

Building a GPS System for Insurers

Enterprise Risk Management Symposium
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E_{nterprise}

$$\frac{R_{\text{return}}}{R_{\text{risk}}}$$

M_{anagement}

What Is Enterprise Risk Management?

- COSO defines ERM as: *“...a process, effected by an entity’s board of directors, management and other personnel, applied in a strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity goals.”*
- RIMS defines ERM as: *“...the culture, processes and tools to identify strategic opportunities and reduce uncertainty. ERM is a comprehensive view of risk from both operational and strategic perspectives and is a process that supports the reduction of uncertainty and promotes the exploitation of opportunities.”*

An Alternative View

- What is ERM? *ERM is a distributed framework for the risk-conscious deployment of capital in localized decision-making.*
- ERM is not just a senior executive responsibility but a mindset that permeates the organization.
- ERM is not just about risk but about organized ways to think about and take on risk-bearing profit opportunities.
- ERM is as concerned with value creation as it is with value preservation.
- How does ERM work? *ERM systematically adjudicates multiple sources of risk emanating from many actual and potential risk-bearing projects, each necessitating the allocation of scarce risk capital amid continually changing prices of risk.*

Some Hypotheses

- Companies do not have “risk appetites” *per se*. What they do have are fragile, fleeting opportunities to sell products and purchase assets in uncertain volumes. “Risk” is often ancillary to the pursuit of nearby profit opportunities.
- Companies may make “inefficient” or “suboptimal” decisions meant to satisfy key constituents:
 - Supporting a marketing channel
 - Subsidizing a product line
 - Maintaining asset supply lines
- Companies continue to care about seemingly arcane metrics
 - Operating income (ignores capital gain/loss)
 - Net income (ignores fair value)

Guiding Wisdom from Sages

- "Every revolutionary idea evokes three stages of reaction
 1. it's completely impossible
 2. it's possible but it's not worth doing
 3. I said it was a good idea all along."

- Arthur C. Clarke, Visionary

- "Information is a message that reduces uncertainty."

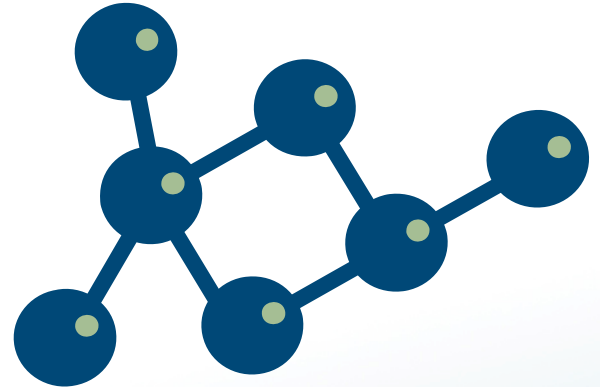
- Claude Shannon, Game Theorist

- "Diversification is the only free lunch on Wall Street."

