Economic Profit and Performance Measurement in Banking

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Successful bank operation requires managers to weigh complex trade-offs between growth, return, and risk. In recent years banks increasingly have adopted innovative performance metrics such as risk-adjusted return on capital (RAROC) and economic value added (EVA^{SM})[1], which assist managers in making such difficult and complex decisions. These innovative measures all share as a basis the concept of economic profit, rather than accounting earnings. By forcing line managers to include the opportunity cost of equity when making investment and operating decisions, banks expect to elicit better decision-making by managers. By implementing performance measurement and incentive systems driven by economic profit and allocated equity capital, senior managers also hope to align managerial behavior more closely with the interests of shareholders.

This article analyzes the use of economic profit for measuring the performance of banks. In particular, since economic profit cannot be calculated without some imputation of equity, the article focuses on the allocation of equity capital to products, customers, and businesses. The first section of the article describes the use of economic profit to evaluate performance, to price transactions, and to reward managers. The second section describes in detail one performance measurement and incentive system, known as EVA^{SM}, which has been adopted by a considerable number of both banks and other companies. The third and fourth sections discuss the shortcomings of performance metrics founded on economic profit, which may distort banks' investment and operating decision-making. These metrics assume that it is possible to allocate earnings and equity capital to lines of business, products, and customers in a way that isolates the economic revenues and costs of each activity. However, if lines of business are related, either in the production of output or in their use of capital, then this isolation may not be possible, and these methods of measuring performance may mislead managers. The conclusion argues that banks need to recognize the ambiguities inherent in the calculation of economic profit and be prepared to create and apply multiple specialized performance metrics.

I. Economic Profit and Performance Measurement in Banks

Economists and accountants differ on the proper definition of profit. To the accountant, profit is the excess of revenues over expenses and taxes and is best measured by earnings. To the economist, earnings fails to include an important expense item, the opportunity cost of the equity capital contributed by the shareholders of the firm. A firm earns economic profits only to the extent that its earnings exceed the returns it might earn on other investments. Thus, earnings will always exceed economic profits, and a firm can be profitable in an accounting sense yet unprofitable in an economic sense.[1]

This conceptual difference has important practical implications. If managers attempt to maximize earnings (or growth of earnings) rather than economic profit, they will invest additional units of equity capital so long as the marginal contribution to earnings is positive. But if they do so, the marginal contribution of the last unit of equity capital will be zero and less than its opportunity cost, and the average return to equity capital may be greater or less than its opportunity cost depending upon how much equity is used. In contrast, a manager who maximizes economic profits will add units of equity capital only until the marginal contribution of capital is equal to its opportunity cost, and the average return to equity capital will equal or exceed its opportunity cost.

As a result, firms that make business decisions without explicitly incorporating the opportunity cost of equity will be inefficient users of equity capital, engaging in investment projects that generate low returns to shareholders.[2] In 1995, a year of robust earnings, one study estimated that fewer than half of the 1,000 largest industrial and nonfinancial firms earned sufficient returns to cover their opportunity cost of capital (see Ross 1997).

Banks and other companies have begun to address this issue by incorporating an explicit opportunity cost of equity into their decision processes. In particular, a number of banks have incorporated a measure of economic profit in three key areas: strategic decision-making, product pricing, and performance evaluation and incentive compensation.

Strategic Decision-Making

Businesses with different risk characteristics require different proportions of equity to achieve the same risk exposure. Evaluating businesses only on the level and rate of growth of their reported earnings fails to take into account differences in their use of equity, and the fact that shareholders may have different required rates of return reflecting the risk of the equity invested. Thus, when allocating scarce resources or when deciding to enter or exit a new line of business, managers compare a return on equity (ROE) for the business unit relative to an appropriate hurdle cost of equity. Business units earning an ROE in excess of a risk-adjusted opportunity cost of that equity are candidates to receive additional resources, while those earning less than this opportunity cost of equity are candidates for corrective action. In recent years, such calculations have been extended from lines of business to products, distribution channels, and even customers.

Pricing

As noted above, different products, customers, or transactions will absorb different amounts of equity capital, with larger and more risky transactions requiring more equity than smaller, less risky ones. To ensure that a transaction is profitable, managers must assign the appropriate amount of capital and a required contribution to equity must be calculated and incorporated in the price applied to the transaction. This use of allocated capital to ensure adequate pricing was first implemented by Banker's Trust in its RAROC system, which subsequently has been adopted by many other commercial banks.

In the RAROC system, the required rate on a loan comprises a cost of funds, a charge for non-interest expenses, a premium for credit risk, and a capital charge. The great contribution of the RAROC system was to include explicit charges for both the credit risk premium and the use of capital. By doing so, it ensures that banks price individual loans to cover credit risks and generate an adequate return for shareholders. An example of the use of the RAROC system to price loans is shown in Table 1. The capital charge is determined as the product of the proportion of equity capital assigned to support the loan and the required pre-tax hurdle rate on equity. As shown in Table 1, a loan rate of 11.25 percent will permit the bank to earn a 15 percent return on the equity required to back the loan. If the bank can obtain a rate greater than 11.25 percent, then it will earn an economic profit, while a

[1] EVA^{SM} is a registered servicemark of Stern Stewart & Co.

[2] While conventional capital budgeting models such as net present value or internal rate of return explicitly include a cost of equity capital, many decisions taken outside the capital budgeting process, such as product pricing or entry or exit from a particular line of business, may not.

Table 1
The RAROC Method of Pricing Loans

Component	Example	Source
Funds Transfer Cost of Funds	5.45%	Funds Transfer Pricing System
Required Loan Loss Provision	1.25	Credit Risk Model
Direct Expense	.70	Customer/Product Cost Accounting System
Indirect Expense	.45	
Overhead	.40	
Total Charges before Capital Charge	8.25%	
Capital Charge	3.00	Allocated equity/loan = 12%
Total Required Loan Rate	11.25%	Opportunity cost of equity = 15% After tax capital charge = .12 x .15 = 1.80% Tax rate = .4 Pre-tax capital charge = 1.80%/.6 = 3.0%

loan rate between 8.25 and 11.25 percent generates positive earnings but an ROE of less than 15 percent.

Incentives

A relatively new but increasingly important area of study, the economics of organizations, analyzes the relationship between organizational structure and performance. One key concept in this new theory is that different agents (managers) within the organization have varied amounts of specific information concerning their businesses, products, and customers. An organization becomes more efficient by allowing investment and operational decisions to be made by those managers or groups of managers with the most specific knowledge concerning a particular decision. Thus, efficient use of specific information argues for a decentralization or devolution of decision-making to those line managers with the most information. Management innovations such as total quality management, quality circles, empowerment, and self-directed teams are all examples of the delegation of decision rights to line managers and employees to make more effective use of specific knowledge (See Wruck and Jensen (1997); Brickley, Smith, and Zimmerman (1997); and Bacidore, Boquist, Milbourn, and Thakor (1997)).

An obstacle that must be overcome, however, in such a decentralized system is the existence of agency costs. Agency costs occur when the interests of the managers are not necessarily the same as those of the shareholders of the firm, so that decentralization of decision-making to line managers can result in decisions that maximize the welfare of the managers rather than that of the shareholders. Such agency costs often appear in the form of higher costs, overinvestment, and suboptimal levels of risk incurred.

A performance measurement and incentives system that aligns more closely the interests of shareholders and managers can resolve this apparent conflict between the delegation of decision-making and agency costs. Most of these systems use some variation of economic profit to measure and reward the performance of managers. They take into account the opportunity cost of the equity capital that must be allocated out to the operating units. For example, in the EVA^{SM} system, discussed below in detail, managers' compensation depends upon either the level of or the increment to the economic value added of their particular unit. Because EVA^{SM} approximates economic profit, it reduces agency costs and permits greater decentralization in decision-making.

