line companies in Europe
- Of those planning improvement, the most frequently cited goal is to improve aggregation capabilities (70%), followed by improving applications (64%)

Plans for Further Improvements

No: 11%
Yes: 89%

Goals of Planned Improvements

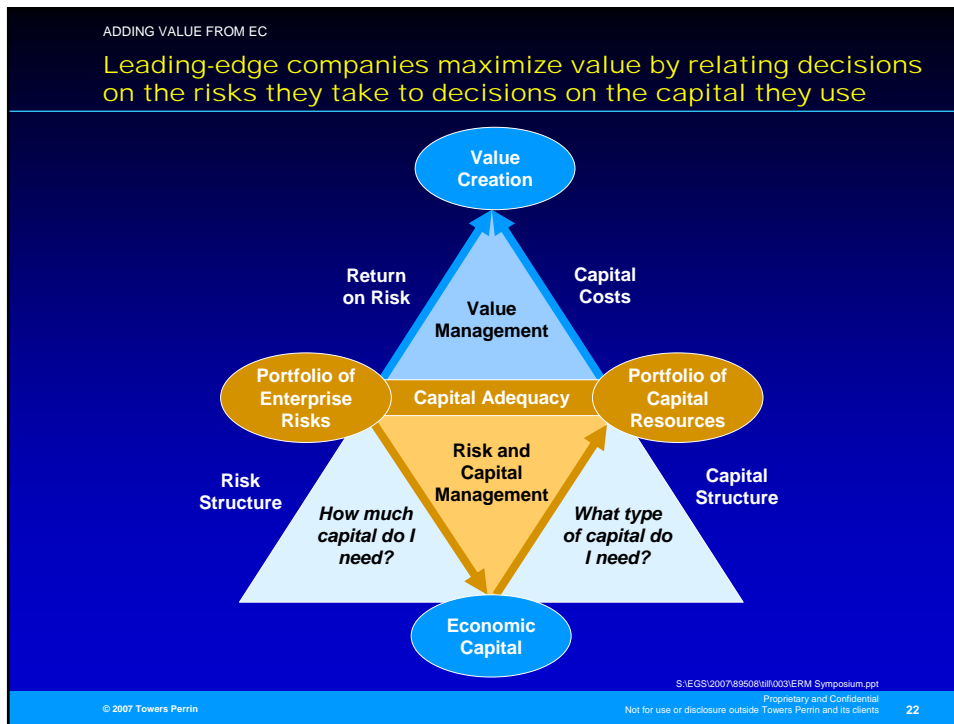
Improving the aggregation capabilities	70%
Improving applications	64%
Enhancing core methodology	56%
Extending the risks covered	54%
Improving internal reporting capabilities	53%
Improving controls surrounding data and process	53%
Increasing software modeling capabilities	52%
Improving the understanding and buy-in of sr. management	50%

