

# **Accounting for Economic *and* Regulatory Capital in RAROC Analysis**

**For a bank trying to assess risk-adjusted returns on capital (RAROC) for different lines of business, understanding the differences between regulatory and economic capital needs is of prime importance.**

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# Accounting for Economic *and* Regulatory Capital in RAROC Analysis

Spurred by deregulation and advances in information technology, the required banking regulatory capital assessment is becoming increasingly more archaic. Consider today, where bank opportunities include acquiring a sub-prime lender, securitizing mortgages and replacing them with index-amortizing swaps, or engaging in a variety of off-balance sheet activities. These new opportunities present new challenges, since regulatory capital charges are often unrelated to the economic capital used. For a bank trying to assess risk adjusted returns on capital (RAROC) for different lines of business, understanding the differences between regulatory and economic capital needs is of prime importance.

A number of new environment new methods of determining bank capital focus on economic rather than regulatory capital (see Lamfalussy, Matten, Parsley, Payant, or Zaik). The idea is to estimate the capital required of a stand-alone business for a particular project. Then, one can apportion the capital estimates, taking into account correlations, so that all of a bank's actual capital is used by spreading all the existing capital on a pro-rata basis; alternatively, some suggest putting the leftover capital into a special department (for example, Treasury), especially if this capital is to be used for strategic purposes.

Most higher level articles on economic risk capital include an obligatory statement that ultimately the regulatory capital requirements are somehow combined with the economic capital figures for strategic purposes. This is because they cannot be reconciled in the sense of translating one into another, like from Fahrenheit to Celsius; they are two almost independent capital requirements. Capital is not a function of both capital requirements; it is a function of one or the other, depending on the existing assets and liabilities on and off balance sheet.

This article will discuss assumptions that underlie the practice of using either regulatory capital or economic capital on a stand-alone basis to determine capital allocations. I will give some examples that show how different capital constraints determine the relevance of economic or regulatory capital in different situations.

## Current Regulations

The Federal Reserve requires certain banking organizations to maintain a minimum 8% total risk-based capital ratio (the ratio of total capital divided by risk-weighted assets), including a Tier 1 capital ratio of at least 4%. This is supplemented by a leverage ratio requirement, defined as Tier 1 capital divided by average total assets after certain adjustments. A "well-capitalized" bank has more stringent requirements (Tier 1 capital ratio of at least 6 %, total capital of 10%, and Tier 1 leverage ratio of 5%). Market risk (for example, interest rate risk) capital regulatory requirements are forthcoming. Often in this environment a bank sets targets for these constraints. To simplify the discussion, we

shall concentrate solely on one regulatory capital requirement and consider this the driving force of regulatory capital. In practice, however, a bank must determine which regulatory requirement is the binding constraint.

Economic risk capital is the composite of credit, market, and operational risk and represents the sufficient amount of capital to protect the bank against adverse losses in the portfolio up to a certain probability of loss. In this context economic capital in this context is a cushion that protects the liability holders of the bank. The method used to calculate economic risk capital is beyond the scope of this paper, which will that this very difficult estimation is calculated correctly.

### **The Relevant Capital Constraint Affects Capital Allocation**

If markets are efficient, the book capital for a bank should be the minimum of regulatory and economic capital: Regulators would not allow a bank to hold less than its regulatory capital requirement, while the market would not allow book capital below the bank's economic capital requirement. The examples below shows that potential projects have different capital requirements depending on which constraints are binding. Consider two banks with the following required capital levels:

#### **Exhibit 1**

	<u>Regulatory Capital</u>	<u>Economic Capital</u>
RiskyBank	\$80	\$100
SafeBank	\$100	\$80

Assuming the market knows what the bank knows (economic capital requirement is \$100), RiskyBank will be capitalized at a minimum of \$100, while SafeBank will also be capitalized at \$100 due to regulatory constraints. RiskyBank has a regulatory capital surplus; Safe Bank has an economic capital surplus. Risky Bank typifies a subprime lender or a bank engaged in significant off-balance sheet activities. Safe Bank is representative of a higher-tier lender. Given this scenario, the twobanks would have different incremental capital needs for new projects (*Exhibit 2*)

#### **Exhibit 2**

	<u>Stand-Alone Capital Requirement</u>		<u>Incremental Capital Requirement</u>	
	<u>Regulatory</u>	<u>Economic</u>	<u>RiskyBank</u>	<u>SafeBank</u>
Project X	\$20	\$0	\$0	\$20
Project Y	\$0	\$20	\$20	\$0

