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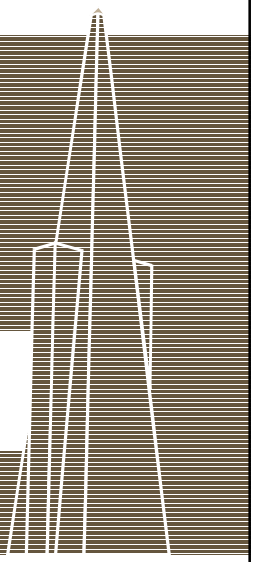

ERM & Economic Capital

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Actuaries' Club of the Southwest, November 2007

TRANSAMERICA REINSURANCE

OVERVIEW

- ERM
  - What is it?
  - Point 2
- Economic Capital
  - Economic Capital Example
  - Economic Capital & Taxes: A tale from Bizarro World
  - Hedging: You can only pick one
  - Solvency II
  - Operational Capital

ERM: What is it?

- Is it the latest fad?
- Is it the latest excuse for consultants to send you a bill?
- Is it SOX for rating agencies?
- Is it from Dilbert's Mission Statement Generator®?
- No, according to the CAS (with SOA assistance):

> **ERM is the discipline by which an organization in any industry assesses, controls, exploits, finances, and monitors risks from all sources for the purpose of increasing the organization's short-term and long-term value to its stakeholders.**

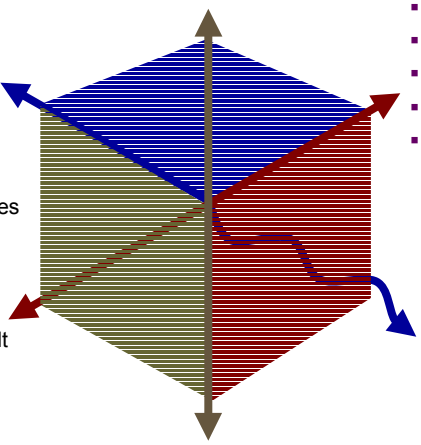
DEALING WITH RISK

- Avoidance (Don't write it)
- Ignore
  - "If *that* happens the government will have to bail us out"
- Elimination (Clever policy design, portfolio allocation)
- Reduction
  - Proactive policies to reduce (disaster recovery, system testing, market conduct training)
- Transfer
  - Reinsurance, Wall Street, policy holder
  - It may be transformation: underwriting to counter party
- Management (Diversification / pooling / pricing)

COMPANIES HAVE DIVERSIFIED RISK 3 WAYS

Kinds of Risk

- Mortality
- Longevity
- Morbidity
- Persistency
- Utilization Rates
- Equity Return
- Basis Risk
- Interest
- Credit / Default
- Currency Fluctuations
- Operational



Characteristics Influencing Risk

- Male / Female / Unisex
- Smoker / Non-Smoker
- Preferred / Standard / Sub-std
- Issue Age / Attained Age 0 - 120
- Occupation Classes

Time

- UW Cycle
- Interest Rates
- Equity Returns
- Credit Cycle
- Mortality Improvement

Disclosure: Past performance is no guarantee of future results

Economic Capital Example

- Consider Ivory Tower Life Insurance Co
- Wants to acquires a block of "interesting" life policies
- The block has a risk profile as follows
  - 90% probability of producing $1 of free cash flow
  - 10% probability of producing -$5 of free cash flow
  - Each year's probabilities are independent.
- The product has a term of ten years
- The risk free yield curve is at 0% for all durations
- Purchase price needs to reflects 1000 bps pre-tax CoC
- Need to maintain AA rating (by S&P VAR standard)

Economic Capital Example Simplistic View

Hypothetical Net Cash Flow for 10 Stochastic Scenarios										
Scn	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr10
1	1	1	1	1	1	1	1	1	1	-5
2	1	1	1	1	1	1	1	1	-5	1
3	1	1	1	1	1	1	1	-5	1	1
4	1	1	1	1	1	1	-5	1	1	1
5	1	1	1	1	1	-5	1	1	1	1
6	1	1	1	1	-5	1	1	1	1	1
7	1	1	1	-5	1	1	1	1	1	1
8	1	1	-5	1	1	1	1	1	1	1
9	1	-5	1	1	1	1	1	1	1	1
10	-5	1	1	1	1	1	1	1	1	1