II. The EVA^{SM} Performance Measurement System

The EVA^{SM} performance measurement and incentive system was developed by the consulting firm Stern Stewart & Co. and it is the best known of a number of similar systems.[3] The EVA^{SM} system is built on the concept of economic value added, defined as the excess of adjusted earnings over the opportunity cost of the capital involved:

$$\text{EVA} = \text{Adjusted earnings} - c^*K$$

where earnings as defined by generally accepted accounting principles (GAAP) are adjusted to better represent economic earnings, c is the opportunity cost of equity, and K is the amount of equity used by the

[3] Other consulting firms' performance metrics based on the concept of economic profit include Holt Value Associates' cash flow return on investment (CFROI), Boston Consulting Group's total business return (TBR), and LEK/Alear Consulting Group's shareholder value added (SVA). See Myers (1996).

unit being measured.[4] EVA^{SM} can be calculated for the firm as a whole, but when used as a basis for an incentive system or to measure the performance of business units or individual managers, the earnings of and amount of equity capital used by these business units must be identified, so that their EVA^{SM} can be calculated.

Managers can improve the EVA^{SM}of their units in three ways: by increasing adjusted earnings, either through improved margins or additional sales; by reducing the equity capital used by the unit; or by reducing the cost of equity. However, measures taken to affect any variable in the EVA^{SM} equation will most likely affect the others, so that managers must take into account and manage trade-offs among the key variables. For example, earnings can be increased through expansion, but such expansion requires an increase in investment. EVA^{SM} will increase only to the extent the additional earnings generated by the expansion exceed the marginal cost of the additional equity capital involved. Similarly, a firm might increase EVA^{SM} by increasing its use of debt and decreasing the amount of equity (K) used. But as K decreases, the riskiness of the equity investment increases and c, the cost of equity, increases, so that EVA^{SM} will increase only if the percentage decline in K is greater than the percentage increase in c.

It is precisely because it requires them to manage these trade-offs at the margin that many managers believe that EVA^{SM} is superior to more conventional GAAP-based performance measures such as earnings or return on equity (ROE). As discussed above, a manager focused on maximizing earnings or the growth rate of earnings, without taking into account the opportunity cost of equity capital, will invest in new projects until the marginal contribution of the last project to earnings is zero. But if the marginal contribution of the last project is zero, then it is substantially less than the opportunity cost of capital at the margin, and the firm will be investing equity capital that the shareholders could better employ elsewhere. Such firms will grow and have positive GAAP earnings, but they will be inefficient users of equity and will fail to generate rewards for the shareholders as high as might be obtained in other uses.

Similarly, if managers focus on maximizing ROE, or the difference between ROE and some hurdle rate, then another problem appears. Logically, maximization of ROE requires that all projects except the one with the highest expected ROE be abandoned. For example, suppose a firm has three potential projects, with expected ROEs of 30, 25, and 20 percent, respectively. The opportunity cost of equity capital is 15 percent. A manager maximizing ROE or the difference between ROE and the opportunity cost of equity capital will pick only the first project, despite the fact that the other two would also generate economic profits for the firm. Thus, a firm that uses a performance metric based on ROE will tend to underinvest and grow more slowly than it should.

A firm using EVA^{SM} would avoid either of these outcomes because managers would be forced to internalize the trade-off between growth and the return to additional equity. A manager maximizing EVA^{SM} would invest until the last project generated an ROE just equal to the opportunity cost of the equity capital employed. Growth would be pursued but only so long as additional projects enhance economic profit. Proponents argue that in addition to causing managers to economize on their use of equity capital, the most expensive part of the firm's balance sheet, an EVA^{SM}-based system makes explicit each manager's contribution to economic profit, and by doing so results in increased focus and commitment.[5]

One problem with any incentive compensation system (and an illustration of agency costs) is that it can be manipulated by managers to maximize their compensation without necessarily increasing the profits of the firm. For example, if the incentive compensation system considers only the manager's performance this period, then it is often possible for a manager to take actions that raise reported perfor-

[4] EVA^{SM} can be defined with respect to either total assets or equity. In a total assets formulation, adjusted earnings represents net operating earnings after tax but before interest expense, while c represents the weighted average cost of capital, and K the total assets of the firm. In the equity formulation, used in the rest of this article, adjusted earnings represents net income after interest and taxes, c is the cost of equity, and K is equity capital.

Stern Stewart has identified over 160 potential adjustments to the GAAP definition of net income that it believes result in a better reflection of economic earnings. For banks, there are four major adjustments: using actual net charge-offs rather than the loan provision, using cash taxes rather than the tax provision, excluding securities gains and losses, and considering nonrecurring events as an adjustment either to earnings or capital, on a case-by-case basis. See Uyemura, Kantor, and Pettit (1996).

[5] Proponents of EVA^{SM} also argue that it is more closely correlated with return to shareholders than are traditional GAAP accounting measures such as earnings, return on assets, or ROE. Such assertions have been criticized. For the proponents' arguments see Stewart (1991); Stern, Stewart and Chew (1995); Uyemura, Kantor, and Pettit (1996); and O'Byrne (1997). For the opposite view see Kramer and Pushner (1997) and Lehn and Makhija (1996).

mance this period but depress it in succeeding periods.[6] For example, in banking, current-period operating earnings can be enhanced by cutting service levels and relaxing credit standards, but such actions will depress future operating earnings as disgruntled customers switch to competitors and credit losses increase. Indeed, incentive systems resemble tax systems in that one of the biggest challenges in designing such systems is to identify and close loopholes that facilitate gaming.

As with any other incentive system that focuses solely on current-period performance, an EVA^{SM}-based system can be manipulated to maximize current incentive compensation at the cost of future reported performance. In many firms, this time horizon problem is addressed by creating an incentive compensation account for each manager into which both positive and negative annual payments are made. Managers are permitted to withdraw only a maximum percentage of the balance in the incentive account in any one year.[7] By creating a rolling five-year time horizon for the effective vesting of the incentive compensation, the manager's incentives to manipulate short-term performance at the cost of long-term performance is limited, since any increase in this period's incentive compensation would be offset by negative incentive compensation in the succeeding periods.[8]

III. Related Operations and EVA^{SM}

To be effective in reducing agency costs and facilitating the devolution of decision-making, any performance measurement and incentive system must apply not just to senior management, but also at the divisional, product, and customer levels. Only by application at the business unit level can a performance measurement system be expected to affect the behavior of managers at these levels. However, application of any measurement and incentive system based on economic profit, whether EVA^{SM} or another, to subunits of a bank is based on a key assumption: that it is possible to isolate the earnings contribution of each business unit of the bank and the proportion of the bank's equity capital it uses. In effect, calculation of economic profit at the business unit level views the firm as being the aggregation of individual units, and the earnings and equity capital of the firm as being the sum of the individual earnings and equity capital used by the subunits. But this "the whole is the sum of the parts" assumption may not be valid if either the earnings of one unit are affected by the actions of another or the economic risks faced by different units are imperfectly correlated. This section discusses the effects of related operations upon the calculation of economic profit, while Section IV discusses issues associated with the allocation of equity capital to business units.

Lines of business, divisions, products, or other subunits are related operationally when the level of activity in one unit affects the earnings of another. Relatedness can affect revenues as well as expenses.

Lines of business, divisions, products, or other subunits are related operationally when the level of activity in one unit affects the earnings of another. An extreme example of related operations is the production of joint products, where a process results in the production of two separate products in fixed relative proportions. A classic example of joint production used in many textbooks is the slaughter of a steer, resulting in both beef and leather. Neither product can be produced without the other, and the volume of each is more or less fixed with respect to the volume of the other. But operations can be related in many circumstances other than strict joint production. In many situations business units share common expense bases, products, distribution channels, or customers.

[6] When, presumably, the manager would no longer be with the firm.

