

RAROC

A Tool for Factoring Risk into Investment, Pricing, and Compensation

•• **Models of risk-adjusted return on capital offer advantages to banks, but they are easy to get wrong. Bankers need to take care when interpreting results.**

BY **ROCKY IERACI**

BANKS NEED TO find better ways to factor risk into their decision making, and they are turning to risk-adjusted return on capital (RAROC) models as part of the answer.

For over a decade, these models have been used by large banks to explore the balance of risk and reward, especially when lending to large corporations. Now they are fast becoming popular in smaller banks specializing in middle-market and small and medium-sized enterprise (SME) lending (see Table 1).

By measuring the amount and cost of the risk capital associated with a bank transaction and comparing this to the bank's returns, RAROC helps banks make better decisions when approving, structuring, and pricing deals. It also helps them in assessing business unit performance and risk-adjusting compensation.

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between what RAROC-based results are taken to mean by decision makers and what they actually mean, which is

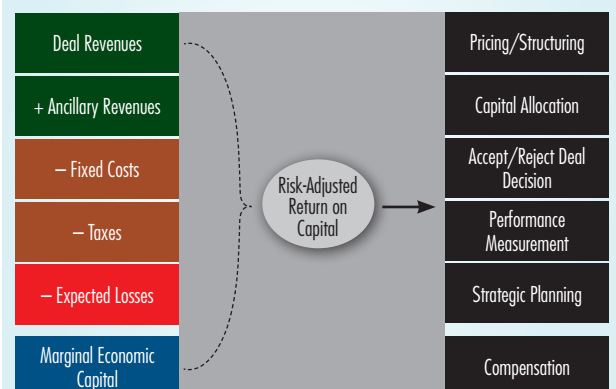
The RAROC equation is simple in concept (left side of Figure 1), but there are plenty of devils in the details. In particular, it is easy for inconsistencies to arise

driven by the many inputs and assumptions that underlie the RAROC model.

Confusions creep in because RAROC is the culmination of the bank's various attempts to measure and analyze risks, costs, and revenues. As such, inputs must be drawn

Figure 1

How Does the RAROC Equation Drive Key Bank Applications and Decisions?



from all over the bank and are themselves often dependent on an underlying risk model; for example, economic capital usually depends on the bank's internal risk-rating system. For RAROC to be meaningful, all the inputs must be consistent with one another and with a clearly set goal for RAROC—for example, “a one-year forward assessment of risk-based profitability” or “risk-based profitability over the life of the deal.”

For reasons we'll discover, RAROC results can be especially fragile when the bank uses them to compare the profitability of different lines of business and when there are turning points in the economic cycle. So banks should be particularly vigilant in the current period.

Banks must learn to ask, “Are our RAROC results measuring what we think they measure?” While the perfect RAROC model may prove elusive, banks should make sure that flaws are taken into account when making important decisions.

Let's look at some specific pitfalls when building RAROC models in areas ranging from capital allocation processes to monitoring how RAROC results are used.

How Do Capital Allocation and a Changing Risk Appetite Drive RAROC?

Economic capital models calculate the amount of risk capital the bank requires after taking into account various concentration costs and diversification benefits at the enterprise level. To support RAROC applications, the bank then has to allocate a portion of this firm-wide capital amount to each of its businesses, activities, and individual exposures.

This allocation process is fraught with difficulties. Unfortunately, a single “correct” allocation model does not exist and institutions must understand the implications

of their modeling choices. For example, if a bank with a largely North American loan portfolio set up an international lending group to make loans in Brazil, the new business group might well attract massive capital benefits from risk diversification. These in turn will drive the new group's deal RAROCs up to startlingly high numbers. It

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is not uncommon to see RAROCs over 100% owing to diversification benefits attributed by capital models.

These hypothetical returns are really due to modeling inaccuracies and lack legitimacy from a more fundamental credit perspective. The new group should be working hard to differentiate between the risk-adjusted profitability of Brazilian borrowers, rather than getting a free ride from diversification benefits arising from the whole bank's portfolio composition.

Our point here is that banks should not *inadvertently* allow diversification benefits and other quirks of capital allocation to distort their assessment of business unit performance. Their use of the numbers to make decisions should be conditioned by a deep understanding of RAROC drivers and by sound business intuition. Similarly, model developers make important choices, largely hidden to the users of RAROC results, about how the bank's risk appetite should drive capital allocations.