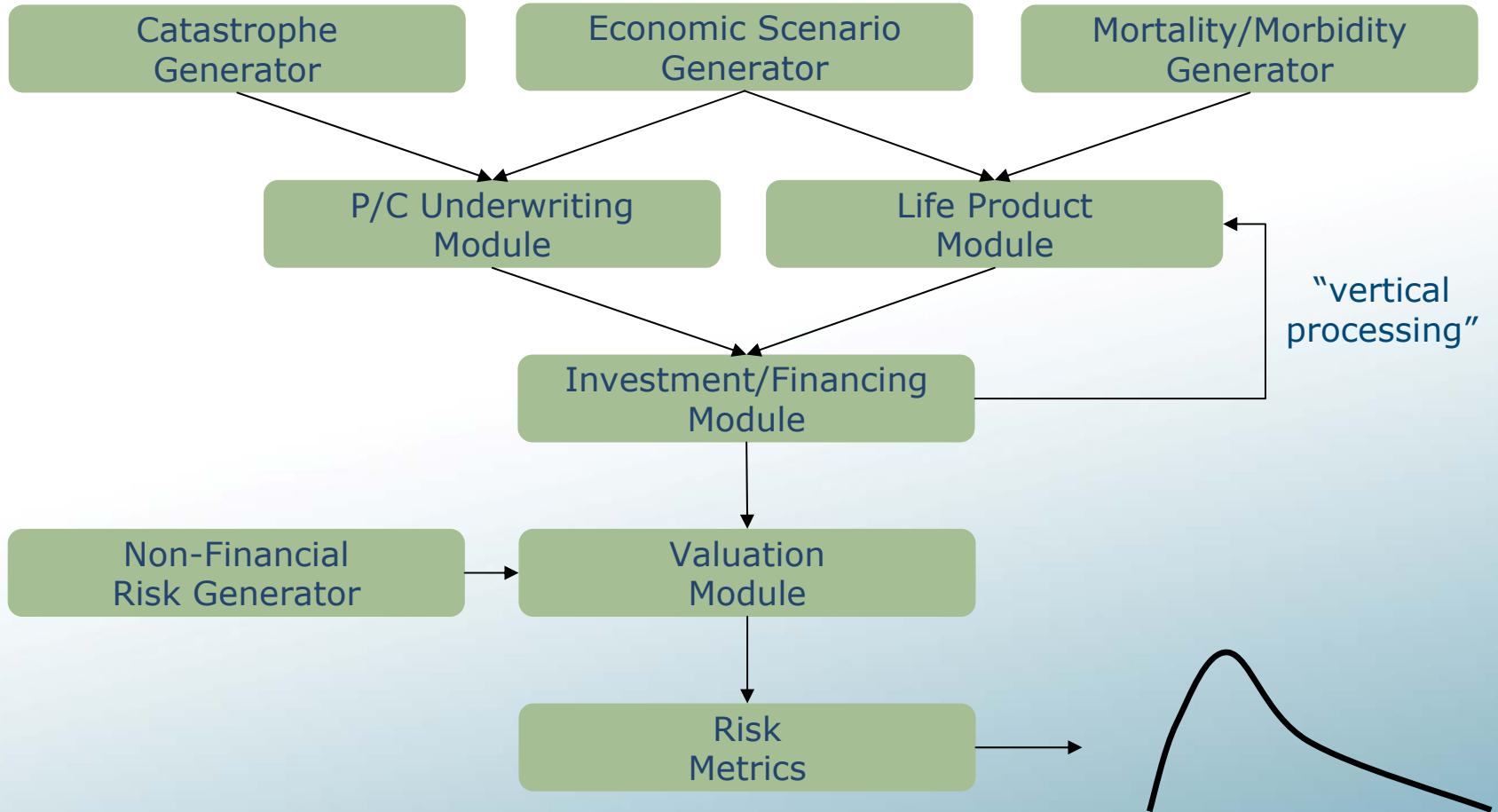
- Harry Markowitz, Nobel Scholar

What Is Economic Capital?

- What is EC? *Economic capital is the balance-sheet power that ensures the long-range economic resilience of the enterprise and its ability to take on risk-bearing profit opportunities.*
- Economic capital derives from estimates of resource demands placed upon the enterprise under extreme risk conditions and how interconnections across the enterprise work to intensify or diminish those demands.
- Connecting orthogonal parts of the enterprise in an EC model quantifies potential diversification benefits by pairing up risk partners.