In Exhibit 2, “stand-alone capital requirement” refers to the incremental capital required for a stand-alone bank with no other assets. Marginal capital required for Project X is zero for Risky Bank, since adding Project X does not cause Risky Bank to increase its capital. Regulators will demand \$100 in capital, but this already exists, so no change in capital structure is needed. One of the tenets of Markowitzian portfolio theory, that an

asset's riskiness is its marginal addition of risk; similarly, an asset's true internal capital cost is its marginal requirement of capital. Safe Bank, on the other hand, has no regulatory surplus, so Project X necessitates the addition of \$20 in capital for Safe Bank.

Project Y, meanwhile, has the exact opposite affect on the two banks. Since Risky Bank has no economic capital surplus, the marginal requirement of \$20 for economic capital necessitates a \$20 increase in capital. Safe bank, however, has a surplus of economic capital; therefore, the Project Y simply absorbs this latent reserve.

### **A General Formula For Allocating Capital**

The general function for determining the marginal capital for a Project I is the following:

$$\text{MarginalCapitalCost}(I) = \text{Max}[\text{RegCap}(I) - \text{SurplusRegCap}, \text{EconCap}(I) - \text{SurplusEconCap}]$$

Here Regulatory Capital (I) and Economic Capital (I) reflect the marginal increase in required regulatory and economic capital for Project I, respectively. Surplus regulatory and economic capital is defined as the following:

$$\text{SurplusRegCap} = \text{Max}[\text{BookCapital} - \text{Regulatory Required Capital}, 0]$$

$$\text{SurplusEconCap} = \text{Max}[\text{BookCapital} - \text{Economic Required Capital}, 0]$$

This simple formula is the marginal application of a linear programming problem of the following sort: The corporation has a fixed amount of capital and various projects to choose from. Each project has two critical components: required regulatory capital and required economic capital. The required risk capital for each project, however, is a function of the composition of the final portfolio. (To write this out would involve needless notation, but the interested reader may contact the author for its explicit formulation). Determining the marginal required capital for a project is a function of both regulatory and economic capital, but the use of the "Max" function implies that in most cases either regulatory *or* economic capital will be the sole constraining factor.

### **The Pure Regulatory Approach**

It is useful to compare the above calculation to alternative approaches to attributing capital. Consider the allocation of regulatory capital always and everywhere. The logic of this approach is that if a loan has a regulatory requirement of 6% of its notional amount, its capital use is 6% regardless of how much economic capital it uses. To see that this approach can be misleading, consider the case where a project's required economic capital is higher than its regulatory requirement (for example, sub-subprime lending). Adding the lower regulatory capital is not sufficiently prudent *if* the economic capital constraint is binding (that is, book capital = economic capital). Many banks believe they have an economic capital surplus (that is, they are overcapitalized due to regulatory requirements); in these cases the extra economic risk is simply soaked up by surplus economic capital, and regulatory capital is appropriate.

The straight regulatory approach is correct in some cases, depending on the riskiness of the current bank's portfolio. If the portfolio has surplus economic capital and is constrained by regulatory capital, it works fine. For example, if a bank with zero regulatory capital is considering a project where economic capital is zero, but regulatory capital requirement for the bank would increase by \$100, the capital assessment should be \$100.

## The Pure Economic Capital Pro Rata Approach

Consider the pure economic allocation as used in the pro rata allocation of book capital by economic risk. A loan with very small economic risk (such as investment-grade loans) will, even after a pro rata allocation of total capital, still have a capital assignment much lower than its regulatory capital charge. For example, a one year loan to Salomon Swapco will have at most an economic capital charge of 2%, but 6% is needed for a well-capitalized bank: The pro rata economic approach would make these loans seem very attractive. If there is surplus regulatory capital (that is, book capital is greater than regulatory capital this is appropriate, because the marginal requirement of capital will be driven by the economic and not regulatory requirement for the project. If there is no regulatory capital surplus, however, the bank will need 6% in new capital to accommodate the new loan, and the pro rata economic approach would underattribute capital.

An opposite effect can occur. Assume that a bank has a \$120 capital target but uses \$80 in economic capital and is capitalized at \$120. Adding a loan with \$0 regulatory capital but \$40 in economic capital would assign \$40 to the project even though it would require zero in new capital for the bank. Here the pro rata economic approach overattributes capital to the project.