[7] For example, suppose a manager earns an incentive compensation bonus in 1997 of $10,000. The $10,000 is deposited as deferred compensation into an incentive compensation account. The manager is allowed to withdraw only 20 percent of the account in any one year, so that a maximum of $2,000 can be withdrawn in 1997 with a balance of $8,000 carried over to the next year. If in 1998 the manager earns another $5,000 in incentive compensation, the balance in the account will be $13,000, and the manager may withdraw a maximum of 20 percent, or $2,600. On the other hand, if the manager's unit does poorly and the manager earns an incentive compensation payment of a negative $5,000, then the balance in the account declines to $3,000 and the manager may withdraw only $600.

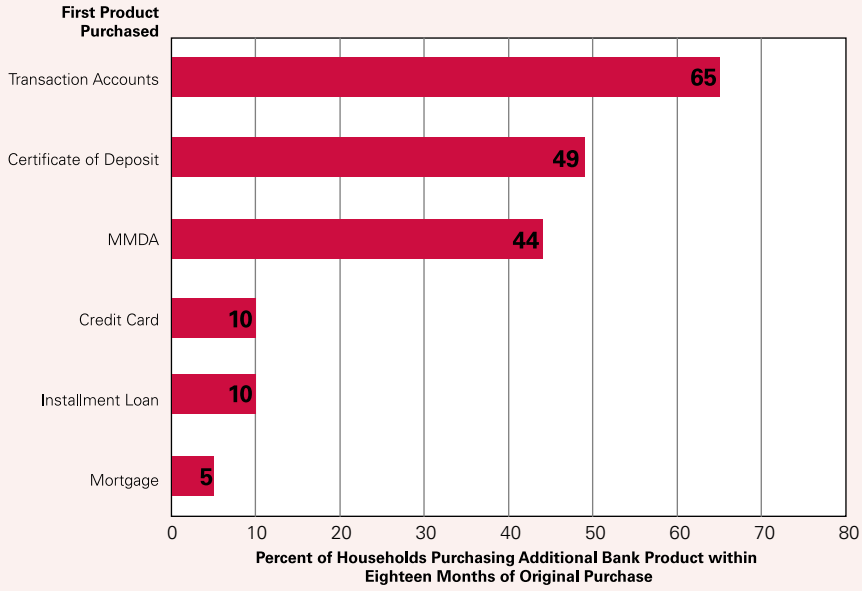
[8] Such systems work only if the manager is willing to accept negative incentive compensation in poor years, and if any remaining balance in the incentive compensation account is forfeited if the employee leaves the firm. The latter condition also acts as "golden handcuffs" to reduce turnover of key managers.

For example, bank products such as credit cards and home equity loans may share the same revolving loan system used to process account payments and statements. Similarly, advertising that stresses a bank's willingness to lend may affect more than one loan product.

The existence of shared expense bases means that these costs must be divided among the subunits that share them, if the earnings of each are to be calculated. If the expenses of the shared cost center vary directly with volumes, they can be allocated to the subunits in proportion to their usage. But in most cases, the expenses of the cost center are relatively fixed or vary less than proportionately with volumes. Cost allocations then become arbitrary and can lose their economic usefulness. Consider the example of a bank operating a revolving loan system used by two loan products: credit cards and home equity loans. An economist would argue that each product or transaction should be charged its marginal cost. But in the case of the revolving loan system, most of the costs are fixed in the form of system development and maintenance, and the cost of executing an additional transaction or adding a product is almost zero. Thus, the manager for either product could argue that it should not be allocated any of the costs of the system since the marginal cost of adding the product or transaction to the system, once it exists, is zero. In reality, the costs of such systems are usually allocated on the basis of usage, so that each product is effectively charged an average cost per transaction times the number of transactions executed.

Figure 1

Propensity to Purchase Additional Products Based on First Product Purchased



Source: Gemini Consulting.

Even if one is willing to overlook the distortions introduced to decision-making by the use of average costs rather than marginal costs, one is still left with the result that changes in the volume of activity of one product will affect the costs of the other. For example, in the case of the revolving loan system, should the credit card product increase its volume while the home equity product did not, then the fixed costs of the revolving loan system would be spread out over a larger number of transactions, and the average cost per transaction would fall. If both products are charged the equivalent of average transaction cost times the number of transactions, then the allocated expenses of the home equity product will fall, solely because it shares an information system that has economies of scale.[9]

Relatedness can affect revenues as well as expenses. For example, to the extent that advertising is positively correlated with sales, all the business units

[9] Management accountants try to mitigate this relationship between volume variances and allocated expenses by allocating expenses on the basis of budgeted volumes rather than actual ones. That is, the expenses of the revolving loan system would be allocated on the volumes the credit card and home equity products expect to occur rather than actual ones. Thus, unexpected increases or decreases in volumes do not affect the amount allocated. However, this approach is a short-term remedy at best. While an unexpected increase in the volumes of the credit card business will not affect the costs allocated to the home equity product this period, next period the credit card business will revise its planned volumes upward to match the actuals, and at that point the proportion of systems costs allocated to the home equity product will decline.

may benefit from a corporate advertising campaign. Similarly, to the extent that customers prefer to purchase on a relationship basis and cluster their product purchases with one supplier, the acquisition of a new customer by one unit may enhance the revenues of other units. This is illustrated in Figure 1, which compares the propensity of the retail customers of a large money center bank to purchase a second product within 18 months of purchasing different initial products. As the figure shows, 65 percent of customers who opened a transactions account as their first product purchased a second product within 18 months, compared to only 5 percent of customers who took out a mortgage as their first product. Thus, it would appear that the initial sale of a transactions account has positive externalities for other retail products and that this positive impact is much larger than those connected with the initial sale of other products.

In such cases the existence of shared expenses or revenues can make it impossible to isolate costs or revenues in an economically meaningful way. In the extreme case of joint production, the sale of the two products generates two streams of marginal revenue, but there is only a single shared marginal cost. As a result, economists have long recognized that it is impossible to meaningfully calculate the profitability of either of the joint products, and that the condition for profitability maximization is the production of the joint products until the sum of their marginal revenues just equals the joint marginal cost. In the case of relatedness arising through sharing, something similar occurs. Ideally, the revenues and expenses allocated to a business unit would consist not only of those that can be directly traced to a change in the volumes of that unit, but also of the incremental revenues and expenses of other subunits that result from the change in volumes of the first unit. Banks often attempt to accomplish this by implementing transfer pricing systems. Thus, a retail branch that serves corporate customers of the middle market group may receive an internal credit to cover the associated incremental expenses. But relatedness often appears in subtle and intangible ways, so that it is unlikely that transfer pricing can capture all of the effects.

Relatedness would not be an issue in performance measurement if the degree of relatedness was small or if positive and negative effects for each unit canceled each other out. While no empirical data exist that would permit us to measure the effects of related operations on reported revenues or expenses, intuitively one can expect relatedness to exist and to increase in importance, the smaller the subunit being considered. Moreover, there is reason to believe that the effects of relatedness are not unbiased, but instead act to cause some subunits to systematically underestimate their contribution to earnings and others to overestimate it.

Indeed, some form of related operations is a necessary condition for different lines of business to exist or different products to be produced in the same firm. If no relatedness is present between lines of business or products, then each business or product could operate independently with no loss in value, and there is no economic rationale for joining them in the same firm. Increasingly, this argument is being accepted by managers, as demonstrated by the increased number of spin-offs and sales of "nonstrategic" businesses or products. It is only when benefits exist from joint operation that lines of business or products should be combined in one firm, so that these benefits can be captured.[10] In effect, multidivisional or multi-product firms exist because relatedness causes the value of the whole to be more than the sum of the value of the parts (see Zimmerman 1997).