The classic example of this problem concerns how a portfolio of loans with a low probability of default but large exposure amounts (for example, lending to large corporations or financial institutions) compares with another

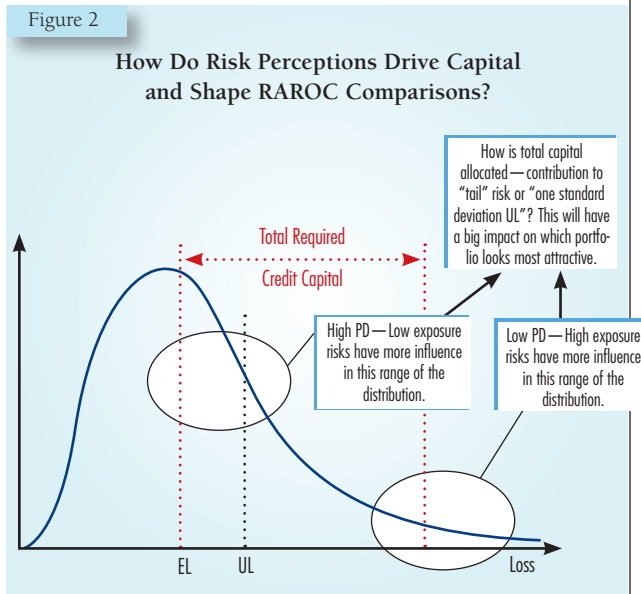


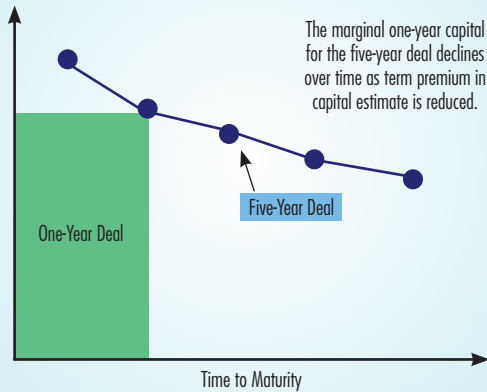
Table 1

Key Differences between Large Corporate and Middle Market/SME Lending

Large Corporate	Middle Market/SME
Nonhomogeneous pools of obligors common	Homogeneous pools of obligors the norm
Large exposures	Smaller exposures
Portfolios weighted to low PD obligors	Sub-investment-grade obligors the norm
Specialized and often complex deals	Standard products and terms
Lengthy decision process attributable to size and nature of deals	Volume-oriented and highly automated decision tools
Fair amount of discretion allowed in pricing individual deals	Pricing matrix common base on product type and obligor rating
Credit risk dominant risk type	Operational risk significant

Figure 3

Longer-term Deals May Be Penalized in Terms of One-Year Marginal Capital



In the ideal world, a RAROC model would take account of all the risk costs associated with a given deal.

portfolio that exhibits higher probabilities of default but smaller exposures (for example, SME loans).

As Figure 2 illustrates, the SME portfolio will look relatively risky if

capital is allocated based on how much each exposure contributes to the loss distribution around the mean (that is, one standard deviation, or “unexpected loss”). By this measure, the SME portfolio’s RAROC will look relatively low compared with the large corporate portfolio since the latter does not contribute significantly to the loss distribution in this region. (In reasonably normal times, large corporations are not expected to default.)

On the other hand, if the model allocates capital based on how much a portfolio contributes to severe downturn risk (tail risk), then the capital allocated to the large corporate portfolio will be much higher (and thus less capital will be allocated to the SME portfolio). This will, in turn, make the large corporate portfolio look relatively less attractive in RAROC terms compared to the SME portfolio.

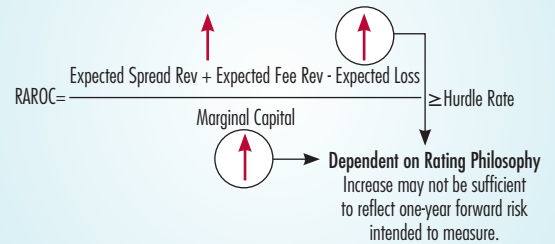
How Should the Nature of the Bank’s Business Drive Its RAROC Modeling?

It’s easy for banks to fall into the trap of using a generic RAROC approach that does not reflect the risk profile of their various lending businesses. Take, for instance, the two problems of loan maturity and risk-type coverage.

Loan maturity is an issue because RAROC models with a one-year time horizon—often chosen because the bank’s economic capital has been calculated using a one-year horizon—can be biased against longer-terms deals; for ex-

Figure 4

Direction of RAROC Inputs as the Economy Enters a Downturn



ample, they underestimate the true profitability of a five-year loan compared with a one-year loan.

