# Contemporary Issues in Regulatory Risk Management of Commercial Banks

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## I. INTRODUCTION

Banks are unique economic entities primarily due to their ability to create money, and the impact that bank information production and liquidity services have on the real economy. The origin of bank regulation in the U.S. is often viewed as a manifestation of the ''free banking'' period prior to the middle of the 19th century. In the absence of regulation banks could create violent swings in the amount of money created and therefore have real effects on business activity and prices. In addition, banks of that time were often inadequately capitalized due to excessive dividends and/or the prevalent practice of contributing capital in the form of promissory notes. Banking of the era was further characterized by speculative loans and inadequate liquidity. Government regulation was seen as the answer to bank panics and subsequent recessions.

The traditional theory of financial intermediation identified a critical function of commercial banks as the transformation of the financial contracts that borrowers (i.e., people and firms that need money but don't have it) prefer to issue into the contracts that savers (i.e., people and firms who have money but don't immediately need it) prefer to hold. More recent theories have stressed the role of delegated monitoring in shaping the assets in which banks invest and the role of liquidity services in shaping the liabilities that banks issue.

A detailed review of the theory of financial intermediation is beyond the scope of this study. It is important to note, however, the theoretical foundation for the systemic high leverage in the banking industry. Diamond and Rajan (1998) do so. In their model savers need liquidity because they are uncertain about when they will need to sell a financial asset and borrowers need liquidity to meet unanticipated funds needs and also because they may not be able to retain current funding in the future. The authors argue that the real problem is neither borrowers nor lenders can commit future human capital to the savers and therefore both real assets and financial assets are illiquid. The real assets cannot be sold for the full value of the potential cash flows because the entrepreneur may be absent. In the same vein, incumbent lenders can obtain more for real assets that come under their control than any third-party simply selling the

assets at auction. Accordingly, financial assets are also illiquid. If, however, a bank can find a way to commit to pass all loan inflows to depositors, it will be able to attract new depositors and won't be forced to cash-in illiquid financial assets. The authors argue that banks can make such a commitment to their depositors by adopting a fragile financial structure that is susceptible to runs. Hence the characteristic high leverage of commercial banks. For more information on this topic see, for example, Diamond and Dybvig (1983) and Calomiris and Kahn (1991).

A primary purpose of bank regulation in the contemporary setting is to limit the negative externalities arising from bank failures. Accordingly, an important aspect of regulating banks is the analysis of bank-specific risk. One part of the academic literature on bank risk has focused on the perverse nature of a federal bank safety net, especially deposit insurance. This was first identified and quantified by Merton (1977), who established the isomorphic relationship between a loan guarantee or deposit insurance and a put option on the guarantor or insurer. Since depositors are not worried about bank risk due to a government guarantee, banks are exempt from the normal discipline creditors exercise over their debtors. More importantly, in the face of non-risk based insurance premiums, banks are directly motivated to maximize shareholder value by increasing risk. This represents the classic agency problem of moral hazard. The traditional tool of choice by bank regulators to deal with this problem has been the establishment of capital adequacy requirements.

Bank capital adequacy is another area rich in both the depth and breadth of academic literature. The Basel Capital Accord (I) and the proposed new Accord (II) have stimulated lively discussion as to the merits of existing and proposed bank capital requirements. However, arguments have been made that capital requirements actual increase bank risk, while other writers document the efficacy of a strict capital regime.

In the second part of financial research reviewed here, agency problems between shareholders and managers are analyzed. Arguing that non-diversifiable human capital renders managers more risk-averse than shareholders, the managers are seen as unwilling to increase risk to the level that would maximize firm value. Stock options and related incentive compensation are viewed as tools to align the differing interests of managers and shareholders. Of course, in the banking industry, the objective of increasing risk is normally quite contrary to the wishes of the regulatory authorities.

The dynamics of the interplay between these two theories, first, moral hazard arises from a government sponsored bank safety net and second, incentive compensation is a means of aligning the interests of managers and shareholders, has received some consideration in the literature. This article attempts to review the literature in these areas with the purpose of identifying areas needing further research.

The balance of this study is organized as follows. Since capital adequacy is a primary factor mitigating risk, in Section II we review the current state of capital

regulation and proposals for changes in the future. In section III we explore the relationship between bank risk and a federal safety net. In Section IV we define bank risk more precisely and discuss the risk measurement tools historically employed. In Section V we shift attention to look at the impact of incentive compensation on risk. In Section VI we review the empirical literature that both supports and refutes the two main agency theories examined, and in Section VII we offer some concluding remarks.

## II. CAPITAL REGULATION OF COMMERCIAL BANKS

The historical emphasis of bank regulators has been on capital adequacy as the vehicle to control underlying levels of bank risk such as credit risk, liquidity risk, etc. Any discussion of capital, of course, must start with Modigliani and Miller's proposition that in a frictionless world of full information and complete markets capital structure is irrelevant. In the banking industry there are unique frictions arising out of the agency problems related to deposit insurance and the other elements of the federal safety net. These are in addition to the usual frictions of taxes, costs of financial distress, asymmetric information and other agency problems.

Equating bank viability with capital adequacy appears to be axiomatic. Capital is the cushion that protects liability holders from decreases in asset values. Therefore it also protects the deposit insurer. Somewhat surprisingly prior to 1981 there were no formal capital requirements even though capital ratios had been falling for over 100 years. Instead, the regulatory authorities used a subjective peer-group analysis to determine the adequacy of an individual bank's capital.

In 1981 the first formal capital requirements were introduced in the U.S. There were different requirements based on bank size but not based on bank risk. In 1988 the Basle Accord was adopted and this, for the first time, introduced risk-based measures into the determination of capital adequacy. Owing to its central position in determining capital adequacy standards for banks, a brief history and summary of the Basle Accord is needed.

The Basle Committee was established by the central bank governors of the Group of Ten countries in 1974 and was designed to foster cooperation on bank supervisory matters among the member countries. The Basle Committee reports to the Committee of Central Bank Governors that meet at the Bank for International Settlements in Basle, hence the committee's name. Since the early 1980s the Basle Committee's efforts have been concentrated on the issue of capital adequacy. This effort was in response to the deteriorating capital position of many international banks at a time of a perceived increase in international risks.

In 1988 the Committee issued a capital measurement system usually referred to as the Basle Capital Accord or Basle Accord I. The Accord had two primary objectives: first, to increase bank capital and reduce credit risk and, second, to provide a level playing field for competition between the banks of the different

countries. The Committee felt that the second goal would be accomplished if there was uniform implementation of the rules associated with the first goal.