Advocates of this approach offer several justifications. *First*, if economic capital is measured too low this simply illustrates that the economic capital estimation excluded some unmeasurable operations risk or a miscalculation of risk correlation that the market perceives. In other words, the economic capital constraint is binding and there is a regulatory capital surplus. While this can indeed be true, two important qualifications must be made:

- An excess of capital above the regulatory requirement should not be considered a surplus if it exists solely to act as a safety margin. Since most banks operate with a safety margin above their regulatory capital level, this safety margin is not excess or surplus capital. If the target capital level is a function of required regulatory capital the surplus regulatory capital is effectively zero.
- Capital may be held above the safety margin for strategic purposes such as acquisition. Therefore, this strategic capital should not be allocated to, say, commercial lending or any other line of business. the department(s) who are demanding this strategic reserve should be charged for it just as businesses are charged for loans, even if they do not use them right away.

Having zero economic capital surplus does justify using the pure economic approach, but one must be certain that this excess regulatory capital is not for safety margin or strategic purposes.

*Second*, some proponents argue that a pro rata allocation of book capital can be justified using a flawed analogy with the two-fund separation theorem of portfolio theory. This theorem states that an optimal portfolio consists of two separate decisions: how much of the risky asset to hold (for example, stocks), and what the composition of that portfolio of stocks should be. Similarly, supposedly can use regulatory capital to

determine the overall level of required capital and then economic capital to determine the relative allocation of this required capital for pricing or internal scorekeeping. This analogy is reasonable on its surface but ultimately plain wrong. The optimal composition of bank assets is a function of the amount of required regulatory capital, while in the two-fund theorem, the optimal composition of stocks is unaffected by the amount allocated to risky assets.

Since many banks are currently constrained by regulatory and not economic capital, the economic approach may appear irrelevant. Yet calculating economic capital for regulatory constrained banks is still extremely valuable when evaluating bank activities as a complimentary, not substitute, picture. For example, if a bank targets its capital based on regulatory requirements, a loan with \$1 economic capital but \$10 in regulatory capital will require \$10, regardless of its economic capital requirement. So, \$10 should be applied to that loan in its return of equity calculation. But the information that the loan uses \$1 economic vs. \$10 in regulatory capital is relevant when evaluating the big picture. If the market is requiring much less capital than the bank, it would seem that a nonbank would have a comparative advantage in this loan; therefore, this is probably not a niche that the bank should target. If this is a loan for a company that can only receive bank financing, however, the comparative advantage does not exist (since competitors face the same capital requirement). The question then becomes whether the market pricing on this loan, together with other expected income from ancillary services from the relationship, will cover the costs of the regulatory capital requirement.

### **Implications and Evidence**

The strategic implications are straightforward. One should calculate the required regulatory and economic capital for a project. If a bank is constrained by regulatory capital, it should use the regulatory capital for assessing a project's return on equity; if the bank is constrained by economic capital, it should use the economic capital. Projects that have the greatest deviation between economic and regulatory capital invite the greatest inquiry: They present the greatest opportunities either to dispose of value-destroying projects or take on value-creating projects.

If a bank is confident that its economic capital is well below regulatory capital, this approach will push them into projects where economic capital exceeds regulatory capital. Indeed, this is exactly what we are seeing in the market. Moves into subprime lending, fiduciary services, and capital markets and out of high quality lending are all manifestations of this realization.

The distinction between regulatory and economic capital may also explain why so many banks are liability sensitive to interest rate movements (that is, they consistently take on interest rate risk). It has always appeared puzzling banks take on this bet, since investors require a premium for it in the market. That is, purchasing long-dated treasuries and financing them with overnight money will produce a positive expected return since the yield curve is generally upward sloping, but this is risky and therefore does not enhance a bank's risk-adjusted return. Furthermore, an individual investor can easily implement this strategy by simply keeping cash in a Treasury bond mutual fund. On the surface, banks appear to be wasting their time and clouding their performance by augmenting their

regular intermediation activities with this strategy. With so many banks pursuing this interest-rate play, however, the market must not put a premium on eliminating this risk (as could be easily done with swaps). One explanation is that if banks are overcapitalized due to regulatory requirements, they have an excess of economic capital, and take on interest-rate-risk simply exploits. In this situation, the additional interest-rate risk requires no new regulatory capital and only uses otherwise superfluous economic capital.