Where relatedness exists, any performance metric that is calculated only on the allocated revenues and expenses of a single business unit, such as EVA^{SM}, will be an inaccurate measure of that unit's contribution. The contributions of business units that generate negative expense or positive revenue effects for other units will be underreported, while the contributions of subunits that enjoy either lower expenses or higher revenues as a result of the activities of others will be exaggerated. Managers attempting to maximize unit EVA^{SM} will underinvest in units that generate positive externalities and overinvest in units that receive them. The failure to incorporate relatedness into the calculation of EVA^{SM} leads to a "management myopia" where each manager is trying to maximize business unit EVA^{SM} but not bankwide EVA^{SM}. As discussed in the box, "Relatedness and Incentive Systems," incentive systems can be constructed to encourage managers to take into account the effects their decisions will have on other business units, but such incentive systems are complex and usually are only partially effective.

[10] In the strategic planning literature the effect of relatedness is captured in the concepts of core competencies and horizontal strategies. A core competency is a skill or activity that cuts across lines of businesses or products and is the basis for the competitive advantage of the firm. A horizontal strategy is one that is built around a core competency. See Prahalad and Hamel (1990) and Porter (1985), Chapters 9–11.

Relatedness and Incentive Systems

In cases where subunits generate substantial externalities, implementation of an incentive compensation system based on subunit profitability can lead to perverse results by encouraging managers to ignore the effects of their actions on other subunits. This adverse effect has long been recognized, and a variety of approaches have been developed to address it. They can be summarized as linked incentives, hierarchical grouping, and hybrid systems.

Linked Incentives

In a linked incentives approach, the incentive compensation of a manager is determined by two or more components: the performance of the manager's own unit, and the performance of either the firm as a whole or some other subunit. For example, 70 percent of a manager's incentive compensation might be determined by the EVA^{SM} of her own unit, and 30 percent by the EVA^{SM} of the bank as a whole or by the EVA^{SM} of some other related unit. The intent is to cause the manager to optimize the trade-offs between the EVA^{SM} of her own subunit and that of other parts of the bank.

Such linked incentive plans obviously expand the manager's horizon but they have two potential drawbacks. First, their efficacy in optimizing decision-making requires that the effects of relatedness be accurately identified and quantified in the incentive scheme. If they are not, the incentive scheme will not elicit optimal decision-making.[a] A second drawback of cross-linked schemes is that the more effective they are in identifying and quantifying externalities, the more complex they become. If the level of activity in one business unit affects multiple other units, any incentive scheme that accurately reflects this becomes immensely complex and unwieldy. Even if the average impact of one unit's activities on the rest can be determined, the marginal impact may vary from transaction to transaction, so that any simple cross-linkage scheme will fail to elicit efficient decision-making.

Hierarchical Grouping

A second approach to internalizing relatedness is through hierarchical grouping. In a grouping approach, the manager of each business unit is responsible for and compensated only on the EVA^{SM} of that unit. Related business units are then combined in groups, with the manager of the group evaluated and compensated on the EVA^{SM} of the group. The manager of the group thus has an incentive to maximize the synergies that might exist between the subunits. This approach avoids the rigidity of the cross-linkage approach, since the group manager's decisions are made on a case-by-case basis rather than with respect to an oversimplified and probably inaccurate formula. However, while the manager of the group has an incentive to maximize the cross-unit synergies, doing so could place him in conflict with the subunit managers, especially if the actions required to maximize group EVA^{SM} do not maximize business unit EVA^{SM}. To avoid this divergence in interests between unit manager and the group manager, business unit managers often are penalized if the group does not meet its EVA^{SM} goals.[b]

[a]For example, suppose a manager is operating under an incentive scheme where she will receive seven-tenths of 1 percent of the incremental EVA^{SM} of her own unit and three-tenths of 1 percent of the incremental EVA of the rest of the firm. The manager is evaluating an investment that will decrease her unit's EVA by $100,000 but will increase the EVA^{SM}of other units by $200,000. Although acceptance of the project would increase the firm's EVA^{SM} by $100,000, the manager has an incentive to reject it. If she accepts the project, her incentive compensation will actually decline by $100.

A drawback to grouping is that while it addresses synergies that occur among the subunits of the group, it does not address those that occur among different groups. To address these higher-level synergies, divisions consisting of related groups must be created, with division managers evaluated and compensated on the EVA[SM] of the division. But this solution, in turn, does not address the issue of synergies across divisions. In effect, grouping is probably a more flexible way to address the issues of related operations, but it requires the creation of a hierarchical management structure. As more layers of management are added, the hierarchical structure created has its own drawbacks in the form of higher costs, slower decision-making, and a reversal of the decentralized decision-making that was the original objective of implementing an EVA[SM]-based system.

Hybrid Systems

Yet another approach is to expand the performance measurement system to include nonfinancial variables. For example the "balanced scorecard" approach measures managers in areas such as "leadership," "customers," and "people," as well as the more traditional financial goals. Such a scheme can address the issue of relatedness by including key operating measures that affect other business units. These key operating measures might be the number of new customers added or the number of leads generated for other areas of the bank. For example, if, as shown earlier in Figure 1, the origination of new transactions accounts has positive externalities for other areas of the bank, then a manager in the retail banking business might be evaluated both on the EVA[SM] of his unit and also on the number of new transactions accounts originated.

Of course, such hybrid systems of financial and nonfinancial variables come with their own set of drawbacks. In particular, by evaluating a manager's performance on an "apples and oranges" basis, the system loses both its objectivity and its capacity for internalizing trade-offs. For example, suppose a manager has the dual objectives of generating 1,000 new transactions accounts and an EVA[SM] of $100,000. Unfortunately, such a system gives the manager little guidance about how to make decisions at the margin. For example, is it better to generate only 900 transactions accounts but an EVA[SM] of $110,000, or 1,100 transactions accounts and an EVA[SM] of only $90,000?

No incentive compensation system is perfect, and many firms and banks end up using a combination of systems.

While the efficacy of incentive compensation systems in encouraging managers to capture the effect of cross-unit synergies can be increased in a number of ways, none is perfect and most involve costs of their own. Many firms and banks end up using a combination of hierarchical groupings, hybrid performance measurement systems, and linked incentives to address this issue. Such integrated systems must be carefully constructed and monitored to ensure that they have a positive effect on the overall performance of the bank.

[b]This approach does not completely avoid conflict. Subunit managers have an incentive to cooperate with the group manager until the group goal is achieved. At that point the conflict between the subunit manager's objective to maximize subunit EVA[SM] and the group manager's objective to maximize group EVA[SM] reemerges.

Table 2
Peer Group Approach to Allocating Equity Capital for Consolidated Amalgamated Bank

Line of Business	(1) Assets ($millions)	(2) Equity ($millions)	(3) Equity/Assets (Percent)	(4) Return on Assets (Percent)	(5) σ_{ROA}	(6) Z-Ratio
Credit Cards	20,261	2,018	9.96	4.94	1.08	13.80
Mortgage Banking	11,314	1,949	17.23	4.96	2.78	7.98
Subprime Lending	5,072	1,666	32.77	14.67	7.96	5.96
Total	36,647	5,633	15.37	5.99	1.29	16.56

Source: Compustat and author's calculations.

IV. Allocating Equity Capital

If some variation of economic profit is to be calculated at the business unit level, then the bank's equity capital, as well as its earnings, must be disaggregated and divided among the business units. This allocation of equity capital is critical, since without it the opportunity cost of equity cannot be calculated. In any firm, equity has two different functions: as a source of funding to purchase equipment, premises, and inventory, and as a cushion to protect debt holders against loss in the event of operating losses. Because banks hold relatively few of their assets in the form of real assets, equity's function as a cushion for economic risk is especially important in banking. The proportion of equity needed to support a line of business, product, or customer within the bank will depend upon the riskiness of the activity, with riskier activities requiring additional capital.[11] Thus, the amount of equity capital allocated to a particular business unit will depend both on the scale of operations (for example, the amount of assets held) and the riskiness, so that a small but risky subunit could require as much equity as a large but low-risk one.