The rules adopted contained three primary elements. The first element was a system of risk weighting of the assets banks held (see Table 1). This was intended to eliminate the problem of two banks having an identical capital-to-assets ratio even though one bank held a significantly higher amount of risky assets than the other. The second element was a definition of what constituted "regulatory

Table 1: Basle Capital Accord I

| Risk-based weights assigned to balance sheet assets | |
| --- | --- |
| *Items with 0% weight* | *Items with 50% weight* |
| Cash Balances at Federal Reserve Bank | Loans fully secured by first liens on 1–4 family residential property |
| US Treasury securities OECD governments | Non-GO municipal bonds |
| Some US Agency securities (e.g., GNMA) | Credit equivalent amount of interest rate and FX contracts, except those assigned to lower risk category |
| *Items with 20% weight* | *Items with 100% weight* |
| Cash items in process of collection | All other on-balance sheet |
| US and OECD inter-bank deposits | items not listed elsewhere, |
| Some non-OECD bank and government deposits and securities | including loans to private entities and individuals, |
| GO obligations of municipalities and political subdivisions | some claims on non-OECD governments and banks, real |
| Some mortgage-backed securities | assets, investments in subsidiaries, contingent or guarantee contracts (e.g., loan commitments, letters of credit) except those assigned to a lower risk category. |

| Factors to convert off-balance sheet items to equivalent balance sheet items | |
| --- | --- |
| *Item* | *Factor* |
| Direct credit substitute standby letter of credit | 100% |
| Performance-related standby letter of credit | 50% |
| Unused portion of loan commitments with original maturity of more than one year | 50% |
| Commercial letters of credit | 20% |
| Bankers acceptances conveyed | 20% |
| Other loan commitments | 0% |

capital". Differing accounting definitions of the member countries led to the potential for differing amounts of capital support for the risk-defined asset categories. As a result the Committee created two classes of capital, "Tier 1" capital and "Tier 2" capital, with specific guidelines as to how much Tier 2 capital could be used in relation to the amount of Tier 1 capital (see Table 2). The third element of the Accord was the inclusion of off-balance sheet items in

Table 2:  Basle Capital Accord I

| Definitions of allowable capital items |
| --- |

*Tier I Capital*: Must equal or exceed 4% of risk-weighted assets and is composed of the following items:

| Item | Limit |
| --- | --- |
| Common stock | No limit |
| Qualifying preferred stock | Maximum of 25% of total Tier I |
| Minority interest in consolidated subsidiaries | Not allowed to introduce elements that would otherwise not qualify for Tier I capital |

Total Tier I Capital equals the sum of the above items minus Goodwill.

*Tier II Capital*: Cannot exceed the Total Tier I Capital and is composed of the following items:

| Item | Limit |
| --- | --- |
| Allowance for loan and lease losses | Maximum of 1.25% of risk-weighted Assets |
| Other perpetual preferred stock | No limit within Tier II capital |
| Hybrid capital instruments (e.g., equity contract notes, equity commitment notes) | No limit within Tier II capital |
| Subordinated debt and limited life preferred stock | Maximum of 50% of Tier I capital |

Total Tier II Capital equals the sum of the above items.

*Total Capital*: Must equal or exceed 8% of risk-weighted assets and is defined as the sum of Tier I Capital plus Tier II Capital minus the following items:

| Item | Deducted from |
| --- | --- |
| Investments in unconsolidated subsidiaries | All items are deducted equally from Tier I capital and Tier II capital |
| Reciprocal holdings of capital securities of other banking organizations | |
| As determined by supervisory authorities for other subsidiaries or joint ventures | |

the determination of the amount of risk and therefore the amount of capital a bank was required to maintain (Table 1). The general rule of the Accord stated that banks were required to maintain a minimum capital ratio (with acceptable capital as defined by the Accord) equal to 8% of their risk-weighted assets and off-balance sheet exposures.

The Basle Accord was a unique example of international cooperation and produced an impact beyond its status as an unofficial and un-elected body of international bank regulators. It was, of course, not without critics. In the U.S. a Shadow Financial Regulatory Committee operates with the purpose of increasing awareness and influencing members of the financial services industry, public policy makers, the media and the general public.

Specific criticisms of the Accord were sometimes referred to as the "Seven Sins". First, the underlying philosophy was to micromanage categories of bank risk but the categories were too broadly defined. This provides incentive for banks to engage in what has become known as regulatory arbitrage, the swapping of low risk assets for high risk assets that have been placed in the same risk category. The second flaw was seen as inconsistency in the definitions of regulated capital from country to country. One of the objectives of the Accord was to improve the capital adequacy of major banks on an international basis. This would not be possible with differing definitions of what is actually included in regulated capital.

The third "sin" was that the committee provided no justification for the 8% capital rule. Why 6% would be too low and 10% too high was simply not discussed. In combination with the first problem noted above, the coarseness of risk categories and the related regulatory arbitrage, the value of an 8% rule was completely opaque. The fourth problem identified was that the Accord had an underlying assumption that equity is better capital than debt. The most obvious challenge to this assumption is that debtholders are far more likely that equityholders to discipline management in regard to risky action.

The fifth "deadly sin" deals with the stated objective of an international leveling of the playing field for bank competition. The problem here was felt to be that any capital accord, by itself, could not achieve this goal due to the wide variety of other issues that are subject to bank regulation and therefore potential limits on competition. Error number six was that the Accord ignores risk reduction from diversification. Investment in risky securities can be mitigated through investment in a portfolio of individual assets. The Accord ignored this widely accepted theory of portfolio management.

The final flaw in the Accord was that the rules were too simplistic and rigid to govern the complex world of banking, especially off-balance sheet activity. The Accord focused on the traditional lending activity of banking while the industry was moving quickly in the direction of offering risk management products.

At the same time that U.S. bank regulators were actively participating in the development of the Basle Accord, the U.S. Congress pursued legislative remedies to the problems associated with the S&L crisis and the increased commercial bank failures of the 1980s. In 1991 the Federal Deposit Insurance

Corporation Improvement Act (FDICIA) was enacted. The act re-capitalized the FDIC after large losses critically reduced the insurance funds available to meet future bank crises and also mandated the development of management standards and policies.

Importantly, the FDICIA defined ''Prompt Corrective Action'' that had to be taken when a bank's capital ratio fell below certain limits (see Table 3). The concept here is to enforce minimum capital standards and to require action before a bank is completely insolvent. At the same time this act limited the flexibility of regulators in their attempt to resolve troubled bank problems.

In June 1999 the Basle Committee, after several modifications and almost a decade of experience with the original Accord, proposed a new capital adequacy framework appropriately known as Basle Accord II. Two additional goals were added to the objectives of the revised Accord. In addition to promoting a sound financial system and competitive equality, the Committee desired to address risks in a more comprehensive way and also render the rules applicable to banks of all sizes and levels of sophistication.

The new proposed Accord focuses on what are called ''three pillars'': minimum capital standards, supervisory review, and market discipline. The new Accord's most significant change regarding minimum capital standards was an increase in the ability of banks to characterize the risk of their commercial and industrial loans by using either public rating agencies or the bank's own internal rating system (see Table 4). Regarding supervisory review the Committee argues that regulatory authorities should go beyond the traditional analysis of financial data and consider such things as the bank's strategy, its willingness to accept risk, the markets served, and the level of diversification. The authorities should take corrective action whenever problems are anticipated, and the review should be coordinated across national borders. The third pillar, market discipline, is an acknowledgement by the Committee of the benefits or having market participants involved in the monitoring of banks along with the supervisory authorities.