Economic Capital Example Actual Probabilities

Loss	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr10
0	35%	39%	43%	48%	53%	59%	66%	73%	81%	90%
1	39%	39%	38%	37%	35%	33%	29%	24%	18%	10%
2	19%	17%	15%	12%	10%	7%	5%	3%	1%	
3	6%	4%	3%	2%	1%	1%	0%	0%		
4	1%	1%	0%	0%	0%	0%	0%			
5	0%	0%	0%	0%	0%	0%				
6	0%	0%	0%	0%	0%					
7	0%	0%	0%	0%						
8	0%	0%	0%							
9	0%	0%								
10	0%									

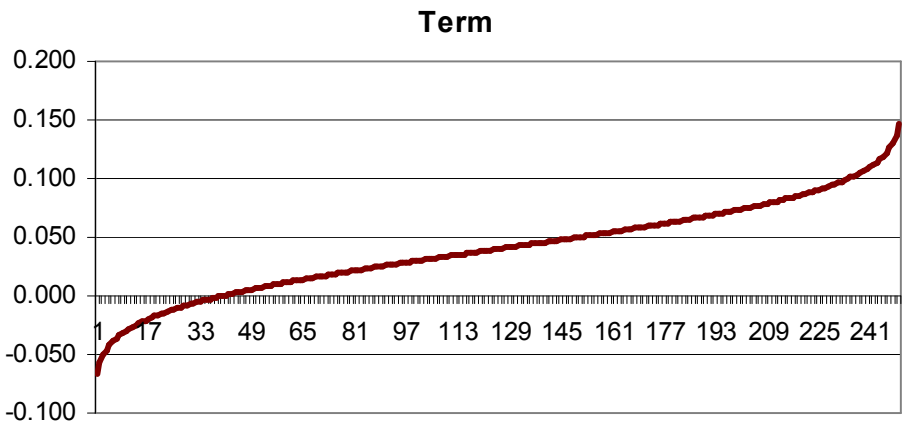
Economic Capital: CTE Vs. VAR

- Conditional Tail Expectation (CTE)
  - Is calculated as the arithmetic average of the tail
  - CTE(90) is the average of the final 10% of the distribution
  - CTE(0) is the mean
- Value At Risk (VAR)
  - Is the loss associated with the probability listed
  - A 99.7% VAR is the amount of capital (in addition to reserves) needed to survive the 99.7% worst case scenario
- S&P's Default history