Source: Tillinghast 2006 ERM Survey. S:\EGS\2007\89508\03\ERM Symposium.ppt

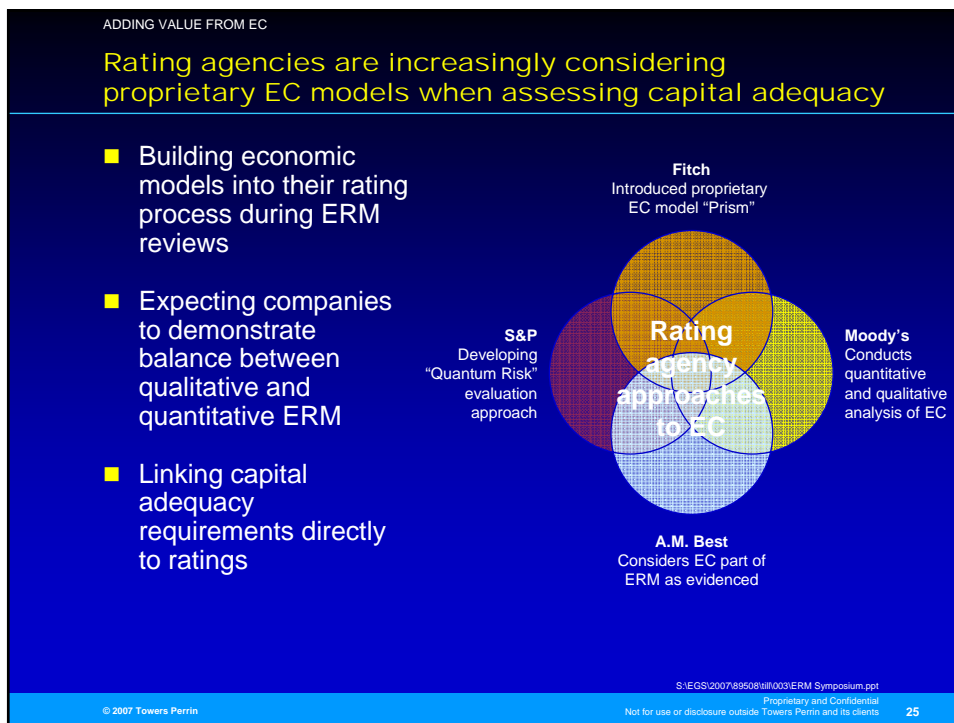
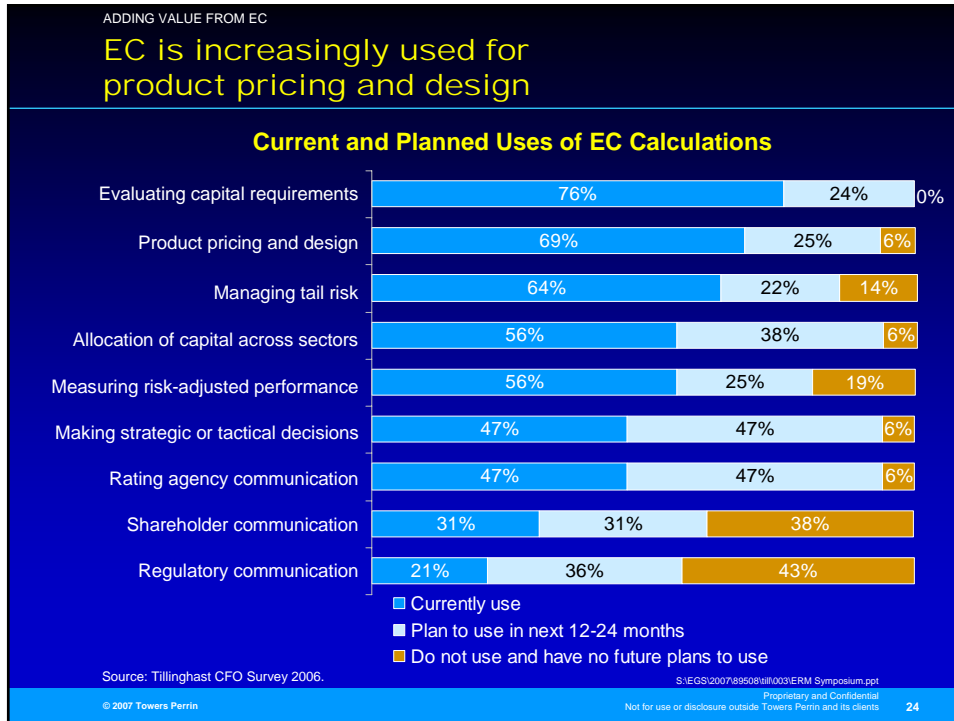
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Adding Value from EC

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- ADDING VALUE FROM EC
- ### Adding value from EC
- Increased focus on allocation of capital for performance management purposes
 - EC as required capital for EEV/MCEV calculations
 - Use of EC as a metric for short-term/long-term incentive plans
 - Use of EC for business planning
 - Requires projection of future new business
 - Use of EC in pricing
 - Requires projection of EC at annual intervals
 - In practice, factor-based shortcuts are typically used
 - EC is seen as a key component of ERM framework
 - Increasing scrutiny by regulators/rating agencies
 - Basis for principles-based capital
- Leading-edge companies are leveraging EC to connect risk and value**
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ADDING VALUE FROM EC

All major U.S. rating agencies are currently developing or enhancing their capital adequacy models

- Standard & Poor's (S&P) has recently enhanced its capital adequacy model to reflect changes brought about by principle-based capital regulation
- For EC, S&P uses the five-year default rate for a bond that has a financial strength rating equivalent to that of the company in determining the percentile the required capital should be based on:

New S&P Percentile Levels

S&P Rating	Percentile	Old Factor
BBB	97.2%	100% CAR
A	99.4%	125% CAR
AA	99.7%	150% CAR
AAA	99.9%	175% CAR

Source: Standard & Poor's (December 2006)

- In June 2006, Fitch introduced a fully stochastic global EC model for life and non-life insurers
 - Initial rollout is in the U.S., U.K., France and Germany
 - Cash flow-based simulation over full life of liabilities
 - Ratings standards based on CTE linked to default rate thresholds
- AM Best and Moody's also are in the process of enhancing their capital adequacy models

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A FastTrack Approach to Calculating EC

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A FASTTRACK APPROACH TO CALCULATING EC

Towers Perrin's FastTrack EC approach follows a well researched and thoroughly tested path

Decision 1: Period for assessment	Decision 2: Definition of capital	Decision 3: Measure of risk	Decision 4: Risks to include	Decision 5: Quantification methodology	Decision 6: Aggregation
One year	Statutory	Risk of ruin	Market	Stochastic modelling	Additive
n years	GAAP	TVaR/CTE	Credit	Stress Testing	Variance/Covariance
Run off of portfolio	Economic	ECOR	Insurance	Factor based	Stochastic
			Operational		
			Liquidity		

Implemented by a majority of multinational insurers and adopted/proposed for: UK ICA regime, Swiss Solvency Test, EU Solvency II

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A FASTTRACK APPROACH TO CALCULATING EC