To the critics, the proposed new Accord represents only superficial change. The new risk weights under both the standardized approach and the internal ratings model approach continue to allow only a very limited number of categories. This was referred to as the first ''sin'' of the original Accord. While there may be some reduction in the propensity for regulatory arbitrage it is not expected to be significant. The Committee's new proposal does not address the question of a standard definition of capital (''sin'' number two) nor why the arbitrary 8% ratio is correct (''sin'' number three). The fourth ''sin'', implying equity is better capital than debt, is addressed to some degree by the Committee's acknowledgement of the benefits of market discipline. In terms of ''sin'' number five, the inability to level the international playing field, it can be argued that the new proposal makes things worse instead of better. Because the internal ratings methodology is only available to sophisticated banks, the use of this alternative will give these banks a new competitive advantage over less

Table 3: Requirements for Prompt Corrective Action (PCA) mandated by FDICIA Leverage ratio equals the sum of common stock and perpetual preferred stock divided by total assets. Total risk-based ratio equals total capital divided by total risked based assets. Tier I risk-based ratio equals Tier I capital divided by total risk-based assets

| Capital Zone | Leverage Ratio | Total Risk-based Ratio | Tier I Risk-based Ratio | Required Action | Discretionary Action |
|---|---|---|---|---|---|
| 1. Well capitalized | 5% or above | 10% or above | 6% or above | None | None |
| 2. Adequately capitalized | 4% or above | 8% or above | 4% or above | 1. Prohibit brokered deposits exhibit with FDIC approval | None |
| 3. Undercapitalized | Under 4% | Under 8% | Under 4% | 1. Suspend dividends and management fees<br>2. Require capital restoration plan<br>3. Restrict asset growth<br>4. Require approval for acquisitions<br>5. Prohibit brokered deposits | 1. Order re-capitalization<br>2. Restrict inter-affiliate transactions<br>3. Restrict deposit interest rates<br>4. Restrict other activities<br>5. Allow an other action that would help PCA |
| 4. Significantly Undercapitalized | Under 3% | Under 6% | Under 4% | 1. Same as Zone 3<br>2. Order re-capitalization | 1. Enforce any Zone 3 actions<br>2. Appoint conservatorship or receivership if fails to submit or implement plan or re-capitalize pursuant to order |

| 5. Critically Undercapitalized | 2% or less | 2% or less | 2% or less | 3. Restrict inter-affiliate transactions<br>4. Restrict deposit interest rates<br>5. Restrict pay of officers<br>1. Same as Zone 4<br>2. Appoint receiver/ conservator within 90 days<br>3. Appoint receiver if still in Zone 5 four quarters after becoming critically undercapitalized<br>4. Suspend payments on subordinated debt<br>5. Restrict certain other activities | 3. Enforce any other Zone 5 provisions if necessary for PCA |

Table 4: Proposed risk weights under Basle Capital Accord II

| Instrument | Rating | Risk Weight |
|---|---|---|
| Government Securities | AAA to AA | 0% |
| | A+ to A− | 20% |
| | BBB+ to BBB− | 50% |
| | BB+ to BB− | 100% |
| | Below B− | 150% |
| | Unrated | 100% |
| Banks – Option 1 (based on risk weighting of country in which bank is incorporated) | | |
| | AAA to AA | 20% |
| | A+ to A− | 50% |
| | BBB+ to BBB− | 100% |
| | BB+ to BB− | 100% |
| | Below B− | 150% |
| | Unrated | 100% |
| Banks – Option 2 (based on the assessment of the individual bank) | | |
| | AAA to AA | 20% |
| | A+ to A− | 50% |
| | BBB+ to BBB− | 50% |
| | BB+ to BB− | 100% |
| | Below B− | 150% |
| | Unrated | 100% |
| Corporates | AAA to AA | 20% |
| | A+ to A− | 100% |
| | BBB+ to BBB− | 100% |
| | BB+ to BB− | 100% |
| | Below B− | 150% |
| | Unrated | 100% |

sophisticated banks, for example banks in developing countries. The sixth "sin" was ignoring diversification as a tool to minimize risk. In the new proposal the Committee continues to reject measuring capital based on the bank's entire portfolio and instead calls for the simple summing of individual asset requirements. Finally, no significant change in the assessment of derivatives and other off-balance-sheet items is suggested, thus failing to mitigate the seventh and final "sin".

Before leaving the area of capital regulation it is important to note that not everyone is in agreement that capital regulation is the solution to the problem of bank risk. Kim and Santomero (1988) note the ineffectiveness of a simple capital ratio and the need for correct risk weights in a risk-based capital requirement. Rochet (1992) expands the discussion by distinguishing between value-maximizing banks and utility-maximizing banks. In the former, Rochet argues that capital

regulation is ineffective while in the latter he finds effectiveness only with the correct risk weights.

Berger, Herring and Szego (1995) review bank capital ratios from 1840 to 1990 and find at least a century-long decline. In 1840 bank capital funded over half of bank assets. While the trend was already declining, in 1863 the National Banking Act legislated requirements that reduced the inherent risk in the new national banks and the decline in capital ratios continued. The creation of the Federal Reserve System further reduced risk in member banks by providing a discount window as an alternative to the forced sale of assets in times of stress. Again, the decline in capital ratios continued. In 1933, the FDIC was created and most bank deposits were covered by an unconditional government guarantee. Around the same time Regulation Q was established which limited the amount of interest banks could pay for their deposits and this, in effect, improved the quality of uninsured bank deposits. This study also includes the initiation of the Basle Accord and its risk-based capital requirements. The industry equity-to-asset ratio, on a book-value basis, actually increased from 6.21% in 1989 to 8.01% in 1993.

The Berger *et al.* study notes that regulators worry about capital for the same reasons as any other creditor. In addition, however, the regulators are concerned about the negative externalities arising out of banking industry problems. Any increase in systemic risk can create heavy social costs in the form of bank runs and a concomitant credit contraction. On the other hand, excessive capital requirements cause social costs associated with lower levels of intermediation. Importantly, the authors point out that raising capital requirements may have unintended consequences such as risk arbitrage, increased securitization and off-balance sheet guarantees, all of which could mitigate the benefits of the increased capital standards.

Blum (1999) presents a theoretical argument as to why capital adequacy requirements may not reduce risks in banking. In an inter-temporal setting higher capital requirements will usually reduce risk in period one. If, however, capital requirements are raised, or even just expected to be raised, in period two it would be advantageous for a bank to increase risk in period one. In other words, if additional capital in period two is more valuable, then there is an incentive to increase risk in period one.

John, Saunders and Senbet (2000) argue that regulatory emphasis on capital ratios may not be effective in controlling risk. In this article the authors develop a model incorporating asset-risk choices by bank managers. They show that the effectiveness of capital regulation depends on the investment opportunity set available to the bank. An efficient allocation of bank funds must incorporate different risk taking for different investment schedules. The authors go on to argue that bank senior management compensation offers another vehicle through which risk can be controlled with incentive compatible contracts.

Finally, Allen and Gale (2002) note that bank capital regulation represents a strange combination of complex regulation with almost no theoretical

foundation. To date there are no definitive answers to the questions of what represents an optimal capital structure nor what market failures support the imposition of capital adequacy standards. The authors go on to argue that unregulated banks will choose the socially optimum capital structure unless there is a "welfare-relevant pecuniary externality" present. They do recognize that financial fragility and the risk of contagion is an example of such an externality.

### III.  BANK RISK AND THE FEDERAL SAFETY NET

The decade of the 1980s was by far the worst decade for banking and thrift associations since the 1930s. The cost of bank and thrift failures in the 1980s exceeded, in real dollars, the cost of all the bank failures in the 1930s. Clearly something seemed to be wrong and evidence pointed to deposit insurance, a "solution" for the problems of the 1930s, as a "cause" of the problems in the 1980s.

Of course deposit insurance is not the only element of a federal safety net. In the U.S., access to the Federal Reserve System's discount window can serve a similar purpose to deposit insurance as long as bank assets are of sufficient quality. In addition, regulatory forebearance and the specific methods employed to deal with problem banks are also contributing factors to the moral hazard of the safety net.

Agency theory has a long and distinguished place in academic literature related to the field of finance. Jensen and Meckling (1976) are generally recognized as the originators of this literature and they have been followed by many others. The agency cost of debt has received a great deal of attention in the sphere of corporate finance, and monitoring of firm activity has been shown to reduce these costs. In a banking environment, however, monitoring by debtholders, i.e., depositors, is unnecessary because there is a government guarantee that can be relied upon. The principal-agent problem is not between equityholders and debtholders, instead it runs from equityholders to the deposit guarantor, the FDIC in the U.S., and ultimately to the taxpayers of the country involved.