The problem arises because credit capital models, which account for the major portion of economic capital for lending exposures, often assign a term premium for longer-dated exposures in the first year of the deal. While longer-term deals are indeed “riskier” than shorter-term deals, the magnitude of this premium and the fairness of comparing the front-loaded first-year capital of a five-year deal to the capital of a one-year deal are problematic.

Furthermore, the longer-dated deal will attract less and less one-year capital as it matures (Figure 3). By the last year of the term, the one-year RAROC of a matured deal may look much greater than the RAROC of the one-year deal it was originally compared to!

The problem can be countered by calculating the whole-of-life risk of the loan, in addition to pure one-year measures (which are still important for certain deal-comparison purposes) or by using average one-year capital usage over the life of a deal. Alternatively, the bank can take account of the bias in a judgmental way when making decisions based on RAROC.

Risk-type coverage is another significant issue. In the ideal world, a RAROC model would take account of all the risk costs associated with a given deal, commonly defined as market, credit, operational, and business risk. In reality, bank RAROC models rarely cover all types of bank risk due to methodology or operational constraints, and some are driven entirely by credit risk.

How much this matters depends on how the bank is using RAROC. The focus on credit risk may be legitimate if the results are used mainly to compare the risk-adjusted profitability of lending transactions within a portfolio of large corporate loans.

Problems arise, however, when we consider other kinds of portfolios or make comparisons across business lines. For example, middle-market and SME lending may be largely model-based and automated with only limited underwriter oversight. Here, there is a considerable risk that something systematic will go wrong in the bank's decision making that is not accounted for in its credit risk calculations. This kind of risk usually is classed as an operational risk, and it will account for a larger percentage of total economic capital in an SME portfolio than in a portfolio of large corporate exposures.

Therefore, the bank needs to make some estimate of the operational risk associated with its approach; otherwise, it may overestimate business line profitability and underprice transactions for SME-like portfolios.

This example points to a more general lesson: Banks need to understand what drives their RAROC model in light of the model's application to a diverse set of portfolios. Incorporating the full picture of risk (credit, operational, market) becomes important when assessing risk-adjusted returns at the consolidated bank level to ensure optimal allocation of the capital a bank needs to carry on its balance sheet.

Does Our Credit-Rating Approach Distort RAROC Results over the Economic Cycle?

The credit-rating philosophy that underpins a bank's estimates of credit risk capital can also drive RAROC in unexpected ways.

For example, some banks adopt a "through-the-cycle" approach to determining internal risk ratings and the probabilities of default associated with them. These banks' internal ratings reflect a long-term, cycle-neutral measure of borrower default risk. But this may not align with the bank's RAROC approach if the RAROC model adopts a one-year forward horizon.

Other inputs into the RAROC model will be in alignment, such as estimates of spread revenues plugged into the model. As the economy goes into a downturn, spread revenues will rise to reflect the general tightening in bank lending; at the same time, the bank's through-the-cycle risk estimates (and therefore marginal capital estimates) will not rise in line with present realities, owing to the bank's choice of rating philosophy (Figure 4).

The result might be a model that underestimates RAROC during the early part of an expansionary period, but then overestimates RAROC as the economy goes into a downturn.

From a RAROC perspective, the loss-given-default estimates used in models of bank credit risk could also be problematic, because they usually reflect average losses for particular types of products, structures, and collateral over many years, rather than being a current estimate in line with

a typical RAROC model's one-year forward time horizon.

Banks may not be keen to change their rating philosophies to make them consistent with RAROC calculations, but they can gauge the extent of the potential problem so that decision makers can take this into account. There is no one-size-fits-all solution to the challenges faced in aligning rating philosophies with the various uses of performance measurement tools such as RAROC. Many banks are realizing that they may need more than one variation of the standard RAROC measure to properly assess their complex range of products and businesses.

Regulatory Capital and Risk-adjusted Decision Making

Using regulatory capital as a substitute for economic capital in RAROC calculations is now widely recognized as poor practice because regulatory capital, particularly Basel I, is not a very accurate or sensitive risk measure. But banks can't simply ignore regulatory capital in their risk-adjusted decision making. Regulatory capital has an economic cost attached to it so long as the bank's regulatory capital requirements are higher than its economic capital requirements.

There are various ways to take the cost of

regulatory capital into account. For example, to the extent that its regulatory capital requirement is greater than its economic capital requirement, a bank might allocate a portion of the gap back to each business line and product. Or the bank can insist that deals exceed a given hurdle in terms of *both* RAROC and return on regulatory capital.

