Risk-Adjusted Return on Capital (RAROC)

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How do you measure the profitability of lines of business, products, or customers?
Banking is a **risky business**, and has many internal and external factors that impact the amount of risk per activity. This is **one** reason that financial institutions are getting serious about viewing risk across the entire franchise instead of in the organizational silos where they most exist.

<table>
<thead>
<tr>
<th>Key Performance Measures</th>
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<tbody>
<tr>
<td><strong>ROE</strong> = NI/C</td>
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<tr>
<td>NIM = II – IE / A</td>
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</table>

- **ROE** (Return on Equity) = Net Income / Capital
- **ROA** (Return on Assets) = Net Income / Assets
- **ROI** (Return on Investment) = Earnings / Investment
- **NIM** (Net Interest Margin) = Interest Income – Interest Expense / Assets
- **RAPM** (Risk-Adjusted Performance Margin)
- **VIR** (Value at Risk) or **PIR** (Profit-Related Income) = Present Value / Initial Investment
Need for Risk Adjusted Performance Measurement

Risk-adjusted performance Measurement encompasses a set of concepts. Those concepts may vary in detail depending on the context they are used in. However, all risk adjusted performance measures have one thing in common: they compare the return on capital to the risk taken to earn this return – i.e. some kind of risk-adjustment is adopted.

In the past years risk-adjusted performance measures have gained great importance.

i. The first reason for this development is the emergence of investment funds as an important investment category.

ii. The second reason is the introduction of the Basel II regulatory framework.
Risk-Adjusted Return on Capital (RAROC)

(RAROC) is a unique risk adjusted performance/profitability measuring tool that presents risk-oriented view for the revenues in the perspective of magnitude of risks taken to generate those revenues. The basic aim of the RAROC model is to adjust returns by expected losses and to provide an Unexpected Loss based capital buffer.

RAROC is seen as a substitute for other performance measurement tools, provided it is applied correctly.
Uses of RAROC

Some uses of RAROC models include:

- Accept/Reject decisions;
- Loan pricing;
- Structuring (i.e. collateral coverage); and
- Compare profitability across business segments.

Having the appropriate methodology is critical as it has a direct impact on the bottom line. Both refusing “Good Credits” and accepting “Bad Credits” puts you at a competitive disadvantage.
RAROC – History & Chronological Evidence

The concept of RAROC was first introduced by a group at Bankers Trust in the late 1970s, with an original intention to manage and measure credit risk in order to limit bank’s losses. With the passage of time and advancement in methodology RAROC made its way to risk pricing and profitability measurement.

<table>
<thead>
<tr>
<th>Author</th>
<th>Research Paper</th>
<th>Reference</th>
<th>Year</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>
RAROC – Model Parameters

- Revenues
- Cost of Funds
- Transfer Price
- Expenses
- Adjusted Exposure
- Loss Given Default
- Probability of Default
- Expected Loss
- Unexpected Loss
- Economic Capital

\[
EC = f(UL)
\]

Economic capital is the capital reserve (buffer), which protects against insolvency. Unexpected loss is the estimated volatility of potential loss in the asset.

Economic capital = Function of [UL]

The key expression is: EC (\alpha) = VaR (\alpha) - EL

\[
\sigma^2_{EDF} = EDF \times (1 - EDF)
\]
Demystifying RAROC Equation

In practice, different versions of RAROC equation prevail, though all versions direct to same conclusion that where banks make money after risk costs are taken into account.

\[
RAROC = \frac{\text{Risk Adjusted Return}}{\text{Economic Capital}}
\]

**Simplistic Version:**

\[
\text{Revenues +/- Treasury Transfer Prices - Expenses - Expected Losses} \div \text{Economic Capital}
\]

**Generalized Version:**

\[
\text{Revenues - Cost - Expected Loss} \div \text{Risk Based Required Capital}
\]

**Holistic Version:**

\[
\frac{(\text{Exp. Return - Costs - } \sum \text{(EL)} + \text{Return on EC - Transfers}) (1 - T)}{\text{EC}_{MR} + \text{EC}_{CR} + \text{EC}_{OR} + \ldots}
\]
Demystifying RAROC Equation

RAROC Numerator

Numerator of RAROC equation represents Risk Adjusted Return, that include sum of Expected Revenue and Transfer pricing after taking expenses and costs out of it. Then net returns are adjusted by expected losses to arrive at risk adjusted return.

\[
\text{Revenues} - \text{Cost} - \text{Expected Loss}
\]

or

\[
\text{Revenues} +/\text{- Treasury Transfer Prices} - \text{Expenses} - \text{Expected Losses}
\]

RAROC Denominator

Denominator of RAROC equation represents Risk Adjusted Capital i.e. Economic Capital, elements of EC are unexpected losses and loss distribution.