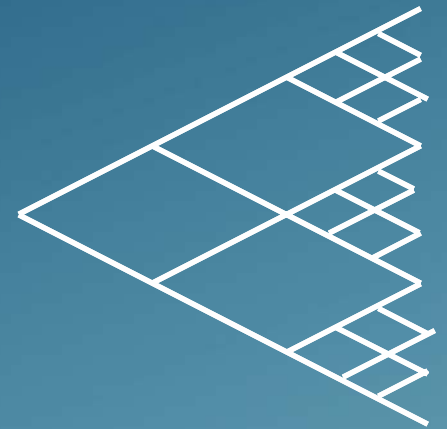
An EC Model of a Multi-Line Company



EC Helps Answer Two Key ERM Questions

1. "What is the incremental economic return on a prospective project in relation to the risk capital it commands?"
 - EC intrinsically captures the covariances between the project and the enterprise's existing risk profile.
 - Permits consistent, coherent and comparable conclusions about a project's advisability.
2. "What is the optimal arrangement of assets and liabilities given my business situation and business opportunities?"
 - "How can I capitalize upon the diversification potential of my balance sheet?"
 - "How can I objectively tell which product lines created value and which extinguished value?"

Optimizing the Enterprise: A Simplified Experiment



Moving From *What-If* to *What's-Best*

- Old-fashioned descriptive model



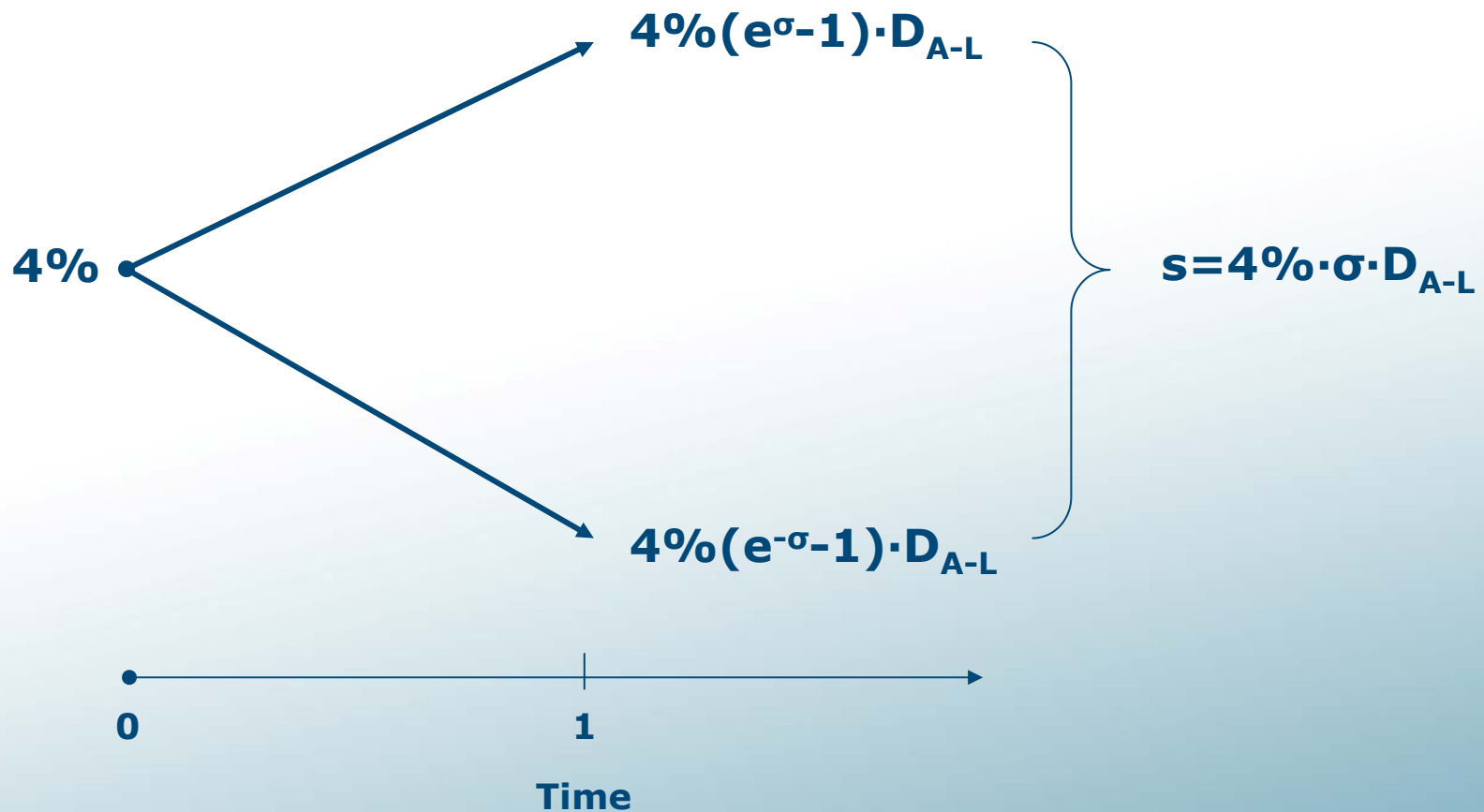
- New-fangled prescriptive model



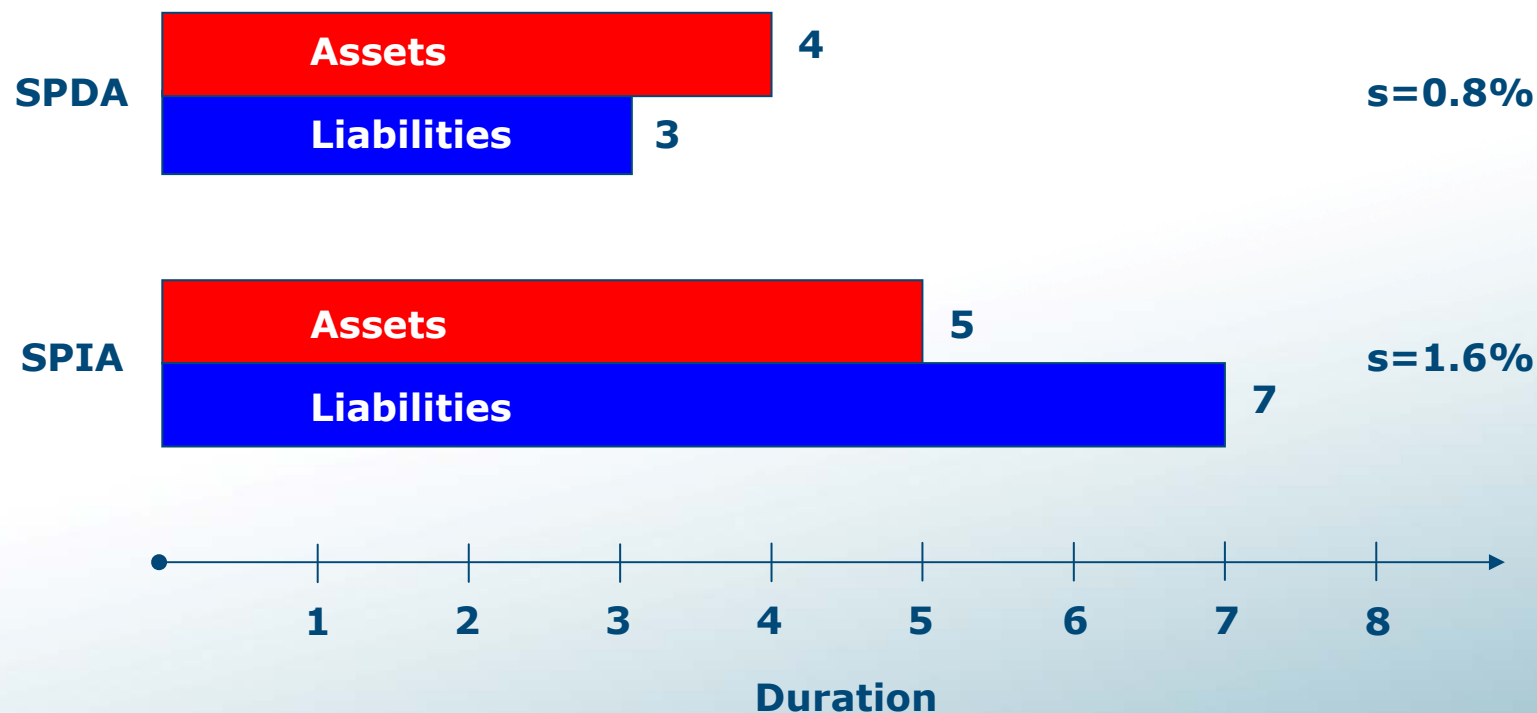
Optimizing Deployment of Risk Capital

