Getting the Details Right:

Effective Use of Risk-Adjusted Return on Capital Measures

Session CS 3D

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State of the Art in ERM for Insurers

- Most firms are still in early stages of introducing ERM and Risk-Adjusted Return on Capital (RAROC) Measures
  - Recent E&Y Risk Measurement and Capital Management Survey
    - 75% of Insurers surveyed have a formal risk framework
    - 60% of these firms stated that their framework implementation is less than 3 years old
    - 15% have said that their framework is still in the development stages
- Limited agreement in the literature on a variety of important issues
- Tremendous variation in practice
  - What is being measured
  - How it is being measured
  - How it is used
    - Communication with rating agencies, shareholders and others
    - Performance measurement
    - Strategic business decisions
- But many implementations share one thing in common – lack of attention to specific details.

Five Common Pitfalls to Avoid

- Capital Standard vs. Capital Attribution
- Economic Capital vs. Risk Capital
- Consistency of Risk Exposure Horizons
- Retrospective vs. Prospective RAROC Measures
- Setting RAROC Targets

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Capital Standard vs. Capital Attribution

- Capital Standard Defined:

  A decision rule used to determine the amount of capital needed to support the insurer's operations.

- Often based on probability of default over some specified time horizon
  - Management selects a target default probability
  - Capital is determined to ensure default probability less than the target probability
  - Value at Risk measure is often used to quantify the capital need
- Other plausible capital standards:
  - Ensuring a target credit rating
    - Now
    - At some future date
    - Over selected time horizon
  - Ensuring minimum surplus levels over selected time horizon
    - Minimize potential impairment of franchise value
- Key point – Capital requirement should be linked to a clearly stated objective.

Capital Standard vs. Capital Attribution (*continued*)

- Capital Attribution Defined

  A proportional allocation of the firmwide required capital (determined based on the chosen Capital Standard) to different business units and/or risk sources.

- Driven by relative risk and/or contribution to total risk
- Variety of risk measures and approaches can be used (see Venter)
  - Proportional Allocation with Risk Measure (VaR, Tail VaR, Expected PH Deficit)
  - Incremental and Marginal Contributions to Firmwide Risk Measure
  - Target EPD Ratio
  - Myers'-Read
  - Co-Measures (Kreps, RMK Algorithm)
  - Sherris' Exchange Option

Capital Standard and Capital Attribution
Why Is It Important to Separate These Steps?

- Many practitioners assume that the methods and/or risk measures used for the two steps must be the same
- They adopt a 99.97% Value at Risk measure as the capital standard for the firm and then assume that each business unit's capital attribution must also use the 99.97% VaR
  - Places too much reliance on difficult to measure, unreliable and unstable estimates of the extreme tail
  - Implicitly assumes that a "default probability" concept even applies at the business unit or risk source level
    - Can a single line default on its own?
    - Can the operational risk source "default"?
    - Then what's the basis for 99.97% as the VaR level used? Does it mean anything?
  - Seems to encourage the use of risk measures with potentially undesirable properties
    - Not Additive
    - Not Coherent

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Economic Capital vs. Risk Capital

- Practitioners often use the following terms interchangeably:
  - Required Capital
  - Risk-Based Capital
  - Risk Capital
  - Economic Capital
- Preferable to define different forms of capital more precisely:
  - Cash Capital – The actual cash capital that must be used to enter into a given position.
    - For assets, this is simply the cost of purchasing the asset
    - For insurance liabilities, this is usually negative
    - For derivative positions, this is usually small or zero
  - At-Risk Capital – A measure of the potential change in value of a position, subject to an arbitrary probability level
  - Risk Capital – The capital required, *in addition to the cash capital*, to guarantee that you can satisfy an obligation
    - Can be measured relative to Cash Capital or At-Risk Capital
    - Exists only for liabilities (or derivative positions that are potential liabilities)
    - There is no “risk capital” associated with an investment in a bond or equity (though of course there is both cash capital and at-risk capital).
  - Economic Capital – The sum of Cash Capital and Risk Capital
- See Sherris

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Consistency of Risk Exposure Horizons

- Some practitioners prefer to model different categories of risk separately:
  - Market Risk (e.g. Equity Portfolio)
  - Credit Risk (e.g. Corporate Bond Portfolio)
  - Insurance Risk (e.g. P&C Claim Costs)
- For each risk type, they determine a risk measure for a given risk exposure horizon (e.g. 99.97% 1-Year Value at Risk)
- However, they often do not define “Value at Risk” consistently
  - VaR for Market Risk – Based on change in market value of an asset/position over the specified time horizon (one year)
  - VaR for Insurance Risk – Often based on distribution of ultimate liability, discounted or undiscounted, without regard for the one year horizon.
    - For consistency, need to reflect only the potential for the present value of the losses during the horizon and the reserves as of the horizon date to deviate from current estimates
    - Alternatively, could extend the Market VaR horizon – but this introduces a host of practical implementation issues associated with long-horizon VaR