As far back as 1977, writers have pointed out the incentives banks have to increase risk at the expense of a deposit guarantor. In that year Merton demonstrated the isomorphic relationship between a loan (or deposit) guarantee and a common stock put option. Using now familiar option pricing techniques he then noted that fixed-rate deposit insurance premiums allow banks to transfer wealth from the deposit guarantor to the bank's shareholders. This was accomplished by increasing bank risk, which in turn increased the value of the deposit guarantee, but entailed no additional cost to the bank due to the fixed-price insurance premium.

In addition to providing an analytic explanation for the moral hazard associated with fixed-rate deposit insurance, Merton also provided a quantitative vehicle for measuring bank risk. If the value of the deposit insurance went up

then the bank had increased its risk and vice versa. Marcus and Shaked (1984) were the first researchers to actually put Merton's methodology to work. To do so they had to solve estimation problems associated with Merton's theoretical model. Specifically, Merton's formula required both the market value of bank assets and the volatility of these assets. But these asset values are not observable and therefore neither are their volatility. The authors employed implicit solutions for the unobservable variables and applied the methodology to a sample of real banks.

Marcus and Shaked's results indicated that the FDIC insurance premium was much higher than was warranted by the bank's risk. Further, even if the average premium was properly adjusted to the average underlying risk it would still be true that low-risk banks were subsidizing high-risk banks. There was a clear motivation for bank's to increase risk.

In a 1990 article Keeley raises the question as to why it was not until the 1980s that banks started exploiting FDIC insurance when the insurance had been around since the 1930s. In other words, historically why have banks not worked to maximize the value of deposit insurance? He notes that while there have been perceptible declines in both market-value capital ratios and book value-capital ratios over the past several decades, further examination shows that the market-value ratio actual moved from a premium over book value to a discount under book value. This is evidence of a decline in charter value.

A decline in charter value is consistent with deregulation of the banking industry. During the period covered by Keeley's study banks received expanded powers to operate in larger geographic arenas and to offer more diversified products. These powers came from both regulatory interpretation and from specific banking legislation. Increased competition, however, brings with it a decline in charter value. Viewed from the opposite perspective, any limitation on competition increases market power and therefore is a source of value to the bank's charter.

This paradigm leads to the implication that when bank charter values are high banks are reluctant to increase risk in order to protect their charter value. On the other hand, if charter values decline, as they did over the period of Keeley's study, then banks are more apt to increase their risk because they have lower costs of financial distress (i.e., less to lose). Accordingly, it was not until the 1980s that banks started to exploit the fixed-rate deposit insurance.

If deposit insurance and other elements of the federal safety net are the reason for increases in bank risk, why do they continue to exist? The answer lies in the theory of financial intermediation. A large number of articles have demonstrated the need for both demand deposit contracts and the related possibility of bank runs as a consequence of this form of contract. See for example, Diamond and Dybvig (1983), Gorton and Pennacchi (1990) and Diamond and Rajan (1998). Since the risk of a bank run is inevitable, and bank runs incur real costs, government backed deposit insurance arises as the optimal solution. This is referred to as the ''run-prevention'' rationale for a federal safety net.

Bank failures can have negative externalities besides bank runs. Again, the theory of financial intermediation explains the unique ability of banks to resolve the information asymmetries associated with risky loans. Any borrower who is not able to raise funds in the public capital market can rely on bank credit. But bank failures can result in a contraction of this credit and when bank loans are called production will be interrupted and ''fire-sale'' auctions of valuable equipment will occur. This is referred to as the ''bank-credit'' rationale for a federal safety net.

If a federal safety net is required as a necessary element for financial system stability but can simultaneously increase the systemic risk of banks then incentive-compatible risk control tools are required. Calormiris (1999) makes a strong case for the use of subordinated debt as just such an incentive-compatible instrument. If banks are required to include subordinated debt in their capital structure the subordinated debtholders will be in the same credit priority position as the deposit guarantor. This would produce marketplace monitoring and disciplining of banks. If banks took inordinate risks they would not be able to sell their subordinated debt and they would be forced to either shrink risky assets or raise new capital to satisfy their private uninsured debtholders. The key distinction in this arrangement is that debtholders do not benefit from increased risk taking while equityholders may be rewarded from risk-increasing actions. In response to the obvious question of what to do with small banks that cannot sell debt in the public market, Calormiris contends that they could simply sell it to larger banks who would actually be the best possible monitor of what the smaller bank was doing.

A number of alternatives to capital regulation have been proposed in the literature as tools to control the level of risk in commercial banks. Prescott (1997) reviews what is referred to as the pre-commitment approach to regulatory risk management. This methodology suggests that allowing banks to choose their own capital levels but then fining them if their losses exceed this level of capital provides a proper incentive for risk control. It is, of course, obvious that this methodology cannot be applied to total bank risk because a fine cannot be levied against an insolvent bank. However, if regulators are primarily concerned with one element of a bank's overall risk, for example a trading portfolio, then the fine can be paid by other parts of the bank.

The pre-commitment approach uses menus of contracts to enable banks to ''commit'' to a certain level of capital. A menu choice is a level of capital and a fine schedule associated with that level. If bank losses exceed the committed level of capital then the fine is imposed. The menu choices provide the proper incentives for a bank to manage risk and to efficiently allocate capital to the place where it is most needed.

A pre-commitment approach to market risk differs significantly from what is referred to as the standardized approach and also to the internal models or VaR approach. The standardized approach treats market risk the same way as it treats credit risk. Assets are placed into risk categories and capital is allocated

based on the perceived risk of that category. The criticism of this approach is that regulators do not have sufficient ability to properly understand, and therefore categorize, complicated trading asset portfolios. The internal models approach employs the banks' own estimates of the "value at risk" of its assets to establish capital requirements. The criticism here is that a bank is encouraged to develop a model that minimizes capital requirements rather than maximize reliable results.

Another concept suggested for regulatory control of bank risk is to establish contingent liability as an obligation of the equityholders. Using data from 1900 to 1915, Esty (1998) studies the impact of contingent liability on the risk-taking attitudes of bank shareholders. He argues that in the past, roughly from 1863 to 1933, bank regulators imposed double liability on national bank shareholders. Under this system the shareholders could not only lose all of their investment value, but they were also subject to an assessment equal to the par value of the equity whenever it was needed to meet the claims on the bank. At the time most bank equity was issued with a $100 par value and sold for the same price so bank shareholders could lose twice the amount of money they invested.

Esty finds a negative relation between the level of contingent liability and the asset volatility of the bank. He attributes this negative relation to the changes in asset allocation and capital levels engendered by the contingent liability. Further, Esty documents a lower propensity to increase risk when confronted with a decline in net worth when shareholders are subject to an additional capital assessment.

Another proposal to resolve the moral hazard arising from a federal safety net is referred to as "narrow banking". Gorton and Pennacchi (1992) start with the question: "Must banks forever be regulated?" Their answer is "no" and it is based on a revision to a critical element in the theory of financial intermediation. Historically, banks have provided both credit services and deposit services. Indeed this was the fundamental purpose of banks, to transform the claims depositors demanded into the claims that borrowers needed.

Gorton and Pennacchi argue that these services no longer need to be provided by a single entity. As they look at the financial landscape of today they conclude that finance companies are able to provide essentially the same credit services as banks, and money market mutual funds are able to provide essentially the same deposit services as banks. There is, however, a crucial distinction. The government no longer has to guarantee the "deposits" at a money market mutual fund because the fund assets are limited to liquid investments. If the federal safety net is removed then so are the perverse incentives for banks to increase risk.