- What is the goal of this experiment?
 - To illustrate the dynamics of enterprise optimization under a robust definition of economic capital
 - To determine how sales should be split to optimize deployment of risk capital and maximize overall ROC
- Assume two business lines, subject to a single risk factor
 - SPDA: $D_A > D_L$ is the price of market entry
 - SPIA: Sufficiently long assets typically can't be found
- Assume both lines are priced to a 0.20% post-FIT margin
- Assume capital set at 99% one-year TailVaR
- Now, let's use handy duration statistics to help model risk

Volatility of Assets less Liabilities



Market Realities Dictate Risk Positions



TailVaR Exhibits Attractive EC Properties

- Under a TailVar metric, economic capital allocation to each product line is its contribution to the tail.
- Capital budgeting via TailVaR automatically includes all sources of variation and covariation.
- Economic capital is easily determined using various methods.
- TailVar Is a mathematically “coherent” EC metric
 - Subadditivity: For losses X and Y , $\rho(X+Y) \leq \rho(X) + \rho(Y)$.
 - Monotonicity: If $X \leq Y$ for each outcome, then $\rho(X) \leq \rho(Y)$.
 - Positive Homogeneity: For positive constant b , $\rho(b \cdot X) = b \cdot \rho(X)$.
 - Translation Invariance: For constant c , $\rho(X+c) = \rho(X) + c$.
- $EC_i = \phi(\text{VaR}) / (1 - \Phi(\text{VaR})) \cdot \sigma_i^2 (1 + \rho_{i,j} \cdot \sigma_j / \sigma_i)$, where $j = \text{not } i$

Trial 1: Freestanding Product Lines

	Volume	Pricing	DA-L	SD	VaR ₉₉	EC ₉₉	ROC
SPDA	\$100	0.20%	1	0.80	1.86	2.13	9.38%
SPIA	\$100	0.20%	-2	1.60	3.72	4.26	4.69%
Total	\$200	0.20%	-0.50	0.80	1.86	6.40	6.25%

- Risk-sharing across product lines is not enabled.
- Economic capital is determined for each line separately.

Trial 2: Enable Risk-Sharing

	Volume	Pricing	DA-L	SD	VaR ₉₉	EC ₉₉	ROC
SPDA	\$100	0.20%	1	0.80	1.86	-2.13	-9.38%
SPIA	\$100	0.20%	-2	1.60	3.72	4.26	4.69%
Total	\$200	0.20%	-0.50	0.80	1.86	2.13	18.76%