Stand-Alone Allocation Methods

One approach to allocating equity bases the allocations on the capital structure of independent "pure play" peers. To do so, a bank would construct for each line of business a group of publicly traded peers and allocate capital according to the average capital ratio of the peer group.[12] For example, the mortgage banking business would be assigned equity as though it were an average, independent, publicly traded mortgage banker. While this approach has the advantage of being based on objective market data, actual implementation quickly reveals several drawbacks. The number of independent publicly traded peers may be small or in some cases nonexistent, and these peers may differ in important respects from the business being analyzed. And even if a sufficient number of publicly traded peers exist, their capital ratios may vary significantly, so that management must choose among a possible range of capital allocations rather than a closely clustered point estimate.

This approach is illustrated for a fictional Consolidated Amalgamated Bank in Table 2. The Consolidated Amalgamated Bank is constructed from data for three separate publicly traded monoline lenders: a mortgage banker, a credit card bank, and a subprime consumer lender.[13] In Table 2, the capital allocated under the peer group approach is assumed to be the same as the units' actual equity capital in their true identity as publicly traded independent firms. As shown there, while the bank as a whole has an equity-to-asset ratio of about 15 percent, the equity-to-asset ratios of the individual businesses vary from about 10 percent for the credit card business to 33 percent for the subprime lending business.

While the peer group method of allocation clearly differentiates among the lines of business in terms of the amount of capital allocated, it does not necessarily result in equal probabilities of insolvency across different lines of business.[14] For example, if consumer finance companies have on average a higher probability of insolvency than do mortgage banks, then allocation of equity capital based on the average of their respective capital structures will result in a higher

[11] Riskiness is usually measured as the volatility of returns, for example, the standard deviation of the return on assets.

[12] Allocations to products and customers would usually reflect the line of business to which they belong.

[13] This approach was necessary because no bank publishes line-of-business results on a quarterly basis over a sufficient time period to permit calculation of expected returns and their covariance.

[14] Insolvency for a line of business should be interpreted as the probability that the losses of the line of business will exceed the equity capital allocated to it.

Table 3
Capital Allocations for Consolidated Amalgamated Bank with Equal Probability of Insolvency

Line of Business	(1) ROA (Percent)	(2) σ_{ROA}	(3) Z*-Ratio	(4) Equity/Assets (Percent)	(5) Equity ($millions)
Credit Cards	4.94	1.08	13.80	9.96	2,018
Mortgage Banking	4.96	2.78	13.80	33.40	3,779
Subprime Lending	14.67	7.96	13.80	95.18	4,827
Total Bank	5.99	1.29	27.12	28.99	10,624

Required equity capital for bank to achieve Z* = 13.80:
K = (13.80)(1.29) − 5.99 = 11.81%
Equity capital = (11.81%)(36,647) = $4,329 million.

Source: Columns 1, 2, and 3: Table 2 and author's calculations. Column 4: (Column 3 × Column 2) − Column 1.

probability of insolvency for the bank's consumer lending business than for its mortgage origination business. One index of the probability of insolvency is the Z-ratio,[15] defined as:

$$Z = (ROA^* + K)/\sigma_{ROA} \quad (1)$$

where

ROA* = the pretax expected return on assets, usually defined as the historical mean ROA,

K = the ratio of equity capital to assets, and

σ_{ROA} = the standard deviation of ROA.

Thus, the Z-ratio is a function of the normal profit margin of the bank, the variation in that profit margin, and the equity capital available to absorb that variation. In effect, the Z-ratio measures the number of standard deviations by which ROA would have to decline before the book equity capital of the bank would be exhausted. The relationship between the Z-ratio and the probability of insolvency is an inverse one, with higher Z-ratios indicating a lower probability of insolvency.[16] The last four columns of Table 2 calculate the Z-ratio for each line of business and for the bank as a whole. As shown there, the Z-ratios differ significantly across the lines of business, with the credit card business having a substantially lower probability of exhausting its assigned equity than do the mortgage banking and subprime lending businesses.

An alternative approach allocates equity capital based on each business's cash flow so as to create an equal probability of insolvency. Equation (1) above can be rewritten to express the capital-to-asset ratio required to achieve a given target Z-ratio, as follows:

$$K^* = Z^*\sigma_{ROA} - ROA^* \quad (2)$$

where K* is the required capital-to-asset ratio to achieve a target Z-ratio equal to Z*. In this approach each line of business will be allocated capital until its Z-ratio equals Z*. Application of this approach to Consolidated Amalgamated is illustrated in Table 3, which assumes that each line of business is allocated capital to achieve a Z-ratio of 13.8, the initial Z-ratio of the credit card business. This approach results in substantially higher equity-to-asset ratios for the mortgage banking and subprime lending businesses. Indeed, the equity capital-to-asset ratio of the subprime lending business increases from about 33 percent under the peer-group method to about 95 percent under the equal probability of insolvency approach. Similarly, if the required equity of the bank as a whole is the sum of the required equity for each of the lines of business, then the bank will require almost 89 percent more equity under the equal probability of insolvency approach than under the peer group approach.

[15] This measure was developed by Hannan and Hanweck (1988). Although Hannan and Hanweck called the risk index "g," in subsequent work it has generally been called "Z."

[16] If the assumption is made that the potential ROAs of the business are normally distributed, then the one-period probability of insolvency can be calculated as a function of the Z-ratio:

$$p = 1/[2Z^2]$$

However, empirical studies indicate that ROAs are not normally distributed, but instead are "fat-tailed," so that the actual probability of insolvency may be greater than that calculated using the assumption of normality. Moreover, this one-period probability may understate the true probability of insolvency because it measures the risk of a single-period loss being so large it wipes out equity. In reality, insolvency often occurs after a sequence of smaller losses occurring over several periods, indicating that serial correlation between negative shocks may exist.

Table 4
Capital Allocation for Consolidated Amalgamated Bank with Equal Probability of Insolvency and Diversification Effects

Line of Business	(1) Stand-Alone Equity ($millions)	(2) Diversification Effect	(3) Equity Allocation with Diversification Effect ($millions)
Credit Card	2,018	.4074	822
Mortgage Banking	3,779	.4074	1,540
Subprime Lending	4,827	.4074	1,967
Total Bank	10,624	.4074	4,329

Source: Column 1: Table 3. Column 2: $4,329 (from Table 3) ÷ $10,624 (from Table 3). Column 3: Column 1 × Column 2.

Allowing for Diversification

A comparison of the Z-ratios for the bank as a whole with the Z-ratios for the individual lines of business, as shown in Tables 2 or 3, reveals a drawback to both of these stand-alone methods of allocating capital. The Z-ratio for the bank as a whole is considerably greater than the Z-ratio for any of the three lines of business, indicating that the probability of insolvency for the bank is less than that of any of the lines of business. This occurs because the correlation in the ROAs of the individual businesses is less than perfect. To the extent such correlations are less than perfect, they will tend to dampen the fluctuations in returns for the bank as a whole, so that the risk of the bank will be less than the weighted sum of the risks of the individual businesses. In effect, the business units act as partial natural hedges for each other, reducing the need for equity capital. Thus, a bank with a diversified portfolio requires less equity capital to achieve any given probability of insolvency than do the business units on an aggregated stand-alone basis. This is shown at the bottom of Table 3, where the amount of equity capital needed for the bank as a whole to achieve a Z-ratio of 13.8 is calculated to be only $4.3 billion, less than half of the $10.6 billion calculated as the sum of the stand-alone allocations to the individual businesses.