Consider the following real world application. In April 1997, the yield on a five year Baa/BBB muni revenue obligation was about 5.70%. Given other data, such as an assumed interest cost avoidance of 3% and a cost of funding at this date of 7.24% (a 50 basis-point spread to Treasuries) and zero transaction costs, the return on assets for this loan is 0.75%. An economic capital attribution would be around 3%, which imply an ROE of 25%, well above most hurdle rates required for new loans. If the targeted leverage ratio, due to regulatory requirements, were 6%, the ROE would be a mere 12%, below most required hurdle rates. Clearly nonbanks *or* banks not bound by their required leverage ratio have a comparative advantage in this market; thus, we see municipalities issuing bonds for par amounts as low as \$140,000. The clear question for banks in the muni market, therefore, is whether or not the leverage requirement is binding, or whether or not the other services within the relationship compensate for this potential loss leader. For a bank targeting a 15% ROE, the muni loan can either be value creating or value destroying, depending on bank's current balance sheet.

Moving up in quality only confounds this issue, since in these cases the spreads over Treasuries narrow. In the above example, if the muni rate were 5.40%, the ROE is 15% at a 3% capital attribution. Revenue obligations carry a 50% risk weighting, generating required ratios for tier 1, tier 2, and the leverage ratio of 2.5%, 5% and 6% respectively. The economic requirement would be conservatively estimated at 2.0. The profit or loss on a particular deal will be dependent on a variety of factors: If the Tier 1 or economic capital ratio determines required capital, the loan exceeds its hurdle rate; if the leverage ratio is the determining factor the loan does not meet the hurdle rate requirement. Determining which regulatory requirement, if any, is binding is paramount for a bank trying to determine if this muni loan is attractive or not.

For a securitization, economic capital is often greater than regulatory capital. For example, S&P has established guidelines how much economic equity is used in a securitization (see *Equity Considerations in Securitizations*, *Standard and Poor's CreditWeek*, May 22, 1995). S&P attributes economic capital charges of 10% to 30% to the excess servicing asset and up to 100% to the cash reserve. Assume that regulatory capital is constrained by a 6% leverage requirement for these assets. Given hypothetical estimates of \$4MM for the value of the excess servicing asset and \$2 million for the cash reserve (on a \$100MM outstanding securitization), this implies a \$1.8 million capital cost using economic capital (using 20% for the excess servicing asset and 50% for the cash reserve) and \$360,000 using regulatory capital. Thus, the denominator in any return-on-capital calculation is different by a factor of five depending on whether economic or regulatory capital is appropriate. In this case, a firm with surplus economic capital (that is, a firm with excess capital due to regulatory constraints) would actually have an advantage in this market relative to other competitors because its marginal capital requirement would be small. A competitor with zero surplus economic capital would need to add capital at



the margin, as implied by the economic usage. Banks that engage in a lot of off-balance sheet activity or low-quality loans, would be more likely to be constrained by economic capital; these firms would have a comparative disadvantage in securitizing their assets.

### **When Planning Strategy, Look at Capital From Both Sides**

Economic capital is the required capital for an unregulated firm, which may or may not be the same as the capital required for a bank. Ignoring regulatory capital requirements is like evaluating an investment decision but ignoring the relevant tax implications, in that both are only irrelevant in a world without government.

Depend on the current portfolio, in one scenario regulatory capital is used in ROE calculations, in the other scenario economic capital is used. The underlying assumption in the pure regulatory approach is that there is zero surplus regulatory capital and positive surplus economic capital. The underlying assumption in the pro rata economic approach is that there is positive surplus regulatory capital but zero surplus economic capital. Determining which assumption is correct by doing a complete economic capital attribution exercise will make it possible to allocate capital optimally at the margin.

Regardless of whether economic or regulatory capital is binding, a combined picture is always useful when evaluating the larger strategic issues. If there is a large mismatch between the regulatory and economic capital requirement for the bank, it should consider if this implies that the bank is competing in the wrong markets, or that the bank should rearrange its activities so that either the regulatory or economic capital constraint drives decisions. Further, a bank with excess economic capital should realize that its excess conservatism is not optimal; such a bank should consider using this capital for entrance into riskier endeavors where economic capital requirements are greater than the regulatory requirements, since in this case the marginal capital cost is zero.

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