## IV. THE MEASUREMENT OF BANK RISK

Risk in banking can be categorized into a number of distinct elements starting with two broad categories: *market risk* and *firm specific risk*. Market risk refers to those changes in the financial marketplace over which any individual bank

has no control. The level of interest rates and asset prices are the two most obvious examples. Firm specific risk, of course, are those elements of risk over which an individual bank does exercise some degree of control and are often categorized as follows. *Credit risk*, or asset quality, refers to the losses that could be incurred if a debtor of the bank is unable to meet its debt service obligations. *Liquidity risk* is the risk assumed by a bank arising out of its maturity transformation function, i.e., the inability of the bank to fund valid claims due to illiquid assets. More generally, liquidity risk refers to the inability of a bank to meet its cash requirements when needed. *Interest rate risk*, as used here, is distinct from the market risk of changes in the level of interest rates. Here we are referring to the mismatch of fixed rate and variable rate assets and liabilities. In theory, if a bank properly matches its variable rate assets with variable rate liabilities and its fixed rate assets with fixed rate liabilities then any changes in the absolute level of interest rates would have no effect on the bank's earnings. However, as an example, if a bank funds fixed rate assets with variable rate liabilities then any increase in the market level of interest rates will result in a decline in earnings. Interest rate risk can also be referred to as duration risk. Finally, *operating risk* is the term used to cover all other types of firm specific risk not included elsewhere. The risks associated with fee generating business is one example as is the degree of operating leverage a bank maintains.

The degree of financial leverage in a bank's capital structure is also an obvious element of risk. In banking however, this is generally viewed as the vehicle through which a balance is struck with all the other elements of risk detailed above. In other words, capital adequacy is function of the risk assumed by the bank. This was discussed in more detail in our section on capital regulation.

In order to control risk it is obviously necessary to measure risk and Merton (1977), as noted above, is a good place to start, this time looking at the specific problem of risk measurement. In this article Merton derives a formula to calculate the "fair" premium for deposit guarantees by the Federal Deposit Insurance Corporation (FDIC). He finds that the value of the premium is identical to a put option where the value of the bank debt is the strike price and the maturity is the next FDIC examination date. Based on this formula it is then possible to measure the level of risk in a bank and the direction of any risk change by calculating the value of the deposit insurance. If the value of the insurance goes up the bank has become more risky. If the value of the insurance goes down, the bank has become less risky. Merton's formula is structured as follows:

Let $G(T) =$ value to bank of deposit guarantee
$T =$ length of time to maturity
$B =$ value of deposits guaranteed
$\Phi(\cdot) =$ cumulative normal density function
$r =$ rate of return on riskless assets
then: $G(T) = Be^{-rT}\Phi(x_2) - V\Phi(x_1)$

where:

$$x_1 = \left\{ \log(B/V) - \left( r + \frac{\sigma^2}{2} \right) T \right\} / \sigma \sqrt{T}$$
$$x_2 = x_1 + \sigma \sqrt{T}$$

and $V$ = current value of assets
$\sigma^2$ = variance in value of assets

The innovations offered by Marcus and Shaked (1984) render Merton's formula operational for actual bank data. Two estimation problems needed to be solved. First, Merton's formula depends on the value of the bank's underlying assets and this cannot be observed, only the value of deposits and equity can be observed. The authors point out that the value of the assets must be equal to the value of the equity plus the value of the debt and minus the value of the deposit insurance. Substituting these values into the formula allows for an implicit calculation of the premium. The second problem is that if the value of the assets cannot be observed then the variance of the assets cannot be observed either. The authors solve this problem by employing the relationship between the variance rate on the bank assets and the variance rate on its equity as determined in Merton (1974). The relationship is defined as follows:

$$\sigma = \sigma_E \left[ 1 - \frac{B_T e^{-rT} \Phi(x_2)}{e^{-rT} A_0 \Phi(x_1)} \right]$$

where:
$\sigma$ = variance rate on bank assets
$\sigma_E$ = variance rate on bank equity
and $A = D + E - I$
where:
D and E are the market value of debt and equity and I is the value of the deposit insurance

Finally, the authors need to adjust their calculations for the un-insured deposits held by the bank. While it is arguable whether the un-insured deposits are de-facto insured or not the formula adjustment is simply to take the FDIC's potential liability, (total debt minus the value of the assets) and multiple it by the fraction of the total debt represented by insured deposits. As a final caveat the authors emphasize that the results are based on the underlying assumption of normality in stock returns. When the authors apply this methodology to 40 banks that have data available in both the COMPUSTAT and CRSP databases, their results show that the FDIC premium is much higher than warranted by the overall risk of the banks.

Flannery and James (1984) provide additional help in the measurement of commercial bank risk. In their paper the authors' objective is to study the joint

impact of interest rate sensitivity and the mismatch of a firm's asset and liability maturities. From a sample of publicly traded banks and stock S & Ls they find that interest rate changes are indeed correlated with common stock returns and that the strength of the relationship is a function of the size of the maturity difference between the firm's assets and liabilities. However, the article also confirmed that a two-index market model is the appropriate return generating process for commercial banks. The model looks like the following:

$$R_{jt} = \beta_{0j} + \beta_{mj}R_{mt} + \beta_{Ij}R_{It} + \varepsilon_{jt}$$

where:

$R_{jt}$ = return to j$^{th}$ stock over period t
$R_{mt}$ = return on equally weighted portfolio of common stock over period t
$R_{It}$ = return on index of constant maturity default-free bonds over period t

In the article several alternative specifications were tested by the authors and they all produced similar results.

Saunders, Strock and Travlos (1990) use market measures of risk derived from the Flannery and James two-index market model. Specifically, they employ the following market measures of risk:

$\sigma_S$ = total return risk
$\sigma_\varepsilon$ = nonsystematic risk
$\beta_m$ = market risk
$\beta_I$ = interest rate risk
$\sigma_\varepsilon^S$, $\beta_m^S$, $\beta_I^S$ ⇒ short term rates
$\sigma_\varepsilon^L$, $\beta_m^L$, $\beta_I^L$ ⇒ long term rates

The last three measures are calculated using both short-term and long-term interest rates giving a total of seven measures of bank risk. The two-index market model is estimated by Saunders, Strock and Travlos using CRSP stock data, CRSP market data and DRI interest rate data.

A review of risk measurement would not be complete without a brief discussion of how regulatory authorities review the viability of banks. In 1979 the U.S. Federal Reserve System adopted the Uniform Financial Institutions Rating System (UFIRS). UFIRS was modified in 1996 and is the current methodology employed for rating banks. Under this system bank supervisors assign a rating to banks in six critical areas as part of an on-site inspection. The six areas are: Capital adequacy, Asset quality, Management ability, Earnings level and quality, Liquidity adequacy, and Sensitivity to market risk, e.g., changes in the level of interest rates. The ratings assigned range from '1' for excellent, to '5' for unsatisfactory. After the six individual areas are rated an overall rating is then determined. The overall rating is also scaled from '1' to '5' but is not simply the average of the six individual ratings. The overall or composite rating is generally

known by the acronym ''CAMELS'' for the first letter of each of the six areas. A bank that receives a CAMELS of '1' is considered to be completely sound in every respect and probably received individual ratings of '1' or '2' in all six areas. If a bank receives a CAMELS of '5' it has exhibited unsafe and unsound practices.