Thus, in those situations where the ROAs of the individual businesses are imperfectly correlated, a discrepancy will result between the sum of the individual equity allocations to the different lines of business and the equity capital required when the effects of diversification are incorporated. This discrepancy creates obstacles to the evaluation of businesses and their managers. Ultimately, the larger the capital allocation, the more difficult it is for a line of business to earn an economic profit. If capital allocations to individual businesses exceed the actual capital of the bank, then managers may believe this "ghost capital" unfairly biases downward the reported return on equity of each business. The excess allocated capital can also create strategic issues, since the reported EVA^{SM}s of the business units will not sum to the EVA^{SM} of the bank. Theoretically it would be possible for each line of business to fail to earn its required opportunity cost of stand-alone equity, while the bank as a whole surpassed its required opportunity cost of equity based on actual equity capital, which includes the effects of diversification. In extreme cases, a bank might choose to exit a business based on an insufficient return to equity earned on allocated capital, when the return on equity on actual capital might be quite satisfactory.

Proportional Scaling

This problem can be addressed in two ways. The simplest is to scale back the allocations to the individual businesses so that the sum of the allocations equals the actual (diversified) capital of the bank. Thus, if the sum of the individual allocations is 200 percent of the actual capital of the bank, each allocation is reduced by one-half to make the sum of the individual allocations equal to actual capital. This approach is illustrated for Consolidated Amalgamated in Table 4, assuming that each line of business has the same probability of insolvency (from Table 3) and that the bank as a whole has a target Z-ratio of 13.8. In effect, this approach spreads the reduction in equity capital due to diversification across the lines of business in proportion to their initial stand-alone capital allocations.

Table 5
Effect of Scaled Reductions in Capital Allocations on Reported Economic Profit

Business Unit	Adjusted Earnings	Opportunity Cost of Allocated Capital before Diversification Effects	Reported Economic Profit before Diversification Effects	Opportunity Cost of Allocated Capital after 50% Diversification Effects	Reported Economic Profit after Diversification Effects	Incremental Economic Profit due to Scaled Reductions in Capital Allocations
A	100	100	0	50	50	50
B	100	70	30	35	65	35
C	100	50	50	25	75	25

Source: Author's calculations.

While simple to implement, this approach to incorporating the effects of diversification has serious conceptual drawbacks. By allocating the reductions in equity capital in proportion to the initial stand-alone capital allocations, inefficient users of capital receive a disproportionate increment to their economic profits. An example of this is shown in Table 5, which compares three lines of business before and after the scaled reductions in stand-alone allocations.[17] All three lines of business have the same adjusted earnings, but they differ in the amount of capital used and thus in their reported economic profits. If stand-alone capital allocations are scaled back by 50 percent to reflect the benefits of diversification, then the incremental effect on the reported economic profits of Business A, the most inefficient user of capital, will be double that of Business C, the most efficient user of equity capital. As a result, the simple scaling approach obscures the ability of senior management to distinguish among the business units in their efficiency in using equity capital.

Moreover, when the benefits from diversification are allocated in proportion to their initial stand-alone capital allocations, they are being allocated in proportion to the stand-alone total risk of each line of business, weighted by the dollar assets of each business. But the contribution of a particular line of business to the total risk of the bank will depend not only on the stand-alone risk of that line of business, but also on the correlations in returns among the different lines of business of the bank. A line of business with a low or negative correlation of returns with the other parts of the bank will diversify away more risk than will a line of business with a high positive correlation. A simple proportional reduction in stand-alone capital tends to over-allocate capital to lines of business units with low or negative correlations, and to under-allocate equity capital to business units with high positive correlations.

Internal Betas

A second possible alternative to incorporating the effects of diversification in allocating capital is based upon the concept of "internal betas." In this approach, the relative risk contribution of each line of business is calculated as an internal beta, defined as the ratio of the covariance between the business unit's and bank's returns to the variance of the bank's returns:

$$\beta_{Bus} = \text{cov}(R_{bus,}\, R_{bank})/\sigma^2_{Bank} = (\sigma_{Bus}/\sigma_{Bank})\rho_{Bus,Bank}$$

where σ_{Bus} and σ_{Bank} are the standard deviations of the ROAs of the business unit and the bank as a whole, respectively, and $\rho_{Bus,Bank}$ is the coefficient of correlation of returns between the business and the bank. In this formulation the risk contribution of each business will depend on two factors, its stand-alone risk relative to the bank as a whole ($\sigma_{Bus}/\sigma_{Bank}$) and the degree of correlation between the returns of the business and the bank ($\rho_{Bus,Bank}$). The effect of the correlation in returns is unambiguous—the greater the correlation, the greater the risk contribution of the business—but the effect of the stand-alone risk of the business will depend on the sign of the correlation coefficient. If the correlation between the unit's and the bank's returns is positive, then the risk contribution of the business will increase in proportion to its stand-alone risk, but if the correlation in returns is negative, then the risk contribution of the business will decrease as the stand-alone risk of the business increases. Intuitively, if returns are negatively correlated, then variations in

[17] The lines of business shown in Table 5 are fictional and are not those shown for Consolidated Amalgamated in Tables 2, 3, 4, 6 and 7.

Table 6
Allocation of Equity Capital for Consolidated Amalgamated Bank Using Internal Betas

Business Unit	(1) Standard Deviation of Returns (σ_{ROA})	(2) Correlation Coefficient ($\rho_{Bus,\ Bank}$)	(3) Internal Beta (β_{Bus})	(4) Equity Capital Ratio of Business (Percent)	(5) Allocated Equity Capital ($millions)
Credit Card	1.08	.762	.638	7.54	1,526
Mortgage Banking	2.78	.423	.911	10.77	1,217
Subprime Lending	7.96	.429	2.65	31.27	1,586
Bank Total	1.29				4,329

Source: Column 1: Table 2
Column 2: Compustat, author's calculations.
Column 3: (Column 1 ÷ 1.29) x Column 2.
Column 4: Column 3 x (4,329/36,647) (from Tables 4 and 2).
Column 5: Column 4 x Column 1, Table 2.

returns from the business tend to offset variations in returns on the bank as a whole, and the greater the variation in returns on the business (σ_{Bus}), the greater the reduction in the overall risk of the bank.

In the internal beta approach, the equity capital-to-asset ratio for each business unit is equal to the product of the unit's internal beta and the bank's overall equity capital ratio:

$$K_{Bus} = \beta_{Bus} K_{Bank}$$

where K_{Bus} is the capital-to-asset ratio of the business, β_{Bus} is the internal beta of the business, and K_{Bank} is the capital-to-asset ratio of the bank, including diversification effects. This approach is illustrated for the Consolidated Amalgamated Bank in Table 6. As can be seen there, the capital allocations under this approach differ substantially from the equal-scaling approach shown in Table 4. In particular, the business units with relatively low correlation in returns (mortgage banking and subprime lending) are allocated substantially less equity capital under this approach than the business unit (credit card) with a relatively high correlation in returns.

Marginal Capital

While the internal beta approach integrates both the stand-alone risk of the business and its interaction with the rest of the bank, its use to calculate the risk contribution of a business unit involves several restrictive assumptions. As discussed in the accompanying box, the internal beta approach measures the risk contribution of a business unit under the assumptions that the business already exists within the bank and that the relative size of the business (and of the other businesses in the bank) does not change. This means that the internal beta approach is most appropriate in a relatively static situation and results in biased allocations in more dynamic situations such as acquisitions or divestitures, or where business units are growing at different rates. Thus, in situations where the mix of businesses is changing, as a result of either strategic decisions or differential growth rates, capital should be allocated based on the business's marginal risk contribution.

Marginal capital can be defined as the incremental capital (for the bank as a whole) resulting from a change in the scale of operation of a business unit, assuming the probability of insolvency remains constant. For an acquisition or divestiture, marginal capital is measured as the difference between the required equity capital for the bank as a whole, including the business being bought or sold, and the required equity capital for the bank without the line of business. For an existing business that is expanding its scale of operations, it can be measured as the incremental capital for the bank as a whole associated with the incremental increase in volumes.