The important thing is that the cost of supporting regulatory capital is recognized in some fashion when calculating or interpreting RAROC numbers.

Relationships Have a Value

At its best, banking is about building long-term relationships with customers across different product areas. However, the simplest approach to RAROC is to measure the RAROC of each transaction independently of its links to other bank business.

This is frustrating for bankers who can see that a specific deal is the gateway to a much larger transaction or a wider relationship, or who think that offering low-margin deals in one product area is a way to bring in profitable business. An example would be a company that wants a low-margin revolving loan today, but says it will need a large, higher-margin construction loan in a few months.

There are various ways to incorporate the value of relationships into RAROC analysis. One approach is to look

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Figure 5

Has the Profitability Predicted by RAROC Turned Out to Be Broadly Accurate?

Expected Economic Profit, (Sum of individual deals)

$$\text{Expected Revenue} - \text{Expected Expenses} \geq \text{Hurdle Rate} \times \text{Marginal Capital}$$

Realized Economic Profit, (Portfolio)

$$\text{Realized Revenue} - \text{Realized Expenses} \geq \text{Hurdle Rate} \times \text{Capital Usage}$$

RAROC may be the best way for the banking industry to avoid the boom-and-bust conditions we see in many banking markets today.

RAROC for one deal to include a percentage of the profit from a future linked deal, after taking into account the lender's estimate of the probability that the deal will actually happen.

Of course, lenders may be tempted to overestimate the chance of future business to help push the RAROC of the initial deal over the bank's deal-acceptance hurdle rate. This issue can be resolved by tracking outcomes in terms of realized deals and profitable relationships and comparing them to the original estimates. The result might be tougher haircuts for particular lenders or for certain kinds of relationship business.

Monitoring Model Operations and Performing Outcomes Analysis

It is important for banks to monitor how RAROC results are produced and used at a day-to-day operational level. The bank can track how RAROC numbers are used in decision making (for example, the number of times a below-hurdle RAROC deal is approved). It also can look at the average RAROC by segment for new deals and watch for unexplained trends. If RAROC is used to decide whether to accept or reject a deal, the bank can compare initial RAROC estimates with current estimates using actual balances and updated risk information.

Banks also should periodically conduct data integrity tests. For example, are the specified model inputs actually being used when calculating RAROC? And have the underlying systems been validated—for example, the bank's internal ratings system?

Back-testing deal-level RAROC isn't always practical, but we can ask whether the predicted profitability of segments

at RAROC on a whole-relationship basis over a given period. Another is to factor some portion of the benefits of future business into the reported RAROC for the initial deal. For example, the bank might allow the

and portfolios turns out to be broadly accurate (see, for example, Figure 5). This kind of analysis should not prompt the bank to make a simple reject-or-accept decision about the RAROC model. Instead, the results are diagnostic and should prompt investigation into what's driving any misalignments; the variables that are tested indirectly include expected income, expected loss, utilization, and planned capital usage.

RAROC estimates also can be rerun using benchmark models to see if an independent model or methodology produces results similar to those generated by the bank's RAROC model, given the same inputs. Similarly, banks can benchmark their model via a consortium, whereby different banks run a sample of representative deals through their RAROC pricing model and share the anonymous results. The intent of these comparisons is not to accept or reject a bank's RAROC model, but rather to understand key differences and work continuously to refine the overall approach to risk methodologies.

Conclusion

Models of risk-adjusted return on capital can provide a great advantage to banks, but they are easy to get wrong. Too often these models are created by quantitative experts working at some distance from business lines and from the senior executives who will use the results.

RAROC needs to be approached carefully to ensure alignment between expectations about what its results mean and the model's inputs and assumptions—particularly with regard to how capital is calculated and allocated, the bank's rating philosophy, its risk appetite, and the nature of the bank's portfolios. For example, if banks simply apply generic RAROC models built for large corporate portfolios to calculate the RAROC of SME portfolios, they are particularly likely to make poor decisions.

There is no magic answer to some of the practical challenges encountered when implementing RAROC, so users of its results must be made aware of the potential biases and their impact. Users must be able to ask the right questions and allow for the correct margin of error in their interpretation of the model's results.

Despite these challenges, banks must not put off investing in RAROC. Used wisely, the right RAROC tool will help a bank factor risk into its investment, pricing, and compensation decisions throughout the economic cycle. As well as creating long-term competitive advantage for individual institutions, RAROC may be the best way for the banking industry to avoid the boom-and-bust conditions we see in many banking markets today. ❖



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