In addition to on-site examinations, the Federal Reserve System employs the Financial Institutions Monitoring System (FIMS) to review bank performance. FIMS was adopted in 1993 after several decades of development that included predecessor systems such as the Uniform Bank Surveillance Screen (UBSS). The objective of this work was to create a system for identifying potential problem banks in-between examinations through an off-site review of Call Report data. FIMS is composed of two separate ratings, the FIMS rating and the FIMS risk rank. The FIMS rating is an estimate of what a bank's CAMELS rating would be based on the quarterly Call Report data. The FIMS risk rank is an estimate of the probability that the bank will fail sometime over the next two years. Both of the ratings are estimated using econometric models. As reported by Cole, Cornyn and Gunther (1995) FIMS' accuracy, objectivity, consistency, timeliness and flexibility are all improvements over previous monitoring techniques.

## V. THE EFFECT OF MANAGEMENT INCENTIVE COMPENSATION ON RISK

In the general corporate finance literature, Jensen and Meckling (1976) offer the first discussion of agency costs associated with the separation of firm ownership and firm management. In Holmstrom (1979) a solution is offered to the problem of moral hazard arising from an environment where individual actions can alter the probability of returns, but cannot be observed. Since the actions cannot be observed they cannot be contracted upon. The solution proposed entails altering the risk-sharing payoffs so as to induce greater effort on the part of the agent.

In an empirical study Jensen and Murphy (1990) estimate the relation between CEO pay and firm performance. Recognizing the inherent principal-agent problem between corporate shareholders and the CEO, the authors suggest that higher pay-performance sensitivity will better align the interests of the parties. Unfortunately their findings demonstrate that this sensitivity is very low. Their final, all-inclusive measure of CEO compensation indicates that for each $1,000 change in shareholder wealth, CEO compensation changes by $3.25. This, the authors find very puzzling.

In this study, the measures of compensation are regressed on the change in shareholder wealth defined as the firm value at the end of the prior period multiplied by the inflation adjusted return on the common stock. The authors also look at the threat of dismissal as an incentive but find little evidence in the data that CEO's bear much risk of termination.

The authors conclude that optimal compensation contracts must balance the trade-off between the improved risk-sharing of a corporate structure and the

decreased incentives for appropriate management action due to that structure. They hypothesize that the weak pay-for-performance incentives for CEO's is due to political forces operating in the public sector, and internally, to limit large payoffs for exceptional performance. But limiting the upside of payoffs requires the limiting of the downside as well so as to maintain equilibrium in the managerial labor market.

In a similar study, Hall and Liebman (1998) present dramatically different results from the findings of Jensen and Murphy (1990). Hall and Liebman document a strong relationship between pay and performance, based primarily on changes in the value of CEO stock and option holdings. They find changes in CEO wealth of millions of dollars for typical changes in firm value. The authors believe that the difference between their results and Jensen and Murphy is due to their use of more recent data, incorporating a period of significant increase in the use of stock options, and the use of more broad based statistics to measure the sensitivity.

The authors regress their compensation variables on firm performance using as independent variables the firm's rate of return, both contemporaneously and with lags, and the return on the S&P 500 both current and lagged. They find significantly higher sensitivities than Jensen and Murphy, again, in large part due to their inclusion of changes in the value of CEO stock and option holdings. The sensitivity includes decreases in CEO wealth. The authors conclude: "The fortunes of CEOs are strongly related to the fortunes of the companies they manage."

Amihud and Lev (1981) brought the literature into the specific arena of incentive compensation and risk. Looking for explanations of conglomerate mergers that destroy shareholder value, the authors suggest that managers, in an effort to protect un-diversifiable human capital, are motivated to reduce risk. They empirically test the relationship between the number of acquisitions made by a firm and the type of control (manager-controlled vs. owner-controlled) and also the income diversification of a firm and the type of control. Their results are consistent with a theory of managerial motivation for conglomerate mergers. The owner-controlled firms made fewer conglomerate acquisitions and exhibited lower income diversification. The manager-controlled firms, consistent with a higher level of risk aversion, made more conglomerate acquisitions and had greater income diversification.

Agrawal and Mandelker (1987), however, show that large security holdings by managers can provide an incentive to increase risk. The impact of managers' holdings of common stock and stock options have an important effect on managerial incentives that, in turn, influence investment and financing decisions. They find that firms for which return variance increases after an investment announcement have higher stock and option holdings of managers than firms for which the return variance decreases. Likewise, they find that the stock and option holdings of managers of firms who increase their debt-to-equity ratio are higher than managers of firms whose leverage has decreased. Because high

stock and option holdings serve to align incentives of managers and shareholders it thereby produces incentives to increase risk.

Smith and Watts (1992) argue that compensation is less responsive to performance in regulated industries. This implies that bank compensation should not have a significant effect on the risk levels in banks. In a study of the determinants of corporate decision-making, the authors conclude that contracting theories are more important in explaining cross-sectional differences in financial policies than tax, signaling and other theories. One specific result of their analysis is that regulation restricts a firm's investment opportunity set and accordingly compensation is reduced. The authors regress financial policy variables (leverage, dividends, compensation, and use of incentive plans) on the investment opportunity set, regulation, and size. For the compensation variable the accounting return is added to the independent variables.

As noted above, John, Saunders and Senbet (2000) argue that bank senior management compensation offers an effective vehicle through which risk can be controlled using incentive compatible contracts. The authors believe the pay-performance sensitivity of management contracts should be incorporated into the determination of the deposit insurance premium as well as other elements of bank regulation. The authors contrast this possibility with the historical regulatory emphasis on capital ratios and note the potential weakness of capital regulation due to differing investment opportunity sets available to different banks.

Compensation is, of course, only one form of corporate governance and the broader question of governance has received a great deal of public attention recently. While a detailed review of corporate governance literature is beyond the scope of this paper it is worth noting that other areas of study include the impact of the board of directors, especially the outside members of the board, and the impact of institutional shareholders. Macey and O'Hara (2003) highlight specific aspects of corporate governance in the banking industry. The authors argue that bank boards should be held to higher standards of conduct than other corporate boards due to the potential for negative externalities from bank problems. John and Qian (2003) discuss the need to consider the impact of regulatory monitoring of banks and whether it represents a complementary or a substitute form of corporate governance. In addition they raise the unanswered question of the objective of corporate governance concerning other corporate stakeholders in addition to the shareholders.

## VI. EMPIRICAL STUDIES

There have been significant differences in the literature about the efficacy of both capital regulation and incentive compensation as tools to control bank risk. While there is a long history of regulatory focus on bank capital adequacy there is no agreement that such a focus is optimal. Likewise, there is also no clear consensus on the impact of incentive compensation on risk.

CAPITAL REGULATION IS EFFECTIVE

As discussed above, Marcus and Shaked (1984) show how Merton's (1977) put option pricing formula can be made operational and then used the results to estimate appropriate deposit insurance premium rates. The results of their empirical analysis indicated that the then current FDIC premiums were higher than was warranted by the ex ante default risk of the sample banks. This implies that banks are not transferring excessive risk to the deposit insurance safety net and capital regulation is effectively working.

Duan, Moreau and Sealey (1992) address the question of the impact of fixed-rate versus risk-based deposit insurance premiums directly. The authors tested for risk-shifting behavior by banks. If banks were able to increase the risk-adjusted value of the deposit insurance premiums then they had appropriated wealth from the FDIC. This is because the FDIC, at the time, could not increase the insurance premium even though risk had increased. Their empirical findings were that only 20% of their sample banks were successful in risk-shifting behavior and therefore the problem was not widespread. This implies that capital management has been effective.