  AAA 99.9% AA 99.7%

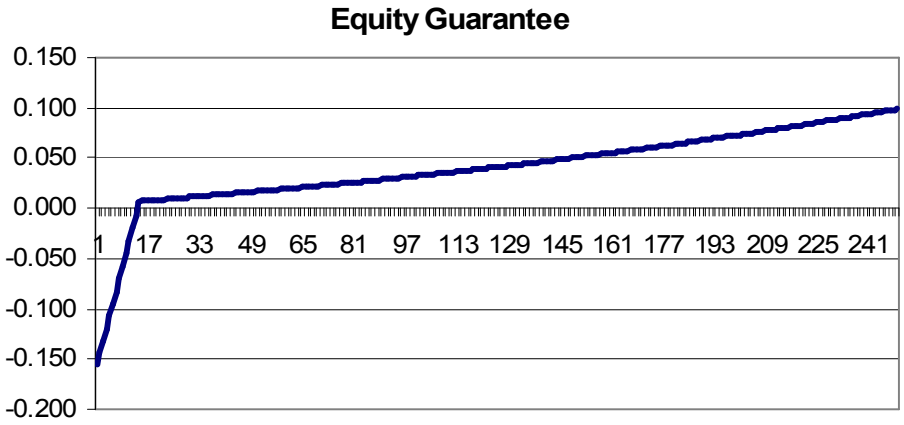
  A 99.4% BBB 97.2%

CTE Vs. VAR: The tale of the tail



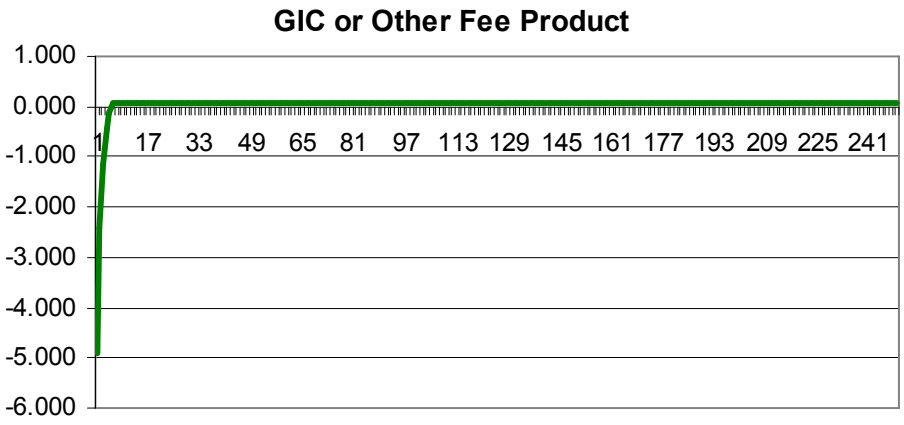
- Mortality risk as measured by the present value of distributable earnings
- Based on level and trend, not catastrophic

CTE Vs. VAR: The tale of the tail



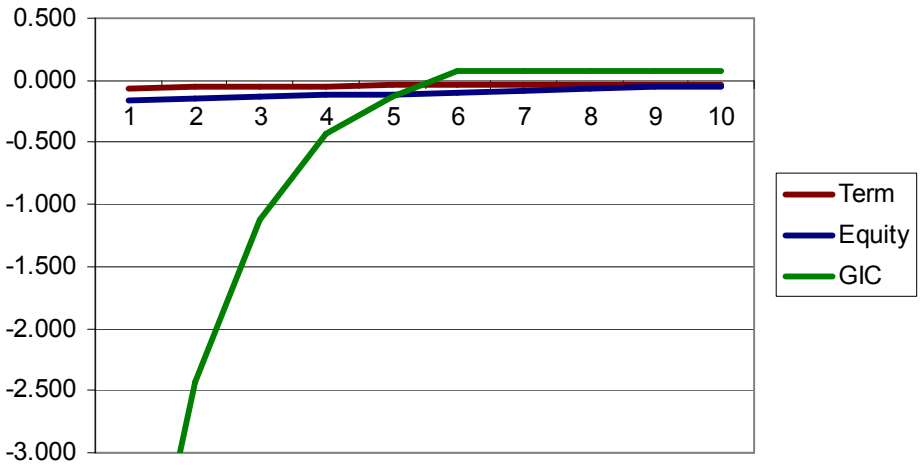
- Results are a combination of the put option and equity growth.

CTE Vs. VAR: The tale of the tail



- Credit risk (no interest rate risk)

CTE Vs. VAR: The tale of the tail



- All curves normalized to equal expected distributable earnings
- Thinking about the tail differently

CTE Vs. VAR: The tale of the tail

Measure	Term	Equity	GIC
VAR 99.7	0.0564	0.1440	2.4274
VAR 99.4	0.0503	0.1318	1.1274
VAR 97.2	0.0365	0.0826	0.0777
CTE (99)	0.0591	0.1464	3.1674
CTE (97)	0.0472	0.1162	1.1790
CTE (95)	0.0400	0.0853	0.6763

Economic Capital Example Value at Risk @ 99.7%

	Year 1	Year 2	Year 3	Year 4	Year 5
Low loss	4	4	4	3	3
Cum Prob	98.72%	99.17%	99.50%	97.42%	98.42%
High Loss	5	5	5	4	4
Cum Prob	99.84%	99.91%	99.96%	99.73%	99.87%
Capital	20	20	20	15	15