There are four stages for implementing the FastTrack EC approach

- Step 1**

Develop an economic view of the business

➤

Economic assessment of assets and liabilities
- Step 2**

Identify key risks and determine levels of stress to be applied

➤

List of stress events to quantify key risks
- Step 3**

Apply stresses to the economic balance sheet

➤

EC requirement for each key risk
- Step 4**

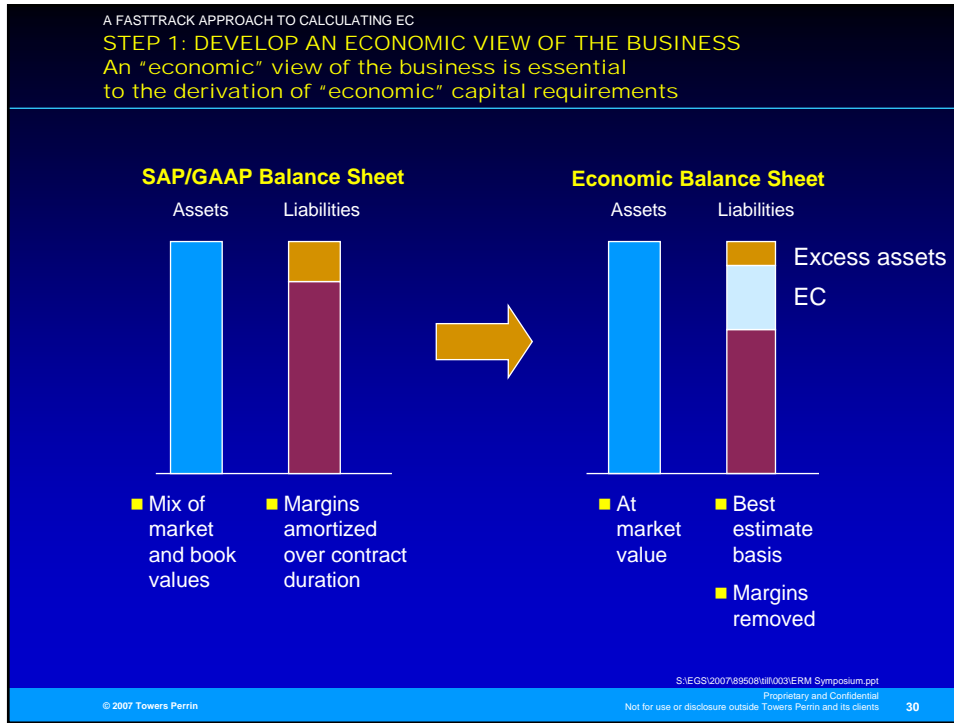
Aggregate individual risk capital results, allowing for correlation effects

➤

Total EC requirement for your business

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A FASTTRACK APPROACH TO CALCULATING EC
STEP 2: IDENTIFY KEY RISKS AND DETERMINE LEVELS OF STRESS TO BE APPLIED
 Stress tests are determined for each of your key risks and at a level consistent with your target financial strength rating

- Your key risk exposures are identified within four major risk categories:
 - Market
 - Credit
 - Insurance
 - Operational
- For example: market risk – equity price fall, fixed interest yield move, ...
- For each risk, a level of stress test(s) is chosen, consistent with your target financial strength rating (illustrative figures):

Target Financial Strength Rating	Equivalent Risk of Ruin Over 1 Year	Equity Price Stress	Fixed Interest Yield Stress
AAA	0.05%	-50%	+/- 200bps
AA	0.1%	-40%	+/- 150bps
A	0.2%	-35%	+/- 120bps
BBB	0.5%	-30%	+/- 100bps

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A FASTTRACK APPROACH TO CALCULATING EC
STEP 3: APPLY STRESSES TO THE ECONOMIC BALANCE SHEET
 The EC required for each risk is derived by applying the corresponding stress test(s) to the economic balance sheet

- The impact of each stress test on the economic value of both assets and liabilities is assessed
- The EC requirement for the underlying risk is determined by the change in “economic net assets” as a result of the stress tests, measured over a one-year period

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A FASTTRACK APPROACH TO CALCULATING EC
STEP 4: AGGREGATE INDIVIDUAL RISK CAPITAL RESULTS, ALLOWING FOR CORRELATION
 Capital requirements for each risk are aggregated formulaically, using a matrix of correlation factors

- Aggregate capital = $\sqrt{\sum_i \sum_j \rho_{ij} C_i C_j}$
- Where C_i is the capital required for the *i*th risk at the required confidence level and ρ_{ij} is the correlation coefficient between *i*th and *j*th risk
- Correlation factors are based on historical data analysis, combined with expert judgment (illustrative figures):

	Market	Credit	Insurance	Operational
Market risk	100%	40%	0%	40%
Credit risk		100%	0%	0%
Insurance risk			100%	0%
Operational risk				100%

- Choice of correlation factors is weighted towards the higher correlations that typically arise in more extreme scenarios

The results of the FastTrack EC approach can be used to help identify estimated capital requirements and provide a basis for further stochastic work

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