Where Economic Capital or EC represents Capital for Unexpected Losses

or

\[
\text{EC} = \text{MRC} + \text{CRC} + \text{ORC} + \text{BRC} + \text{RRC} + \text{SRC} - \text{PEC}
\]

Where:
- MRC = Market Risk Capital
- CRC = Credit Risk Capital
- ORC = Operational Risk Capital
- BRC = Business Risk Capital
- RRC = Reputational Risk Capital
- SRC = Strategic Risk Capital
- PEC = Portfolio Effect Capital
Risk Based Pricing

It is common sense that riskier clients should be charged a higher price than less risky ones. However, selection or pricing strategies based on risk adjusted customer value are not as common practice as one might expect. The risk adjusted price curve below shows the minimum (theoretical) price that should be applied to each applicant in order to match all costs, cost of risk included: the higher the risk, the higher the price.
RAROC Fundamentals

RAROC works on the fundamental risk management principle i.e. customer with High PD is priced more than that of the one with Low PD. Since high PD customers lead to low returns, therefore such customers are priced more. However customers who are Public sector enterprises (PSEs) or equivalent lead to low price due to low likelihood of default.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>PD Increase</th>
<th>PD Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RAROC</strong></td>
<td>14.00%</td>
<td>11.06%</td>
<td>18.42%</td>
</tr>
<tr>
<td>Exposure</td>
<td>2,500,000</td>
<td>2,500,000</td>
<td>2,500,000</td>
</tr>
<tr>
<td>Revenues</td>
<td>230,000</td>
<td>230,000</td>
<td>230,000</td>
</tr>
<tr>
<td>Costs</td>
<td>170,000</td>
<td>170,000</td>
<td>170,000</td>
</tr>
<tr>
<td>EL</td>
<td>20,625</td>
<td>22,688</td>
<td>18,563</td>
</tr>
<tr>
<td>Economic Capital based on ICAAP</td>
<td>281,250</td>
<td>337,500</td>
<td>225,000</td>
</tr>
<tr>
<td>ICAAP</td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>EAD</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
</tr>
<tr>
<td>PD</td>
<td>25%</td>
<td>28%</td>
<td>23%</td>
</tr>
<tr>
<td>LGD</td>
<td>55%</td>
<td>55%</td>
<td>55%</td>
</tr>
<tr>
<td>Recovery Rate</td>
<td>45%</td>
<td>45%</td>
<td>45%</td>
</tr>
<tr>
<td>Total RWA</td>
<td>1,875,000</td>
<td>1,875,000</td>
<td>1,875,000</td>
</tr>
<tr>
<td>EC as % of RWA</td>
<td>15.00%</td>
<td>18.00%</td>
<td>12.00%</td>
</tr>
<tr>
<td>Revenue %</td>
<td>9.20%</td>
<td>9.20%</td>
<td>9.20%</td>
</tr>
<tr>
<td>Cost %</td>
<td>6.80%</td>
<td>6.80%</td>
<td>6.80%</td>
</tr>
</tbody>
</table>

If Hurdle Rate <= RAROC% then grant loan.
Economic Capital

Economic Capital (EC)

Economic Capital (EC) is the amount of risk capital that a bank estimates in order to remain solvent at a given confidence level and time horizon.

It's different from Regulatory capital (RC), RC on the other hand, reflects the amount of capital that a bank needs, given regulatory guidance and rules.

Where:
PDF represents the probability of the random variable falling within a particular range of values is given by the integral of this variable's density over that range.
Advantages and Disadvantages of RAROC

Advantages of RAROC Model

a) The ratio is the only performance measurement tool that accurately incorporates a financial institution’s risks through the use of economic capital;

b) RAROC calculates economic profit of a schedule by including the opportunity cost of capital. This represents a significant improvement over traditional financial institutional measures of ROA and ROE that are used to determine the value contribution of a schedule or business unit;

c) Practical and easy to implement and communicate; &

d) RAROC eliminates the need to calculate a beta for each potential schedule a financial institution reviews.

Disadvantages of RAROC Model

a) Takes static view of credit risk;

b) RAROC does not adjust hurdle rates as schedule capital requirements increase; &

c) RAROC assumes that economic capital is synonymous with cash equity provided by shareholders. As a result, financial institutions tend to over- or understate day-one schedule and business line RAROCs.
Challenges & Way out

Challenges often faced when developing RAROC Model

a) Change Leadership;

b) Data & Model validation;

c) Sanity of assumptions (“simple” models can impact the bottom line significantly);

d) “Hidden” assumptions and their impact on results often overlooked; &

e) Continuous improvement.

Banks can best meet these challenges by adopting a three step approach:

a) Make sure key conceptual judgments / assumptions are in line with best practice and the bank’s goals;

b) Pay special attention to the input variables in the RAROC equation that are most critical. For commercial lenders, these are often estimates of probability of default and loss given default;

c) Create an independent, ongoing process for validating the RAROC model in accordance with regulatory guidelines, making sure gaps have not sprung up between the bank’s RAROC concept and day-to-day RAROC calculations; &

d) Simplicity of the model – **Keep it simple.**
Conclusion & Key Take Away

- The ratio is the performance measurement tool that accurately incorporates a financial institution’s risks through the use of economic capital;
- RAROC modeling requires some assumption and takes a static view of credit risk;
- Key conceptual judgments/assumptions should be in line with best practice and the institution's goals in order to correctly model RAROC;
- An independent, ongoing process for validating the RAROC model in accordance with regulatory guidelines is a necessity to incorporate changes with the passage of time;
- Quantify all major risk types;
- Risk capital for the firm should be less than the sum of the stand-alone risk capital of the individual business units – returns are correlated;
Questions?
Credits & References

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