	Year 6	Year 7	Year 8	Year 9	Year 10
Low loss	3	3	2	2	1
Cum Prob	99.14%	99.63%	97.20%	99.00%	90.00%
High Loss	4	4	3	3	2
Cum Prob	99.95%	99.99%	99.90%	100.00%	100.00%
Capital	15	15	10	10	5

Economic Capital Calculations

- PV of capital = 3*20 + 4*15 + 2*20 + 5 = 145
- Average annual capital = 145 ÷ 10 = 14.5
- Market value margin per year = 14.5 * 1000 bps = 1.45
- Total value of margins = 1.45 * 10 = 14.5
- PV of expected free cash flow = 22.0
- So the fair value is approximately -7.5 (asset / good guy)
- Quite possibly distribution cost was 7.5.
- Acquirer pays ceding company 7.5
- Exit value is ceding company pays -7.5 to transfer rights and obligations

Economic Capital and Taxes

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr10
Capital	20	20	20	15	15	15	15	10	10	5
PV CF	22.0	18.0	14.4	11.2	8.4	6.0	4.0	2.4	1.2	0.4
PV cap	145	125	105	85	70	55	40	25	15	5
Pv mrg	14.5	12.5	10.5	8.5	7.0	5.5	4.0	2.5	1.5	0.5
Ecn Vx	-7.5	-5.5	-3.9	-2.7	-1.4	-0.5	0	0.1	0.3	0.5
Tax Vx	3.0	2.7	2.6	2.6	2.6	2.8	3.1	3.4	3.1	2.0
Refund	3.7	2.9	2.3	1.8	1.4	1.2	1.1	1.2	1.0	0.7
Assets	8.8	11.6	13.8	10.5	12.2	13.3	13.9	8.9	9.3	4.8

Economic Capital and Taxes

- GM, MSFT, GE, COM, P&G, Widgits Inc. etc
  - Raises $100,000,000 by issuing 1,000,000 shares
    - Share price = $100.00
  - Builds a factory expected to produce 10% return after tax
  - Assume it pays a dividend of $11.0168 annually
    - This amortizes value of stock to zero over 25 years
  - Assume capital is depreciated and earnings are 65% of interest
  - Assume tax rate goes to 40% from 35%

Consider the following table:

Economic Capital and Taxes: FIT 35% —> 40%

Yr	Share Price	Div	Int	Prin-cipal	BT Profit	New ATP	New Div	Share Price
0	100.00							94.09
1	98.98	11.02	10.00	1.02	15.38	9.23	10.25	93.25
2	97.87	11.02	9.90	1.12	15.23	9.14	10.26	92.32
3	96.63	11.02	9.79	1.23	15.06	9.03	10.26	91.28
…	…	…	…	…	…	…	…	…
23	19.12	11.02	2.74	8.28	4.21	2.53	10.81	18.92
24	10.02	11.02	1.91	9.10	2.94	1.76	10.87	9.94
25	0.00	11.02	1.00	10.02	1.54	0.92	10.94	0.00

Economic Capital and Taxes

- Ivory Tower Life Insurance Company Inc
  - Raises $100,000,000 by issuing 1,000,000 shares
    - Share price = $100.00
  - Buys block of term policies where VAR (99.7) = $100,000,000

(Q #1) What's the first thing the company does?
(A #1) Buy back $35,000,000 of your stock.

(Q #2) What happens to the stock price?