Marginal capital for each of the lines of business of Consolidated Amalgamated Bank is shown in Table 7 under the assumption that each line of business is being divested. That is, marginal capital is calculated as the difference in the bank's required capital, with and without the line of business in question. As can be seen in Table 7, marginal capital depends both on the extent of the correlation in returns between the business units in question and on the effect of the change on the diversification of the bank.

Adding a business that has a low positive correlation with existing businesses will require less incremental capital for the bank than will acquiring one with a high positive correlation, and acquiring a

Table 7
Calculation of Marginal Equity Capital for Consolidated Amalgamated Bank

Business Unit	(1) Required Equity Capital for Bank with All Three Business Units ($millions)	(2) Required Capital Ratio for Bank without Business Unit (Percent)	(3) Bank Assets without Business Unit ($millions)	(4) Required Equity Capital for Bank without Business Unit ($millions)	(5) Marginal Equity Capital ($millions)	(6) Marginal Capital Ratio (Percent)
Credit Card	4,329	21.74	16,386	3,562	767	3.78
Mortgage Banking	4,329	19.78	25,333	5,012	(683)	(6.04)
Subprime Lending	4,329	12.55	31,575	3,961	368	7.25
Total Allocated Capital					452	
Unallocated Capital					3,877	
Total Bank Capital					4,329	

Source: Column 1: Table 3.
Column 2: Author's calculations, using method from Table 3.
Column 3: Compustat.
Column 4: Column 2 × Column 3.
Column 5: Column 1—Column 4.
Column 6: Column 5 ÷ Column 1, Table 2.

business with a negative correlation with existing businesses can actually reduce the required capital, resulting in negative marginal capital. This is shown in Table 7 for the mortgage banking business. Because the correlation in returns between the mortgage banking business and the subprime lending business is negative (−0.53), adding the mortgage banking business to an existing combination of the credit card and subprime lending businesses actually dampens the variation in the aggregate and therefore reduces the required capital. Moreover, marginal capital is not constant but will vary as the size of the business in question varies relative to the size of the other businesses in the bank. As discussed in the box, "Internal Betas and Marginal Capital," the marginal capital associated with a given increment in the size of a business increases as the business unit becomes a larger proportion of the bank.

Capital Allocations and EVA℠

Table 8 summarizes the results of Tables 2, 3, 4, 6, and 7 and shows the equity capital allocated to each of Consolidated Amalgamated's three businesses using each of the capital allocation methodologies discussed above. Depending on the methodology selected, the allocated equity capital, and thus the reported EVA℠, of a business unit can vary dramatically.

Clearly the capital allocation methodology selected will affect not only the reported EVA℠ of each

Table 8
Equity Capital Allocations for Consolidated Amalgamated Bank, by Allocation Methodology

Business Unit	(1) Stand Alone: Peer Group ($millions)	(2) Stand Alone: Equal Probability of Insolvency ($millions)	(3) Scaled Diversification ($millions)	(4) Internal Betas ($millions)	(5) Marginal Capital ($millions)
Credit Card	2,018	2,018	822	1,526	767
Mortgage Banking	1,989	3,779	1,540	1,217	(683)
Subprime Lending	1,666	4,827	1,967	1,586	368
Unallocated Capital					3,877
Bank Total	5,633	10,624	4,329	4,329	4,329

Source: Column 1: Table 2
Column 2: Table 3
Column 3: Table 4
Column 4: Table 6
Column 5: Table 7

Internal Betas and Marginal Capital

Internal Betas

The risk of a bank (σ^2_{Bank}) with n different business units is given by the formula:

$$\sigma^2_{Bank} = \Sigma\Sigma w_i w_j cov_{i,j} \qquad \text{(B-1)}$$

where w_i is the proportion of assets used by the i-th business unit, and $cov_{i,j}$ is the covariance of returns between the i-th and j-th business unit. This relationship is depicted in Table B-1 as the sum of the terms of a matrix of the business unit variances and covariances,[a] with each row representing a different business unit. Then the risk contribution of business 1 can be expressed as the sum of the terms in row 1, weighted by the assets of the business:

Risk contribution of business 1 =

$$w_1 \Sigma w_j cov_{1,j} = w_1 cov_{1,Bank} . \qquad \text{(B-2)}$$

To measure the proportion of total risk contributed by business 1, we divide equation (B-2) by the overall risk of the bank:

Proportional risk contribution of business 1 =

$$w_1 cov_{1,Bank} / \sigma^2_{Bank} = w_1 \beta_1 . \qquad \text{(B-3)}$$

But this is the internal beta of business 1. Because the proportion of risk accounted for by all the business units in the bank must equal the risk of the bank, then

$$\Sigma w_i \beta_i = 1 . \qquad \text{(B-4)}$$

While the internal beta approach divides up the risk of the bank and does so in a way that incorporates the correlation in returns between the business unit and the bank, using the internal beta to allocate capital involves two very restrictive assumptions. First, because the risk of the bank is the weighted sum of the risk contribution of the business units, it already incorporates the risk contribution of business 1. That is, the risk contribution of each business is calculated on an ex post basis, assuming that the business is already and will remain a part of the bank. If a new business unit is added (deleted) then the variance/covariance matrix used to calculate the risk of the bank will have to add (delete) both a row and a column and the weights of the original

[a] Notice that the covariance of a variable with itself equals the variance of the variable.

Table B-1
Risk Contribution By Business Unit: The Internal Beta Approach

Business Unit	1	2	3		N	
1	$w_1^2\sigma_1^2$	$w_1w_2cov_{1,2}$	$w_1w_3cov_{1,3}$	—	$w_1w_ncov_{1,n}$	Risk Contribution = $w_1\Sigma w_j\, cov_{1,j}$ = $w_1cov_{1,Bank}$
2	$w_2w_1cov_{1,2}$	$w_2^2\sigma_2^2$	$w_2w_3cov_{2,3}$	—	$w_2w_ncov_{2,n}$	Risk Contribution = $w_2\Sigma w_jcov_{2,j}$ = $w_2cov_{2,Bank}$
3	$w_3w_1cov_{1,3}$	$w_3w_2cov_{2,3}$	$w_3^2\sigma_3^2$	—	$w_3w_ncov_{3,n}$	Risk Contribution = $w_3\Sigma w_j\, cov_{3,j}$ = $w_3cov_{3,Bank}$
	—	—	—	—		—
N	$w_nw_1cov_{1,n}$	$w_nw_2cov_{2,n}$	$w_nw_3cov_{n,3}$	—	$w_n^2\sigma_n^2$	Risk Contribution = $w_n\Sigma w_jcov_{n,j}$ = $w_ncov_{n,Bank}$
						Total Contribution = $\Sigma\Sigma\, w_iw_j\, cov_{i,j}$ = σ^2_{Bank}

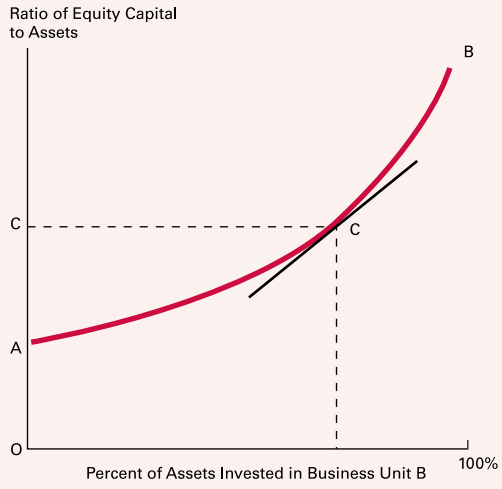
entries will change so that each row of the matrix, as well as the overall risk of the bank, will change. Second, the calculated risk contributions for each business unit are only valid for the asset weightings used. Any disproportional change in the relative importance of a business unit will change the weights on all of the entries in the variance/covariance matrix and thus result in a change not only in the internal betas of that business unit, but also in the internal betas of all of the other business units. Thus, capital allocations calculated using the internal beta approach are valid only for a specific mix of business units and cannot be used for other configurations of business units or asset weightings. Moreover, the capital allocation and reported EVA^{SM} of each business unit will be affected by the activity of the other business units in the bank.