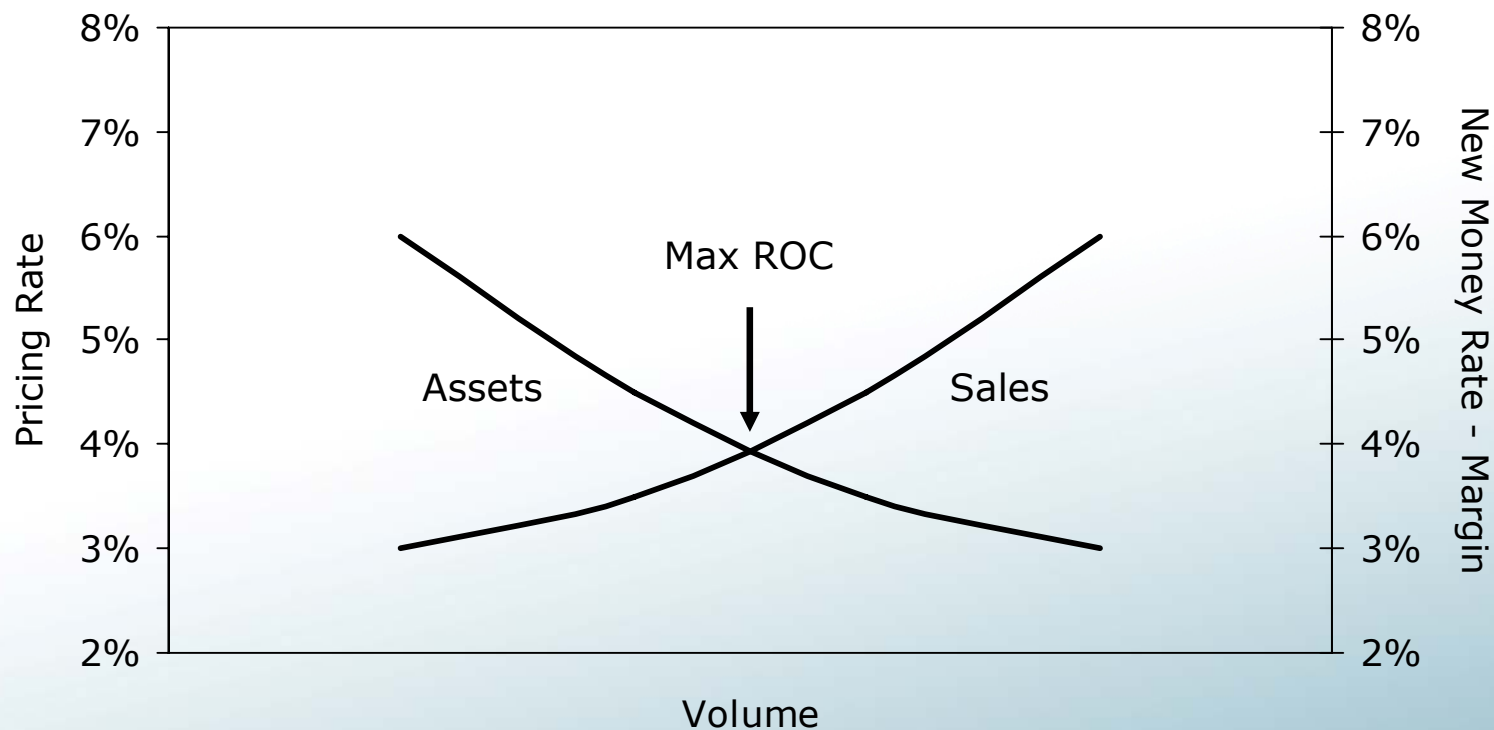
- Economic capital is determined in aggregate and allocated coherently according to TailVaR methodology.
- Instead of consuming capital, the SPDA line generates capital. This phenomenon can only occur when the correlation coefficient is negative.
- TailVaR cannot be used to allocate total capital to constituent lines. Product-line reporting should exclude capital.

Trial 3: Toward Optimality

	Volume	Pricing	DA-L	SD	VaR ₉₉	EC ₉₉	ROC
SPDA	\$110	0.20%	1	0.88	2.05	-2.35	-9.38%
SPIA	\$90	0.20%	-2	1.44	3.35	3.84	4.69%
Total	\$200	0.20%	-0.35	0.56	1.30	1.49	26.80%

- A 10% shift in sales makes better use of the diversifying product line.
- As balances shift between the two product lines, sources and uses of capital also shift.
- In this simplified example with a -1 correlation coefficient, infinite ROC can be achieved (a trivial result).
- In the real world, significant externalities constrain what can be achieved.