The authors reformulate Merton's put option pricing equation to give a per-dollar insurance premium for a bank. Noting that Merton also established that the partial derivatives from the pricing equation with respect to both variance and leverage are positive, Duan *et al.* develop two hypotheses that they then use for testing for risk-shifting behavior. A regression of leverage on variance rejects the first hypothesis of a positive relation between these two factors indicating the presence of factors that mitigate risk shifting by banks. A regression of the insurance premium on variance rejects the second hypothesis of a negative relationship for only a few banks, indicating that any risk-shifting behavior is very limited.

Keeley (1990) argues that there is little doubt the increased bank and S&L failures of the 1980s, and the resultant cost to taxpayers, are related to a decline in capital ratios. The author charts the capital-to-asset ratios of the 25 largest bank holding companies from 1952 to 1986. On a book value basis the ratios decline rather steadily. While the market value ratios actually increase in the late 1950s and early 1960s they then decline quite dramatically and by 1976 the market value ratios are below the book value ratios.

Keeley (1992) empirically studied the impact of the establishment of objective capital-to-asset ratio requirements in the early 1980's. His evidence documents an increase in the book value capital-to-assets ratio of previously undercapitalized banks and this, of course, was the goal of the new capital regulations. His study, however, is unable to confirm the same result when looking at the market value capital ratios. While the market value capital-to-assets ratios also increased, there was no significant difference between the undercapitalized banks compared with the adequately capitalized banks. Nevertheless, this was more evidence that capital regulation was working.

Flannery and Rangan (2002) examine the increase in regulatory and market equity capital by large bank holding companies between 1986 and 2000. While this article primarily argues that the regulatory capital requirements have become non-binding, it does support the effectiveness of capital ratios as a tool for controlling bank risk. During the period covered by this study, legislators and bank regulators were trying to reverse what was perceived as excessive reliance on the federal safety net. The methods for resolving failed institutions were reformed, risk-based capital requirements were introduced, prompt corrective action was mandated for poorly capitalized banks and depositor preference over non-deposit creditors was enacted. Over the same period bank powers were expanded both geographically and by product offerings. This in turn raised the number of options for banks to increase portfolio risk.

Contrary to the theory that banks seek to hold only the minimum required capital in the presence of the safety net, the authors argue that there was a significant increase in bank capital ratios in the 1990s, well above the regulatory minimums, and this was primarily a result of market forces. The combination of a more limited government guarantee with an increase in bank risk resulted in counterparty concerns about bank solvency. Banks were required to meet both supervisory requirements defined in book equity measures and uninsured market-creditor concerns based on the market value of equity. The empirical results support the authors hypothesis that it was primarily market forces that precipitated the increased capital ratios. The authors decompose the changes in capital ratios into ''market'' and ''passive factors''. They find that the ''active/market'' effects account for almost two-thirds of the mean change, confirming their hypothesis. Robustness tests support their conclusions.

## Capital Regulation is Not Effective

Hovakimian and Kane (2000) use the same empirical design as Duan, Moreau and Sealy (1992) but for a more recent time period and they obtain opposite results. Option-model evidence is presented that shows capital regulation has not prevented risk-shifting by banks. It was possible for banks to extract a deposit insurance subsidy. They do, however, find evidence of some market and regulatory discipline.

Consistent with the concept of moral hazard induced by deposit insurance, they find that higher rewards for risk-shifting accrue to banks with high ratios of deposits to total debt. In a comparison of highly levered to less levered banks, the authors find the highest risk-shifting incentives at the weakest banks. This is also consistent with moral hazard theory. They conclude that while charter value and managerial risk aversion may offset risk-shifting incentives in generally good times there is no evidence that this will necessarily be true in poor times.

In their study Saunders, Strock and Travlos (1990) find that management stock ownership induces risk taking. Using capital market measures of risk and the percent of stock owned by managers as a proxy for ownership structure they provide evidence that stockholder-controlled banks take on higher risk to maximize the value of their 'put' option on the FDIC than do managerially-controlled banks.

The model employed specifies that bank risk is a function of the ownership structure of the bank, the financial leverage of the bank, the operating leverage of the bank, and the bank's size. Bank risk is derived from a two-index market model estimated using daily CRSP data for each bank, the CRSP equally weighted market index and DRI interest rate data for the 3-month Treasury bill and the 10-year Treasury note. Ownership structure is proxied by the proportion of stock held by banking firm managers. Financial leverage is measured by the ratio of the bank's book value of capital to total assets while the ratio of fixed assets to total assets represents operating leverage. Size is measure by total assets.

The empirical results provide support for both of the authors' hypotheses. Stockholder-controlled banks have higher value-maximizing incentives to take risks compared with more risk-averse managerially-controlled banks. Also, the risk-taking differences are more pronounced in periods of deregulation.

Hubbard and Palia (1995) show that deregulation in the banking industry resulted in compensation becoming more responsive to performance. Comparing data from banks operating where interstate banking is permitted with data from banks where interstate banking is not permitted allowed the authors to measure the impact of competition. The authors find that there is a stronger correlation between pay and performance and a higher CEO turnover in those banks located in competitive markets.

Pay was defined in two ways: as the total of salary and bonus, and as the total of salary and bonus plus the value of options granted in the current year. Performance was measured by stock market returns with size included as a control variable. CEO compensation was regressed on shareholder wealth, size and a dummy for interstate banking. These results are consistent with the findings of Smith and Watts (1992) but imply that bank incentive compensation will affect bank risk.

Lee (2002) investigates the premise that risk-averse managers will respond to incentive-compatible compensation more aggressively if the risk of bank failure is lower. In other words, the costs perceived by managers of aligning their interests with shareholders are reduced to the extent the risk of bank failure is reduced. The author presents evidence supporting this premise by regressing risk (measured by the standard deviation of stock returns) on insider ownership (measured by the proportion of shares owned by officers and directors to total shares outstanding) and control variables (capital ratio, market-to-book ratio,

and asset size. When Lee splits the sample by asset size and by return volatility (i.e., above the median and below the median) the coefficients on insider ownership are found to be higher for large size and lower return volatility. This is consistent with large size and lower volatility implying less risk of bank failure and therefore a higher propensity on the part of managers to increase risk.

### Incentive Compensation is Not Effective

Houston and James (1995) argue that compensation in the banking industry does not promote risk-taking. Bank CEOs on average receive less cash compensation, consistent with Smith and Watts, and also receive a lower proportion of their compensation in the form of incentive based features. In addition, they document a significant positive relationship between CEO stock holdings and bank charter value which is inconsistent with an incentive to increase risk.

The authors argue that the structure of bank compensation is a function of the cost of monitoring managers, the nature of the assets managed, the discretion afforded the manager, the firm's investment opportunity set, and the regulatory environment. This is the same as in other industries and must be controlled for in any empirical study.

The sample covers the period from 1980 through 1990, includes both banks and non-banks, and tests the support for the contracting hypothesis: differences in compensation reflect differences in the firm's investment opportunity set, compared to the moral hazard hypothesis: providing managers with more equity based compensation encourages risk taking in banking.

As part of their analysis, the authors regress the importance of equity-based compensation on bank and CEO characteristics. They find no evidence that equity based incentives, measured by the proportion of stock held by the CEO and by the ratio of options granted to cash compensation, increase the level of risk taking, measured by the variance in stock returns. On the contrary, they find a positive relationship between the ratio of market-to-book and the use of equity-based compensation. In other words banks with high charter values tend to use more equity-based incentives which is inconsistent with the moral hazard hypothesis.