Marginal Capital

Because a disproportionate change in the activity of one business unit affects the risk weighting of all of the business units, the incremental change in the total risk of the bank is not just the increment in the risk contribution of the particular business unit initiating the change, but also includes the effects on the risk contributions of all of the other business units in the variance/covariance matrix. Except in special circumstances this marginal risk contribution will not be equal to the risk contribution computed using internal betas. This is shown in Figure B-1 for a bank consisting of two business units. Business unit 1 is relatively low-risk and low-return, while business unit 2 is relatively high-risk, high-return. Figure B-1 shows the equity capital-to-asset ratio required to achieve a constant Z-ratio for different asset weightings of units 1 and 2. At point A, 100 percent of the bank's assets are comprised of unit 1 and the bank's required capital-to-asset ratio is simply the stand-alone required capital ratio for unit 1. At point B, 100 percent of the bank's assets are invested in unit 2, and the bank's required capital-to asset ratio is simply the stand-alone required capital ratio for unit 2. The curve AB represents the equity capital-to-asset ratios for all

Figure B-1

Diversification and Marginal Risk



the weightings of unit 1 and 2 to achieve the same probability of insolvency and is thus an iso-insolvency curve. It is convex because the returns of the businesses are assumed to be imperfectly positively correlated.

As shown in Figure B-1, each point on the iso-insolvency curve shows a different capital-to-asset ratio corresponding to a different mix of business units. If the bank increases the size of unit 2 relative to unit 1 it will move to the right along the curve and its required capital-to-asset ratio will increase. The rate at which the required capital-to-asset ratio increases is equivalent to the marginal capital ratio and can be shown as the slope of a tangent to the iso-insolvency curve. At point C, the required capital-to-asset ratio is OC, but the marginal capital is equal to the slope of the tangent at C, which is greater than OC. Thus, the marginal capital ratio will not equal the capital ratio for the bank as a whole, nor will it be a weighted average of the stand-alone risk of each of the business units.

business, but also how well the resulting measure captures the true economic contribution of the business and the incremental risk for the bank. For example, if a stand-alone methodology is selected, then the calculated EVA^{SM}s will be lower than if diversification effects are taken into account, and the sum of the business unit EVA^{SM}s will be less than the EVA^{SM} of the bank as a whole. If diversification effects are included by scaling down stand-alone allocations, then the unit EVA^{SM}s will sum to the bank's EVA^{SM}, but the EVA^{SM} of inefficient users of capital will be improved more than those of efficient users, and capital allocations will still fail to reflect the actual risk contributions of the businesses. In particular, the EVA^{SM}s of inefficient users of capital whose returns are highly correlated with the rest of the bank will be biased upward compared to the EVA^{SM}s of efficient users of capital with low positive or negative correlations.

If the bank chooses to allocate capital based on internal betas, then the business unit EVA^{SM}s will sum to that of the bank, and the capital allocation of each unit will reflect not only its stand-alone risk but also the interaction of the business with the other parts of the bank. But the capital ratios calculated using internal betas do not reflect the incremental risk associated with acquisitions, divestitures, or a change in the scale of operations, and thus will result in biased estimates of the associated incremental EVA^{SM}. Moreover, if the returns of the unit and the bank are negatively correlated, then the internal beta and capital allocation of the business would be negative.

While some observers have argued that negative capital allocations are nonsensical, in fact they merely reflect the reduction in required bank capital that occurs when a unit with negatively correlated returns is combined with the rest of the bank. Negative capital allocations can easily be incorporated into the EVA^{SM} equation shown at the beginning of Section II. The effect of such a negative equity capital allocation is to create a negative opportunity cost of capital and increase the EVA^{SM} of the unit so that it is greater than its adjusted earnings. This augmented EVA^{SM} reflects not only the earnings of the business but the saving in capital costs resulting from the unit's function as a natural hedge. However, a negative equity allocation to a particular business may represent a considerable challenge in terms of convincing the managers of the other business units that they have been treated fairly. Moreover, it is questionable whether one would wish to compensate the manager of a business with a negative equity allocation on the basis of the unit's EVA^{SM}, since the latter represents not only the economic profit of the business but also its value as a natural hedge, which has nothing to do with the manager's efforts.

Finally, if marginal capital is used as a basis for allocations, then the EVA^{SM}s of important strategic decisions will more accurately reflect their contribution to the bank. But as Merton and Perold (1995) have shown, the sum of the unit marginal capital allocations will be less than the capital of the bank, and the sum of the EVA^{SM}s of the businesses will be more than the EVA^{SM} of the bank. For example, as shown in Table 7, the allocations of marginal capital sum to only about 10 percent of the total capital of Amalgamated Consolidated, leaving about 90 percent of the bank's equity capital unallocated.[18] Thus it would be conceptually possible for each of the businesses to be generating a positive EVA^{SM}, but for the bank as a whole to be generating a zero or negative EVA^{SM}. Moreover, negative capital allocations are more likely to occur, resulting in the communications and compensation issues discussed above. Unfortunately, none of the capital allocation methodologies described above will result in an EVA^{SM} that will in all circumstances accurately reflect the economic contribution of the business unit.

V. Conclusion: Using Economic Profit to Measure Performance

Clearly, the incorporation of an opportunity cost of equity capital into a bank's performance measurement system potentially can offer great benefits in terms of improved risk management, greater efficiency in the use of capital, and quicker and more informed decision-making on the part of managers. But if business units are related, either operationally or in their use of equity capital, then the isolation of the earnings and economic capital used by each business becomes problematic. In such situations, estimates of economic profit may be biased and lead to poor decision-making. Attacking this problem is difficult because it is essentially a measurement issue: Identification of the extent and source of the problem would resolve it.

Are there rules of thumb that might help managers to assess the problem of relatedness in perfor-

[18] This unallocated capital is not excess, but represents the amount required to protect depositors and creditors against the positive correlation of returns among the individual business units.

mance measurement? If the assumption is made that the extent of relatedness can be approximated by the degree of correlation among the businesses in their returns, then we can distinguish between two situations: businesses with a high degree of relatedness and correlation in their earnings, and those with little or no relatedness or correlation.[19] In the case of the former, the earnings of the businesses are likely to be related. Thus, the economic contribution of units that generate positive externalities for other units is likely to be underestimated, leading to underinvestment in these units. On the other hand, the business units are unlikely to act as natural hedges for each other, so that each business will need approximately the equity capital required on a stand-alone basis. In this case managers need to focus on identifying cross-unit effects on revenue and expenses, but they can apply a relatively simple capital allocation scheme.

[19] Of course two businesses whose returns are highly correlated may be truly related, or they may be independent but their returns may be correlated with some third factor, such as interest rates or exchange rates. Thus, the effects of plausible third factors should be isolated before the conclusion is reached that the businesses are truly related.

In the case of units with low or negative correlations in returns, earnings will not be affected but the units will act as partial natural hedges, reducing the equity capital required for each unit. If the hedging effects of diversification are not taken into account, excessive equity capital will be allocated to these businesses, biasing downward reported economic profit and once again leading to underinvestment. In this case managers should focus on the capital allocation methodology, to ensure that the allocated capital is proportional to the actual risk contribution of the business.

Finally, while the concept of economic profit has powerful conceptual appeal, the ambiguities that surround its calculation indicate that no single measure of economic profit is able to capture all the subtle complexities, and that managers need to employ many specialized performance measures. For example, marginal capital might be used to compute the EVA^{SM} of a potential acquisition, but capital based on internal betas to measure the EVA^{SM} of an existing line of business. While the concept of economic profit may ultimately result in better measurement of bank performance, it is unlikely to simplify the measurement process.

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