Economic Capital and Taxes

- If tax rate = 0%
  - Capital = 100 Margin = 10 Return = 10.0%
- Assume tax lawyers
  - Say they reduce effective tax rates by 500 basis points
  - (also assume margin of 10 = 12 – 2)
- @ 35% expected tax = -2 * 35% + 12 * 30% = 2.9 < 3.5
  - Capital = 65 Margin = 7.1 Return = 10.9%
- Share price = 100.00 * 10.9 ÷ 10.0 = 109.00
- @ 40% expected tax = -2 * 40% + 12 * 35% = 3.4 < 4.0
  - Capital = 60 Margin = 6.6 Return = 11.0%
  - Share price = 110.00

ERM AND RETENTION LIMIT

Retention Limit is function of capital (acceptable volatility)

Variance of claims = $Avg\_size^2 * npq +$
$(nq)^2 * Var(face\ amount) +$
$(Avg\_size * n)^2 * Var(q) +$
VAR (Catastrophic claims)

Variance in number of claims

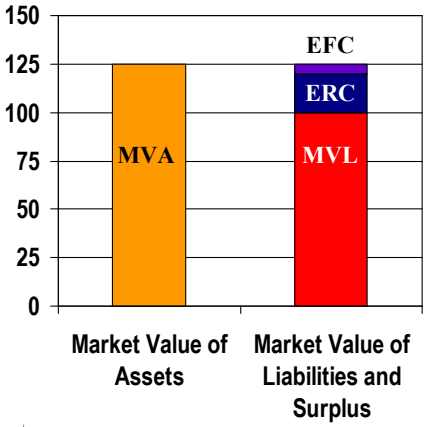
Variance in average size of claims

Variance in q_x (Parameter risk)

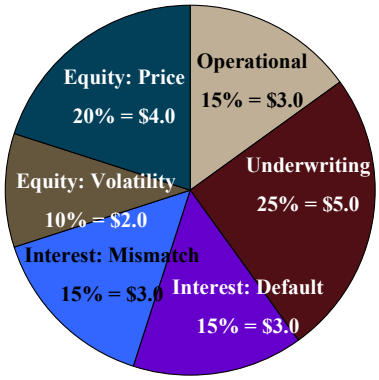
Variance in random process producing claims

Hypothetical Economic Capital: Well Diversified

Economic Balance Sheet



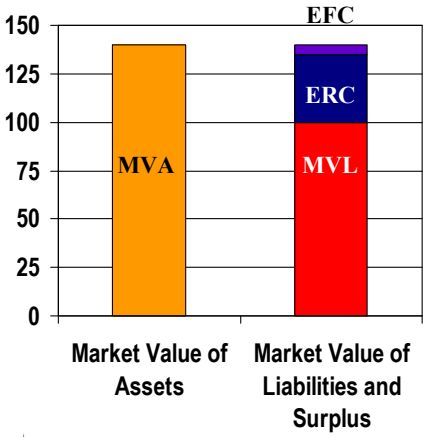
Composition of Economic Required Capital (ERC)



Note: ERC is after diversification and tax effects

Hypothetical Economic Capital: Too Concentrated

Economic Balance Sheet



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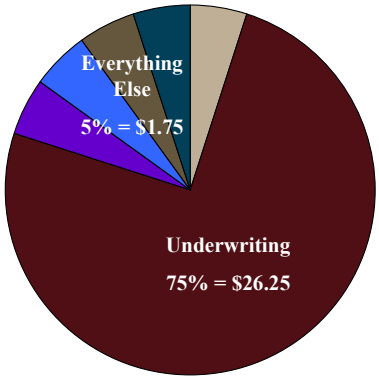


Note: ERC gets much smaller diversification benefit

CATASTROPIC LOSSES AND "THE BLACK SWAN"

- The Black Swan: The Impact of the Highly Improbable
  - By Nassim Nicholas Taleb
- Mediocristan and Extremistan
- Health and Accident Mortality belong in Mediocristan
- Catastrophic events belong in Extremistan
  - Unfortunately our studies co-mingle deaths and treat as on phenomenon
- Biggest problem is that the data aren't any good for predicting the future.
- Cat Cover offered by reinsurers
  - Rating now impacts ERM models and maybe price