Consistency of Risk Exposure Horizons (*continued*)

- Is consistency important?
  - Perhaps different holding periods justify different horizons?
  - If so, what do the aggregate numbers mean?
- RAROC vs. DFA
  - RAROC
    - Tends to be a single period measure
    - Consistency argues for risk measures that focus on short-term risks
  - DFA
    - Focus is usually longer term
    - Risk measures reflect lifetime risk
  - Tools are similar, but their uses differ
    - So do the potential insights into the business

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Retrospective vs. Prospective RAROC Measures

- Retrospective (*ex post*) RAROC
  - Relies on calendar year measures of income
    - Ties to existing financial accounting systems
    - Ties to numbers management and shareholders are used to seeing
  - Reflects risk of adverse development on existing reserves in “capital” measure
    - Reserve risk impacts credit ratings and default probabilities - must be part of “required capital”
  - Useful for performance measurement, external reporting and possibly compensation
- Prospective (*ex ante*) RAROC
  - Recognizes that reserve risk impacts marginal capital for other risk sources and lines of business due to correlations/dependency
  - Excludes the income and capital associated with reserves from the RAROC measure
  - Useful for strategic decisions

Retrospective vs. Prospective RAROC Measures (*continued*)

- Suppose Line A's RAROC is below the "target" RAROC.
- Should we write more premium or less in the coming year?
- Should depend entirely on the potential RAROC of *future* business.
- The "return on capital" for the runoff of old business is difficult to "improve"
  - You are stuck with this poorly performing business segment whether you write more business or not!

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Setting RAROC Targets

- What level of RAROC “maximizes shareholder value”?
  - *“This should be at least equal to the shareholders’ opportunity cost for an investment of equivalent risk, which can be shown to be equal to the market’s required return on the insurer’s stock, derived from the capital asset pricing model.” (*Nakada, et. al.)
  - *“The risk-adjusted return should be compared with the cost of capital for [the] business, where the cost of capital is obtained using an appropriate asset pricing model.”* (Cummins)
- What’s the basis for this?
  - Reflects imprecise recollections of Finance 101 capital budgeting rules
    - “Accept all projects with IRR > Cost of Capital (Hurdle Rate)”
  - But this assumed:
    - No frictional costs (i.e. unlimited access to capital)
    - Assumed ALL acceptable projects would be accepted (i.e. no capital constraint)
    - Funded Investments, where the “Capital” investment is clearly defined

Setting RAROC Targets (*continued*)

- Traditional “cost of capital” models
  - Dividend Discount Models
  - CAPM
  - Fama-French 3 Factor Model
- Reasons why cost of capital models aren’t useful references for RAROC:
  - Differences Between “Return on Capital” Measures
  - Different Definitions of Risk
  - Measurement Issues
  - Leverage Adjustments

Differences Between *Return on Capital* Measures

- GAAP Return on Equity (ROE)
  - Numerator: GAAP Income
  - Denominator: Average Book Value of Equity
    - Ignores Market Value of the Equity
- RAROC
  - Numerator: Market Value Single-Period Income (or GAAP Income in some cases)
    - Ignores changes in franchise value
  - Denominator: Marginal Economic Capital or Risk Capital
    - Reflects arbitrary risk tolerance
    - Reflects impact on particular portfolio of risks
- Shareholder Return
  - Numerator: Total Change in Market Value
    - Reflects income from current and future periods
  - Denominator: Beginning of Period Market Value of Equity

- How comparable are these measures?

Different Definitions of Risk

- Asset Pricing Models
  - Focus is on *systematic* risk measures
    - CAPM Beta – Sensitivity to systematic market risk
    - Fama-French Factors (Market, SMB, HML) proxy for systematic risks
  - Risk measured with respect to small changes in portfolio composition
  - Risk measurement reflects average investor's portfolio
- Economic Capital Models
  - Reflects total risk, not just systematic risk
  - Risk measured for large divisions and business units
  - Reflects particular firm/investor portfolio to determine marginal capital
- Should Risk-Adjusted Returns that use different definitions of risk be compared?
  - If the measure reflects total risk, why use a model based on systematic risk as a benchmark?