The authors note a trend toward more equity-based compensation in banking over the time period covered consistent with Hubbard and Palia (1995). However, they feel that this is more likely the result of the expansion of the bank's opportunity set rather than as an incentive to increase risk.

Finally, the authors use the bank's CAMEL rating to test whether troubled banks tend to provide more risk-increasing incentives than healthy banks. A higher level of compensation, a larger ownership share, and more options granted in the year before a CAMEL downgrade would be consistent with the moral hazard hypothesis. No such evidence is found.

Palia (2001) addresses the endogeneity problem inherent in the relationship of firm value and managerial compensation. Previous studies have assumed that

managerial compensation was exogenous to firm value and that managerial ownership was the only component of compensation that affected firm performance. The author uses a simultaneous equation system to study the impact of the structure of managerial compensation on firm value. The study concludes that incentive-compatible compensation is not statistically significantly related to firm value. In addition, the inverted-U shaped relationship between firm value and managerial compensation is found only when OLS is employed without correction for endogeneity.

The regression equation employs Tobin's Q as a proxy for firm value. The independent variables are the fitted value of pay-performance sensitivity (actually a logistic transformation of the sensitivity) defined as the proportion of shares owned by the CEO plus the proportion of options awarded multiplied by the Black-Scholes hedge ratio, control variables (R&D, advertising, capital structure, and size) and treasury stock (as a predetermined variable for identification). The fitted value of the pay-performance sensitivity variable is derived from a regression on Tobin's Q, four instruments for the sensitivity (CEO experience, CEO quality, firm volatility, and CEO age) and the same control variables.

### Incentive Compensation Has a Non-linear Relationship to Firm Value

Gorton and Rosen (1995) present evidence that managerial entrenchment was more important than the moral hazard problem in explaining the dramatic increase in bank failures in the 1980s. The authors argue that it is bank managers and not bank shareholders that decide how much risk to undertake. Accordingly, the concept of increasing risk to maximize the value of fixed-rate deposit insurance needs to be based on the premise of a close alliance between managers and shareholders.

Gorton and Rosen note that several studies of non-financial firms have found a non-linear relationship between firm value and managerial ownership. See for example Morck, Shleifer, and Vishny (1988) and McConnel and Servaes (1990). At low levels of ownership, firm value increases with managerial shareholdings but this relationship turns negative above approximately a 5% level until it reaches a 25% level and then firm value again increases with larger proportions of managerial ownership. The authors hypothesize that at levels above 5% management becomes effectively entrenched and it is not until there is a much higher level of ownership that managers are again aligned with outside shareholders.

For their banking industry model, Gorton and Rosen impose an environment of deteriorating investment opportunities. Nevertheless, deposit insurance allows banks to continue to increase their liabilities. The risk avoidance of managers described in the corporate finance literature implies that conservative behavior is sufficient for managers to maintain their jobs and their perquisites. In the authors' model, however, they allow for ''bad'' managers to predominate

who may find it necessary to take excessively risky actions in order to prove themselves as good managers. In this model it is possible for aggregate risk-taking to exceed the optimal level.

In the empirical portion of the paper the authors explore the impact of ownership structure on lending decisions, assuming that consumer loans are relatively safe and real estate construction lending is relatively risky. Their conclusion is that managers with controlling interests tend to make safe loans. Instead, it is the entrenched managers who make the more risky loans.

Palia (2001) finds opposite results relative to the relationship between incentive compensation and firm value. As noted above, the author corrects for the endogeneity problem inherent in this relationship. Using a simultaneous equation system to study the impact of the compensation structure on firm value, the study concludes that incentive-compatible compensation is not statistically significantly related to firm value. However, the inverted-U shaped relationship between firm value and managerial compensation is found only when OLS is employed, i.e., without correction for endogeneity.

## Joint Studies of Capital and Incentive Compensation

Demsetz, Saidenberg and Strahan (1997) point out that in addition to moral hazard, another issue is the agency cost of equity and the problems arising from owner-manager conflict. Here, in banking, we find a countervailing force to incentives for increasing risk. A bank manager with non-diversifiable human capital invested in the bank will not increase risk to its optimum level. While this is not in the shareholders' best interest it does work to mitigate the risk-taking incentives of the shareholders.

Empirically, the authors employ a unified model to assess the joint impact of charter value and ownership structure on bank risk-taking. They find a strong negative relationship between charter value and risk, confirming the ability of high costs of financial distress to mitigate risk. In terms of ownership structure they find a significant positive relationship between managerial ownership and risk, but only at low levels of charter value.

Hughes, Lang, Moon and Pagano (2003) use stochastic frontier analysis to measure the level of efficiency at bank holding companies. They then study the impact of managerial incentives from charter value and from ownership structure on firm performance as measured by efficiency. Their evidence supports the contention that dichotomous strategies exist for value maximization as first presented by Marcus (1984). The results are also consistent with an interpretation that one strategy is to maximize the value of the federal safety net while another strategy is to protect high charter value.

The empirical findings establish the presence of dichotomous strategies by documenting that high-leverage banks improve their efficiency by increasing leverage further while low-leverage banks improve their efficiency by decreasing leverage further. It is noted that the low-leverage banks appear to have

exhausted the benefits of this strategy. On the other hand, the high-leverage banks appear to have room for movement toward an optimal capital level. The authors suggest that the latter finding may be a result of regulatory minimum capital requirements.

The authors then pursue the question of what factors influence banks in their choice between the strategies. They argue that inefficiency arises from agency problems associated with high charter value. While high charter value leads to a low leverage strategy it also prompts managers to consume more agency goods. As evidence, the study documents that high charter value is more likely to be associated with inefficient banks in the high leverage group of banks compared with efficient banks in the same group. Further, they show that agency problems related to high insider-ownership levels lead to poor performance (inefficiency) while high levels of outside block-holders, an antidote to agency problems, are associated with better performance (efficiency).

In sum, the study finds that inefficiency, the difference between a bank's market value potential and the achieved value, is a function of charter value, managerial compensation, and outside monitoring. This is strong evidence of agency costs as a contributing source to the shortfall.


## VII. CONCLUDING REMARKS

We have noted here the progress in the study of commercial bank risk and the means of controlling it. We find, however, areas where theories compete and empirical studies produce conflicting results. In particular we have examined the research directed at consideration of bank capital adequacy as a tool for dealing with moral hazard arising from a federal safety net. The other specific area reviewed is the ability of ownership structure to alter the risk profile of banks. The majority of research considers one topic or the other but, with only a few exceptions, not both.

The joint estimation of the impact of capital and incentive compensation on risk appears to be an area of great promise. There is, however, the problem of the endogenous relationships between risk, capital and compensation. Econometrically resolving the estimation problems will be a contribution to the literature in addition to the results obtained. Further, compensation needs to be examined in a comprehensive manner. Stock ownership should be viewed as only one element of incentive-compatible contracts. Other elements to be included clearly encompass stock options.

Compensation is not the only form of corporate governance that should be examined. Recent disclosures of corporate malfeasance and accounting irregularities have drawn wide attention to the broader question of governance. Other areas for research clearly include the role of the board of directors and of institutional shareholders. How to view regulatory agency monitoring is a relevant question specifically related to the banking industry. The objectives of

corporate governance concerning corporate stakeholders other than the shareholders should also be considered.

The differences between commercial banks and other financial intermediaries in the context of risk management is another fertile area for future research. Narrow banking, the use of a pre-commitment approach to capital regulation, and the use of equityholder contingent liability have all been offered as alternative tools to mitigate risk. Finally, the impact of diversification on risk reduction in financial conglomerates is yet another field of inquiry worthy of additional research.

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