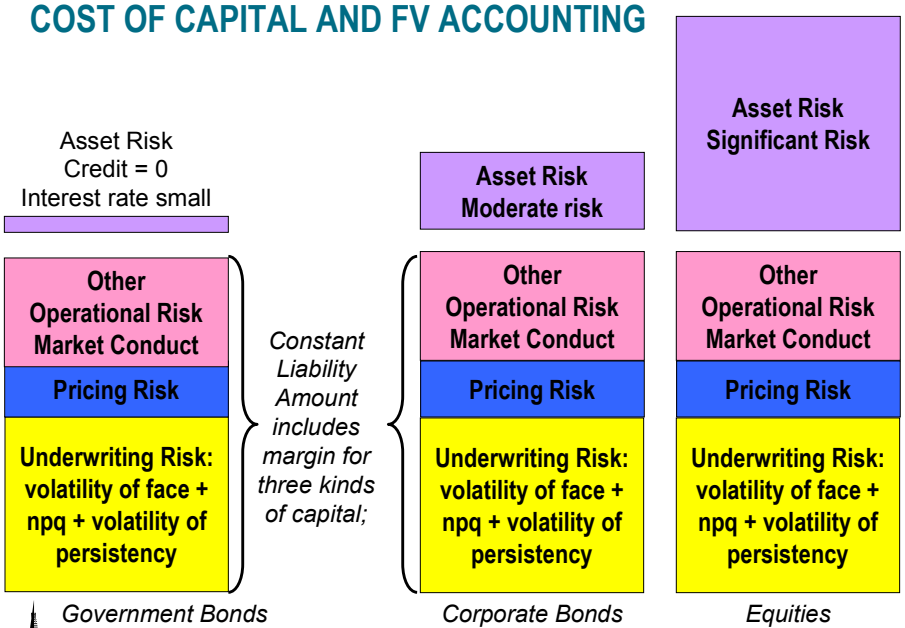
WHAT COULD POSSIBLE GO WRONG?

- Plane Crash ~250 deaths
- Small Pandemic ~800 death from SARS in 2003
- Small Natural Disaster ~2000 Dead from Katrina
- Terrorism ~3000 WTC Dead
- Nuclear Accident 56 plus ~4000 – 100,000 in Chernobyl
- Large Natural Disaster Christmas Tsunami killed ~10,000 in Sri Lanka
- Industrial Accident ~20,000 killed by Union Carbide in Bhopal India
- Gigantic Natural Disaster: an Isle of Man-sized chunk could fall of Canary Islands Tsunami
- Major War
  - WWII 40 – 70 million
  - Vietnam 2.5 – 5 million
- Famine
  - Russian 6-8 million 1932
  - Chinese 20-40 million 1960
- Spanish flu 20-40 million 1918
- Asteroid (Extinction?)

COST OF CAPITAL AND FAIR VALUE ACCOUNTING

- Exit Value requires Discounting at the risk free rate
  - This is really an allocation of capital issue
- You need to get the same liability value irrespective of the asset portfolio
- Infinite number of asset portfolios of increasing volatility
  - Government Bonds (zero credit risk; some interest rate risk)
  - Well diversified portfolio of fixed income securities
  - One giant bond (large credit risk, less interest rate risk)
  - Equities (price risk, not credit; basis risk, duration mismatch)
  - Gold
  - Real Estate

COST OF CAPITAL AND FV ACCOUNTING



COST OF CAPITAL AND FAIR VALUE ACCOUNTING

- Exit value requires incorporation of instrument's credit standing; not company's
  - Need to consider guarantee associations
- WHY?
- Assets and Liabilities need to be valued consistently
- A credit event that impacts the left side of the balance sheet should also impact the right side.
- If spreads widen and depress asset values, own credit standing has probably deteriorated also.
  - If well matched, there will be no earning impact

COST OF CAPITAL AND FAIR VALUE ACCOUNTING

Between valuation periods 1 and 2 there was a credit event that greatly increase credit spreads by 50 basis points

Assets consist of a well diversified portfolio of corporate fixed income securities of AA quality on average

Liabilities are calculated assuming 40 basis points of default risk

Valuation Period 1

Income volatility is immunized if the credit spread of the assets is close to the credit standing of the liabilities

Reduced volatility means less capital

Assets lose value if credit spreads increase by 50 basis points

Liabilities are calculated assuming 90 basis points of default risk

Valuation Period 2