Measurement Issues

- Practitioners prefer to “drill down” to measure RAROC
  - Business Unit
  - Product Line
  - Policy Level
- Asset pricing models (e.g. CAPM) cannot be reliably drilled down to that level of detail
  - Insufficient data to estimate systematic risk measures
  - Limited historical data available
    - Difficult to obtain competitor/industry data in fine enough detail

Leverage

- RAROC Measures are *leveraged* and therefore must be compared to similarly leveraged benchmarks
- Example:
  - Consider a simple firm that engages in just one transaction:
    - Writes a one-year Put on one share of stock
    - Raises capital to fund potential losses on the put transaction
    - Invests proceeds of put sale and capital raised in risk-free assets (r_f = 4%)
  - Assumptions
    - Stock price = 100
    - Put Strike Price = 100
    - Expected stock return = 12% continuously compounded (12.75% annually compounded)
    - Annualized Volatility = 25% continuously compounded
  - Put Price = 7.92 based on the Black-Scholes Model
  - All funds are distributed to shareholders at the end of the year.
- Note that the maximum possible “liability” = 100 at the option maturity
  - Expected value of the option payoff = 5.40

Leverage Example (*continued*)

- Consider the firm's balance sheet before consideration of capital commitment:

Assets		**Liabilities & Equity**	
Proceeds from Put Sale:	7.92	Expected Put Payments:	5.40
		Equity:	2.42

- Now, assume required capital is such that the maximum possible liability payment can be made:

Assets		**Liabilities & Equity**	
Proceeds from Put Sale:	7.92	Expected Put Payments:	5.40
Cash from Initial Capital:	88.16		
Total Assets:	96.08	Book Equity:	90.68

  - Note that committed capital = 88.16
  - Expected Total Profit = 6.47
    - Risk Free Interest on Put Premium
    - *Plus* Risk Free Interest on Committed Capital
    - *Less* Expected Put Payment
  - Expected Return on committed capital = 6.47/88.16 = 7.34%

Leverage Example (*continued*)

- What if we focused on *Rating Agency Capital*?
  - Assume our target AA-rating could be achieved with a .05% probability of default
  - Required capital would decline to the 99.95% one-year VaR level = 42.04 (PV)
  - Balance sheet would now look like this:

Assets		**Liabilities & Equity**	
Proceeds from Put Sale:	7.92	Expected Put Payments:	5.40
Cash from Initial Capital:	42.04		
Total Assets:	49.96	Book Equity:	44.56

  - Expected Return on Rating Agency Capital = 10.91%

Leverage Example (*continued*)

- What if we focused on Management's Risk Tolerance?
  - Assume management sets their target risk-adjusted capital at the 99% VaR level
  - Required capital would decline to the 99% one-year VaR level = 29.47 (PV)
  - Balance sheet would now look like this:

Assets		**Liabilities & Equity**	
Proceeds from Put Sale:	7.80	Expected Put Payments:	5.40
Cash from Initial Capital:	29.47		
Total Assets:	37.27	Book Equity:	31.87

  - Expected Return on Risk-Adjusted Capital = 13.60%

Leverage Example (*continued*)

- Summary of Three Methods:

	Method 1	Method 2	Method 3
Capital	88.16	42.04	29.47
Average Profit	6.47	4.59	4.01
Return	7.34%	10.91%	13.60%

- Notice that the RAROC depends on arbitrary choices of risk tolerance level
  - This is a leverage effect
- Benchmark returns must therefore also reflect this risk tolerance level assumption
  - What information is obtained from comparing a leveraged return to an unleveraged target?
- With multiple business units, this is not *real* leverage
  - The full capital of the firm supports each business unit, regardless of the selected risk tolerance level
  - What would it mean to measure the return on capital assuming only $29.47 of capital is "required" as in Method 3 above if there was other firm capital also supporting this line?

Setting RAROC Targets - Conclusion

- Practitioners want a “RAROC Target”
- Correct target is unlikely to be based on standard asset pricing models such as CAPM, Fama-French
  - These models reflect systematic risk only
  - These models ignore non-diversifiable risks
    - See Froot & Stein, Stulz
  - These models reflect market values
    - RAROC
  - These models do not take the portfolio composition into account
  - These models are difficult to apply at fine levels of granularity
  - These models do not reflect leverage (unless specifically adjusted)
- Is there a better target?
  - Relative comparisons are useful
  - Comparisons to firmwide average are useful
  - Comparisons to management’s own preferred target are useful
- Ultimately, it comes down to a simple question – is a particular strategy going to improve the firm’s return per unit of risk capital?

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