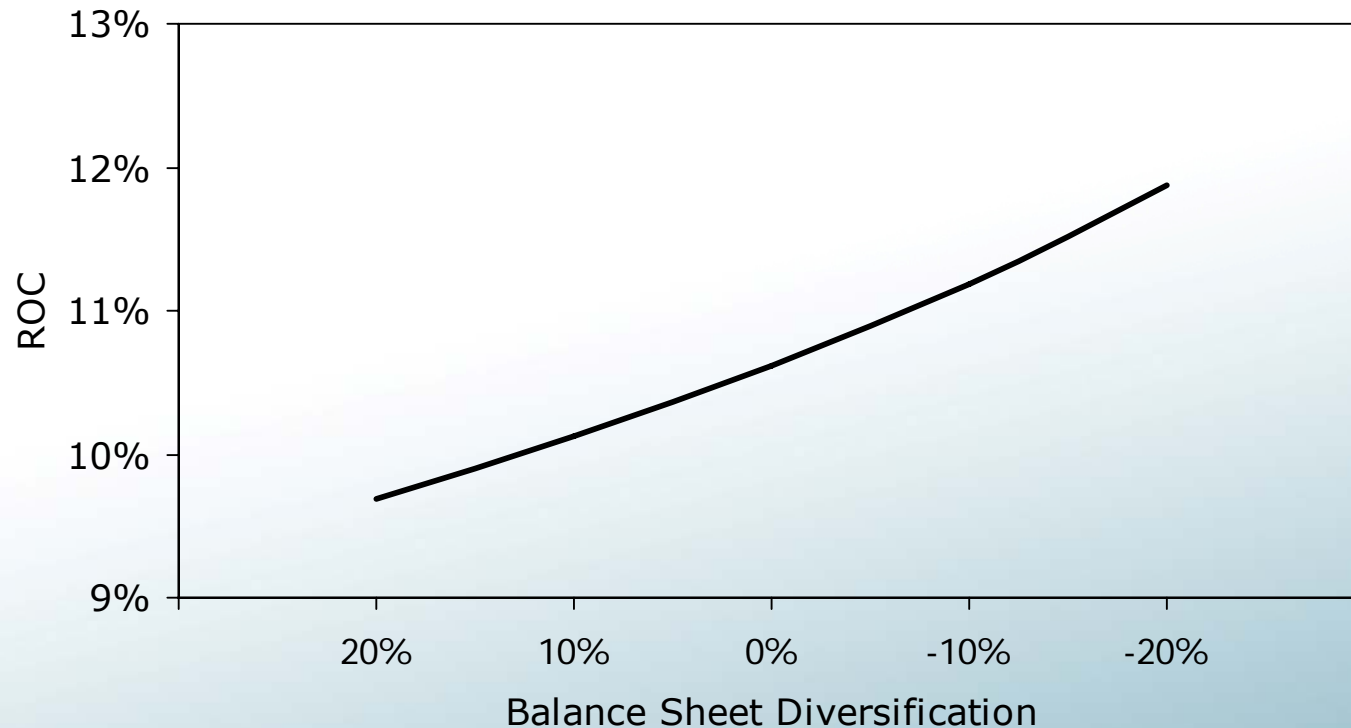
Supply/Demand Elasticities Are Convex



Real-World Optimization Considerations

- Important optimization constraints include
 - Reported earnings expectations
 - Fixed/variable cost structure
 - Desired RBC ratios
- Supply/demand curves must be incorporated
 - Higher volumes can lead to
 - Asset plant “drill through” into less-attractive generic bonds
 - Higher liability costs
 - Lower volumes can lead to fixed-cost overruns
- Institutional forces limit attainment of absolute optimality, but incremental improvements can be significant

Diversification Conveys Significant Competitive Advantage



Conclusions

- Real-world constraints and elasticities exert significant non-linearities in the quest for optimality.
- The ability to attribute, in a coherent way, a constituent's contribution to total capital levels is critical to informed balance-sheet management.
- Some product lines can act to generate risk capital, although real-world dynamics are subtle and complex when multiple constituents share multiple risk factors.
- Diversification conveys significant competitive advantage.
- Third-millennium technology should focus upon GPS solutions to business complexity and uncertainty.



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